Knowledge Age Standards: Present Scope and Potential Use in Education

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Acknowledgments

If you open that Pandora's Box you never know what Trojan horses will jump out.

— Ernest Bevin (1881-1951)

When I opened the Pandora's box of standards, several Trojan horses jumped out, horses I have been trying to tame in this work.[1] In taming them I received invaluable help from a number of people, whom it is my pleasure to acknowledge and thank.

My advisors: Judah Schwartz, who took me under his wing and helped me launch this work five years ago; Claryce Evans, who helped me shape and sharpen the work and hold the horses when they were especially wild; and my chief advisor, David Perkins, who not only helped me identify the horses, name them, and train them, but who personified an exemplary advisor, scholar, thinker, and friend.

My mentors: David Chen, who has guided me for the last ten years and who is responsible for my being an educator; Opie Dawson, who has guided me for the last fifteen years and is responsible for my ability to use technology; and to Lal Chand Verman, who, through his writings, was the single most important source of inspiration for how I deal with the horses.

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[1]In Greek mythology, Pandora ("all-gifted") was the first human woman, created by Zeus to harm mankind. Zeus, seeking to punish men for accepting the gift of fire from Prometheus, who had stolen it from the gods, gave Pandora a box that, without her knowing it, contained all the troubles and diseases the world now knows. Here, Pandora's box is used to denote a challenge that led to some problems.

According to Greek mythology, after ten years of war, the Greek fleet sailed out of sight of the Trojans, leaving behind on the shore as a "gift" a wooden horse in which a coalition of Greek soldiers was hidden. After this Trojan horse had been dragged into the unsuspecting city and under cover of darkness, the Greek soldiers emerged and opened the gates of Troy to the rest of their fleet, which had quietly returned, and thus defeating Troy. Here, "Trojan Horses" denote forces that may be good or bad, depending on one's point of view. (*Grolier Encyclopedia*. CD-ROM Macintosh version 6.0.2.)

ISO, the Israeli Institute of Standards (MATI), and the American Association for Testing and Material. They were all there for me when I needed to yell at the horses.

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Last, my family, who made it all possible: Yitzhak, my father, who instilled in me the desire to learn; Nitza, my mother, who was and still is the best mother in the world; Bossy, my sister, who is not only the best sister in the world but also the most efficient one; Amnon and Gilad, my sons, who gave new meaning to it all and also helped me stay awake in the final nights of writing this work; and, last, the one who was, is, and always will be with me, Adeena, my wife, partner, and friend, who has supported me all the way, above and beyond the standard.

Executive Summary

The diverse uses of "standards" within and outside education, as well as the interaction between educational and general uses of standards, define the goals of this work: (*i*) to develop a general framework of standards, (*ii*) to explore the use of the framework in education, and (*iii*) to reflect on the process and outcome of the development and exploratory use of the framework.

The principal outcome is a framework of standards that includes five dimensions: Level, Purpose, Effect, Sponsor, and Stage, each of which contains five categories that together define the dimension. The dimensions show:

- how standards can be produced and used by entities from different Levels (individual, organizational, associational, national, and multinational);
- how they can have one or more Purposes (simplification, communication, harmonization, protection, and valuation);
- how they can cause diverse Effects (constructive, positive, unknown, negative, and destructive);
- how they can be developed by different Sponsors (devoid, nonsponsored, unisponsored, multisponsored, and mandated); and
- how they can be in different Stages (missing, emerging, existing, declining, and dying).

Part One, the Introduction, presents the initial motivations for this research and the educational and general barriers obstructing inquiry into the concept of standards. As background, the introduction discusses the roles of standards in the industrial age, their potential roles in the knowledge age, and the current turmoil in the standards community, with in-depth discussion of the research goals and the six-step research method. Part Two, a general framework of standards, presents a broad introduction to dimensional frameworks, followed by five chapters about each of the five dimensions. Each chapter, with examples, discusses the categories of the particular dimension and its evidential base. Each concludes with an exploration section, in which the framework is applied to an educational issue. Part Three, which offers both general reflection and reflection oriented toward the field of education, reflects on designing the framework, the framework in general, and on application of the general framework of standards to education.

Note

This report is based on the author's doctoral dissertation submitted to the Harvard Graduate School of Education. In 1995, TECHNOS Press published *Setting Standards in the Age of Knowledge: A Framework for Establishing and Using Educational Standards*, adapted and abridged from *Knowledge Age Standards*.

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Chapter One

Introduction

"Columbusity" can be coined as a term to mean "finding things not sought for."[1] The term is based on the name of the explorer Christopher Columbus, whose quest for a new route to the East led unexpectedly to wider consequences. Columbosity characterized the investigative journey documented here. Originally, I sought to understand the issue of standards within education, but delving into that subject led more broadly to the realm of general standards.

Like America in Columbus' time, the land of general standards appeared vast, shifting, and at times dangerous. At first, I could see its potential, but no clear map was available, even in the literature, to help comprehend it fully. The general concept of standards appeared to lack any comprehensive framework that would allow new explorers, like me, to chart the implications of standards in specific domains—in this case, education.

1.1 Initial Motivation for the Research

The impetus for my work was the need to understand "standards" first as a concept, then as applied to education. This need emerged earlier, during research that suggested that different communities in the field of education use this concept differently.[2] For example, it appears in curriculum efforts,[3] in teacher certification efforts,[4] in discussions about national tests (e.g., those of the Educational Testing Service [ETS]),[5] in U.S. federal position reports, which often invoke "world-class standards,"[6] in discussions of "delivery standards,"[7] and in

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[1]"Columbusity" was originally used by Neil Postman, although in another sense. See his *Conscientious Objections: Stirring Up trouble About Language, Technology, and Education* (N.Y.: Knopf, 1988), 128.

[2]See Yesha Y. Sivan, *Project Y: Toward Standards That Link Business, Education, and Technology: The Case of a University Computer Center* (Cambridge, Mass.: Harvard University Graduate School of Education, 1993).

[3]Standards in Curriculum: National Council of Teachers of Mathematics (NCTM), Commission on Standards for School Mathematics (1989). *Curriculum and Evaluation Standards for School Mathematics* (Reston, Va.: NCTM).; see also section 7.4 in this work.

[4]See, for example, the American Federation of Teachers (AFT), *National Board of Professional Teaching Standards (NPTS)* (Washington, D.C.: AFT, 1990). Guests on the videorecording are Jim Hunt, then Governor of North Carolina, and Jim Kelly, Chair of the Board, NPTS.

[5]See section 8.4 in this work.

[6]See, for example: George Bush, *America 2000: An Education Strategy* (Washington, D.C.: U.S. Department of Education, 1991); National Council on Education Standards and Testing, *Raising Standards for American Education: A Report to Congress, the Secretary of Education, the National Education Goals Panel, and the American People* (Washington, D.C.: NCEST, 1992).

standards-based reform efforts, such as the New Standards Project[8] or the Wisconsin Blueprint of Excellence.[9]

Standards appear at different levels (e.g., local, regional, state, and national), they stem from different sources (e.g., professional educational associations, legislation, for- and not-for-profit organizations), and at the same time are considered extremely constructive and extremely destructive.

The diverse uses and meanings of standards, as well as the heated debates actual standards efforts generate,[10] can be attributed to the general lack of a systematic conceptual framework for standards. The search for such a framework in education, which would allow a more consistent, complete, and coherent concept of standards, defined my original destination. Yet no sooner had my journey started than two barriers appeared.

1.2 Standards in Education: Loved, Hated, and Used in a Limited Sense

The two major barriers, which are related, complicate writing, speaking, or thinking about the idea of "standards for education." The first barrier derives from the love-hate emotions educators associate with standards. The second derives from the limited sense in which standards are commonly used in this field.

On starting to dig around in the concept of standards, I was amazed by the strong contrasting emotions it evoked among educators. On the "love" side, standards are often hailed as the answer to many educational problems. "Standards" provided the basis for the establishment of the National Council on Education Standards and Testing (NCEST), for

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[7]See, for example: Andrew C. Porter, "School Delivery Standards," *Educational Researcher* **22**, 5 (1993), 24–29; Robert Rothman, "'Delivery' Standards for Schools at Heart of New Policy Debate," *Education Week* (7 April 1993), 21–22; Rolf K. Blank, "Developing A System of Education Indicators: Selecting, Implementing, and Reporting Indicators," *Educational Evaluation and Policy Analysis* **15**, 1 (1993), pp. 65–80.

[8]Proposal from the New Standards Project, *New standards: A Proposal 1992–1995* (Pittsburgh, Penna.: Learning Research and Development Center (LRDC), Univ. of Pittsburgh, 1992).

[9]Dept. of Public Instruction, *Wisconsin Educational Standards: A Blueprint of Excellence* (Madison, Wisc.: Dept. of Public Instruction, Bulletin No. 91470, 1991).

[10]For heated debates about standards, see, for example: Grant Wiggins, "Standards, Not Standardization: Evoking Quality Student Work," *Educational Leadership* (February 1991), 19-25; Daniel Gursky, "Ambitious Measures," *Teacher Magazine* (April 1991), 51-56; Diane Ravitch, *Developing National Standards in Education*, a paper presented at the American Sociological Association annual meeting, Washington, D.C., 22 Aug. 1992; Debra Viadero, "Standards Setters Search for Balance Between Excellence, Equity," *Education Week* (23 Sept. 1992), 21, and "The Rhetoric and Reality of High Academic Standards," *Education Week* (2 June 1993), 1, 16–17; Debra Viadero and Peter West, "Standards Deviation: Benchmark-setting Is Marked by Diversity," *Education Week* (16 June 1993), 1, 13–15; Chester E. Finn, "What If Those Math Standards Are Wrong," *Education Week* (20 Jan. 1993), 36, 26.

example, created to advise U.S. governors, the federal administration, and Congress about using standards to revamp the so-called sick state of education in America. Again, the term was called a "catalyst for lasting change" in the context of teaching standards[11] and a "powerful catalyst to put the whole [educational] system into place" in the context of the New Standards Project, which claims to encompass half the U.S. student population.[12]

On the "hate" side, standards are often bashed as the source of many educational problems. Typically, they are associated with often chastised standardized tests. Standards are considered "static constructs [and] imposed requirements."[13] Since publication of the *Curriculum and Evaluation Standards for School Mathematics*,[14] which led to the use of standards in the context of curriculum, rather than assessment, standards have also been attacked on the grounds of equity[15] and diversity.[16] In some instances, the whole standards movement has been called into doubt.[17]

On several occasions, I personally sensed the "hate" baggage "standards" carry. Presenting a paper on this concept to an audience at the Harvard Graduate School of Education, I was "attacked" as a technocrat, as one who was ignoring the diverse needs of students, one bringing business ideas into education. On another occasion, at a research forum of the National Education Association (NEA), I was interrupted ten minutes into a talk by an emotional participant, who said:

> I am very troubled, because I think that the efforts of business and the social compact of education are fundamentally different. The fact that they both use the same word—standards—is unfortunate. It makes us think that there is connection between them but there is really none.[18]

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[11]For teacher standards, see James A. Kelly, *Toward High and Rigorous Standards for the Teaching Profession: Initial Policies and Perspectives of the National Board for Professional Teaching Standards* (Detroit, Mich.: NBPTS, 1989).

[12]See *New Standards: A Proposal 1992–1995*, 9.

[13]For standards as static constraints, see Leroy F. Walser, *Similarities and Differences in Procedures for Developing and Approving Voluntary Standards in Selected Organizations in Education and the Private Sector* (unpublished doctoral dissertation, Dept. of Educational Leadership, Brigham Young University, Provo, Utah, 1989), 1.

[14]See NCTM Commission on Standards for School Mathematics, *Curriculum and Evaluation Standards for School Mathematics* (Reston, Va.: NCTM, 1989), and section 7.4 of this work.

[15]See, for example, Viadero, "Standards Setters Search for Balance...," 21.

[16]See, for example, Viadero and West, "Standards Deviation...," 1, 13–15.

[17]See Finn, "What If Those Math Standards Are Wrong."

[18]Paraphrased from the videotape; Yesha Y. Sivan, *An Expanded Sense of Standards: What Does It Mean for NEA*, invited participation before NEA, March 1993.

Such personal "attacks" were triggered by the prospect of standardizing aspects of the educational industry. Instead of having standards only for assessment or curriculum, I proposed having them for educational computers, a school cable TV channel, or an electronic network for teachers.

My ideas for these standards came from looking at what noneducators called standards. At least initially, standards appeared to have a different role outside education, as in the following examples: the American National Standard Code for Information Interchange (ASCII), the structure of books (pagination, table of contents, index, etc.), the way telephones dial (tone or pulse); the Microsoft Disk Operating System (MS-DOS), the magnetic strip of credit cards, the QWERTY keyboard, quality standards from the International Standards Organization (ISO 9000), the safety code for elevators and escalators, and even the standard for rubber condoms (ISO 4074-2).

K-12 education, examined through the lens of general standards, is easily seen to be one the most standardized processes of the industrial world. From Israel to Iceland and from Austria to Australia, schools look and feel the same. The same standards—such as the use of textbooks and blackboards, the ratio of one teacher to so many students in a classroom, the long vacations between grades (reminiscent of the preindustrial agricultural age), grouping students by age rather than ability or interest, and the forty-five- to sixty-minute periods—all can be found throughout the industrial world.

Despite the omnipresence of these general standards, educational research and practice have almost completely ignored them. Although actual issues, such as teacher-student ratios or teachers' credentials, have often been the subject of both theoretical research and practical debate, the terminology and theory of general standards are missing from both educational research and practice. At best, the term is used haphazardly. As one researcher put it, "the word 'standard' is used by college and university personnel, by professional educators, and by accreditors, as if there were neither variations in meaning nor potential for conflict or misunderstanding."[19]

Such haphazard usage defines the second barrier: the tendency of educators to use standards in a limited sense, and almost ignore the general sense in which they are used outside education. This could be a classic case of the "squeaky wheel getting the grease." Certain kinds of standards, those that evoke intense emotions, get all the attention and leave none for other kinds.

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[19]Walser, *Similarities and Differences in Procedures*, 25; R. W. Larson, "Examining Standards: An Important Task for Those Involved in Accreditation," *Action in Teacher Education* 1 (Spring-Summer 1979), 11.

Faced with both the intense emotions standards have evoked and the limited sense in which they are most often used in education, I turned to general standards. Unfortunately, and to my surprise, two more barriers appeared.

1.3 Standards in General: Everywhere, yet Ignored

At the beginning, I was overwhelmed by the ubiquitousness of standards—different kinds began to appear everywhere. Within a few days I found there are standards for cars, computers, children's toys, international trade, languages, paper sizes, credit cards, TVs, videos, telephones, the way my wife and I write phone messages, and the way we file our house bills. Soon I saw that the organization I worked for, Harvard University, uses standards, standards in purchasing office supplies, hiring and firing, electronic mail, reimbursements for expenses, picture identification cards, the library, and in all financial management matters. The Congressional Office of Technology Assessment (OTA) has estimated that there are roughly 95,000 official federal and private standards in the United States.[20]

Again, I encountered a "love-hate" similar to that met in education earlier, now, for example, in the contrast between a positive headline—"Rivals Join Forces to Design Standard for All Languages"[21]—and a negative one—"Computer Confusion: A Jumble of Competing, Conflicting Standards Is Chilling the Market."[22] Or an optimistic one—"The Silicon Valley Orchestra Is Playing in Tune: Incredibly, Over 40 Companies May Share Designs and Standards"[23]—and a pessimistic one—"Is the OSI [Open Systems Interconnection] Dead?"[24]

Contrary to my expectations, however, no sizable body of research exists to direct one around the new land of standards. A search conducted through the Harvard On-Line Library Information System (HOLLIS), produced many examples of standards in particular fields but few on the general concept. One work, *Standardization: A New Discipline* (1973), confirmed the absence of theoretical treatments of the concept. According to Lal Chand Verman, its author, despite "the proliferation of new disciplines...few have dared to think of

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[20]See Office of Technology Assessment, *Global Standards: Building Blocks for the Future* (Washington, D.C.: OTA, 1992), 50.

[21]See Andrew Pollack, "Universal Computer Code Due; Rivals Join Forces to Design Standard for All Languages," *New York Times*, 20 Feb. 1991, C1(N), D1(L). The code is Unicode.

[22]John W. Verity, "Computer Confusion: A Jumble of Competing, Conflicting Standards Is Chilling the Market," *Business Week* (10 June 1991), 72-78.

[23]Gary McWilliams, "Top of the News—Semiconductors" *Business Week* (25 March 1991), 32.

[24]Wayne Eckerson and Ellen Messmer, *Network World* (15 June 1992), 1, 69.

standardization as a discipline in its own right."[25] Complaints about the lack of a theoretical framework come even from those who develop standards. One appeared in 1977 in the bulletin of an organization that develops and publishes standards: "[While] standards are an essential and all pervasive element of modern society...most people, from the man on the street to the highest offices of the community, understand precious little about what standards are, what they do, who develops them and why."[26]

This state of the field was summarized from an economic perspective in 1990 by Paul David and Shane Greenstein: "the field remains young and in a quite fluid state. Economists have hardly settled on a standards terminology, much less converged on paradigmatic modes of theoretical analysis and empirical inquiry."[27] In 1992, John Gibbons, then director of OTA, wrote, "Standards generally go unnoticed. They are mostly quiet, unseen forces, such as specifications, regulations, and protocols that ensure that things work properly, interactively, and responsibly. How standards come about is a mystery to most people— should they even ponder the question."[28]

In summary, embarking on the original journey to understand the concept of standards within education, I was faced with two barriers: (*i*) the emotions, in particular the hateful ones, that educators associated with standards, and (*ii*) the limited sense in which standards are used in education. These barriers led me to seek the meaning of standards outside education. To my dismay, two further barriers appeared: (*iii*) the sheer scope and complexity of the field, and (*iv*) the apparent absence of theoretical frameworks for standards.

These four barriers are necessary to note, for two reasons. First, they led to the need to define my research goals and, later, set the style of this work. The goals (described in **Chapter Three**) are to develop a general framework for standards, explore its use in education, and reflect on the process. The style—direct, rich in example, and informal—is a deliberate choice arising from the complexity and novelty of the concept of standards.[29]

Second, there are practical ramifications. If, after finishing this work, the reader decides to apply the general framework of standards to future challenges, that reader will probably then face the same four barriers. Recognizing them, and diffusing them up front, may allow

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[25]Lal Chand Verman, *Standardization: A New Discipline* (Hamden, Ct.: Archon Books, 1973), xii.

[26]*ASTM Standardization News* 2 (1977), 24; originally quoted in Walser, *Similarities and Differences in Procedures...*, 5.

[27]A. Paul David and Shane Greenstein, "The Economics of Compatibility Standards: An Introduction to Recent Research," *Economics of Innovation and New Technology* 1, 1-2 (1990), 3-42.

[28]OTA, *Global Standards*, iii.

[29]The informality of the style, however, does not prevent rigor of argument. The widest possible evidential base was sought; see the "Summary and Evidence" sections in Chapters Five through Ten.

the reader to concentrate on the actual challenge. Overcoming these barriers may require a "big picture" (see **Chapter Two**).

Chapter Two

Research Background: Toward Standards in the Knowledge Age

The potentially critical roles of standards in the future convinced me, despite the barriers that appeared, to venture into the uncharted land of general standards. To appreciate these roles required an initial backward glance at the roles standards played in the industrial age.

2.1 Sphere of Standards in the Industrial Age

Every aspect of contemporary life is supported and often controlled by standards—including, for example, the work you are now reading. It has a table of contents (a common standard for quick access), page numbers (another quick-access device), and a standard language, a standard font, and a standard paper size. In producing the work, directly and indirectly, dozens of other standards were involved, among them the Postscript page-description language, the Internet, the HOLLIS system, the QWERTY keyboard, and Microsoft Word software for wordprocessing.

In a typical kitchen of a typical home anywhere in the industrialized world, all electrical appliances share the same electric current. Want a fan? Move one from another room, plug it in, enjoy the breeze. Want music? No problem: grab a tape cassette, put it in the player, press "play," and enjoy the music. Any tape from any vendor can be used to record in any home tape player, and it can be replayed in any other tape player, anywhere in the world.

In a car, the first issue is fuel, which can be obtained in any fuel station, on the next street or in the next state. Any tires can be used, as long as they match the standard specifications of the car. License plate number, registration, and mandated insurance, even traffic signs, directional lights, emission standards, and the radio all involve standards.

The roles of standards in the industrial age, as these examples suggest, were diverse. One researcher has suggested the following laundry list:

> A standard is a formulation established verbally, in writing or by any other graphical method, or by means of a model, sample, or other physical means of representation, to serve during a certain period of time for defining, designing or specifying certain features of a unit or basis of measurement, a physical object, an action, a process, a method, a practice, a capacity, a function, a duty, a right, a responsibility, a behavior, an attitude, a concept or a conception, or a combination of these, with the object of promoting economy and efficiency in production, disposal, regulation and/or utilization of goods and services,

> by providing a common ground of understanding among producers, dealers, consumers, users, technologists and other groups concerned.[1]

Although comprehensive, the list lacks zest, charm, or appeal. A definition of this sort deters people because it does not provoke in a meaningful way. What is needed is a strong, evocative image to capture critical facets of the phenomenon of standards.

My search for an evocative metaphor for standards in the industrial age led to the creation of the image of the "cultures and sphere." The industrial age is represented as two cultures operating within a sphere. The first culture, "technology," has to do with the invention of tools that allow people to produce more and consume more. The second culture, "business," has to do with the management of the production, marketing, and finances that move technologies from laboratories into markets. The sphere represents standards that have oiled the industrial age and facilitated the smooth interaction between business and technology.

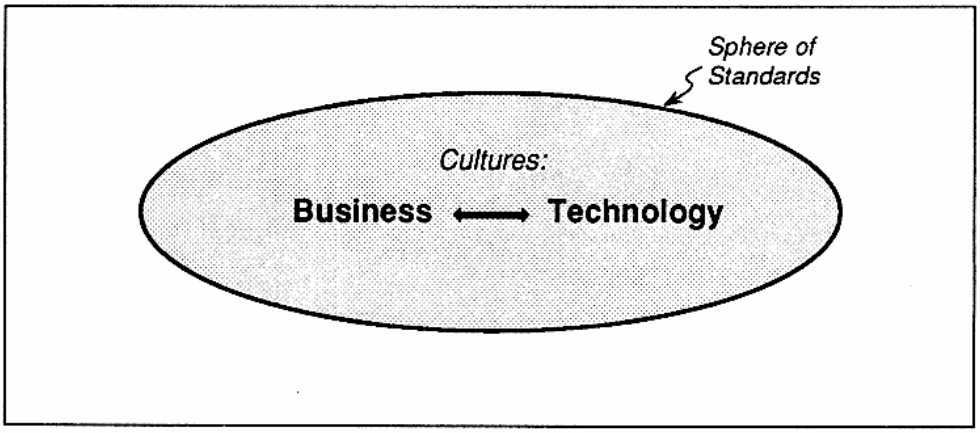

Figure 2-1

Industrial Age Cultures in a Sphere of Standards

Like any model, this one captures the most important facets of the phenomenon. The word "culture" is used to suggest a mindset, a particular way of looking at the world. For example, a technology person is interested in artifacts, how they work, how they can work better, and so on; a business person is interested in costs, processes, control structures, and so

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[1]According to Verman, the ideas behind this definition of standards, which stem from Gaillard's work, were "classic...[and] served the profession for many decades." See Verman, *Standardization: A New Discipline*. Also, John Gaillard, *Industrial standardization: Its Principles and Application* (N.Y.: H.W. Wilson Company, 1934).

on. The word "sphere" is used to mean an environment, in this case mostly intangible, that facilitates the smooth operation of the cultures.

The image has the virtue of catching people's attention and prompting questions about the roles of standards and their specific meaning in relation to business and technology. The next question concerns the roles of standards in the *post*-industrial age, that is, in the "knowledge age."

2.2 A Bigger Sphere of Standards in the Knowledge Age

The knowledge age is dawning, and everyone—individuals, organizations, and nations—already senses its challenges emerging. Armed only with industrial-age frameworks, all of them are dealing with daily television scenes that blend newsmakers and reporters, with round-the-clock, round-the-world, computer-controlled financial activities and with industries struggling to carve their future in a changing world.

Pundits claim the future holds an intense interaction with knowledge.[2] Personal hand-held information managers, interactive cable TV, cellular telephones, and individual newspapers all are used to deal with information.[3] All parts of society respond to the glut of available knowledge, a glut marked by an image-intensive, fast-paced culture symbolized by global names such as Big Bird, Butt-head, and Mario.[4]

Human beings enter the knowledge age still equipped with the innate processing power that served in prehistoric eras. More and more, people feel overwhelmed by the complexities of modern life, as the following examples from personal banking and health care suggest:

Personal financial management has gone beyond the reach of the lay person. Stocks, bonds, futures, options, and other money-making (and money-losing) schemes? have led most

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[2]Alvin Toffler's work was the first to open my eyes to the knowledge age theme. Other works, by John Naisbitt and Marshall McLuhan, also contributed to my sense of the "Knowledge Age." Although these writers take different routes, the theme runs throughout their writing. See, for example, the following by Alvin Toffler, *Future Shock* (N.Y.: Bantam Books, 1971), *The Third Wave* (N.Y.: Bantam Books, 1981), *Powershift: Knowledge, Wealth, and Violence at the Edge of the 21st Century* (N.Y.: Bantam Books, 1990), and Toffler, ed., *Learning for Tomorrow: The Role of the Future in Education* (N.Y.: Vintage Books, 1974); Marshall McLuhan, Marshall, *Understanding Media: The Extensions of Man* (N.Y.: McGraw-Hill, 1964); and two by John Naisbitt, *Megatrends: Ten New Directions Transforming Our Lives* (N.Y.: Warner Books, 1982) and *Megatrends 2000: The New Directions for the 1990s* (N.Y.: Morrow, 1990).

[3]For about $1,000 a year (in 1993), Individual, a Cambridge-based company, would fax or e-mail clients a personalized newspaper compiled from various news sources.

[4]"Sesame Street" is a children's program on public television; MTV is responsible for several music cable-TV channels; Nintendo is the maker of popular home game systems. Because all three are active internationally, they create a global culture that includes such characters as Big Bird ("Sesame Street"), Butt-head (MTV), and Mario (Nintendo).

of us to seek professional help in managing our finances. Reading a bank statement is like looking at an encrypted message: you know some of the letters but don't really understand the message. If there is a error which requires correction, tellers often respond evasively—"the computer is down" or "call the Adjustment Department."[5]

The growth of knowledge owing to information technologies has caused many of us to confront "information gridlock."[6] Generating reports, papers, and data using the new technologies has often brought about the loss, misplacement, renaming, or erasure of information. Electronic communications systems, if not managed carefully, may overwhelm already full lives (users of e-mail occasionally find their mail boxes jammed with dozens of messages).

Another challenge, health care, has begun to dominate both the first and third worlds. While research focuses on new medical treatments, discussion is increasingly focused on prevention through knowledge distribution. Fueled by the spread of AIDS, "education" is now advocated as a key factor in preventing medical and even social nightmares such as acute crime and poverty. (For example, compare the cost of educating a adolescent student about sex and pregnancy—$135—with the far larger cost of public assistance over twenty years to a child born to a teenage mother.[7])

These are just two examples of new challenges brought by the knowledge age that have wide ramifications for many people, especially those now in school who will be adults in the knowledge age. To find a job, they will need to monitor information channels; to invest or borrow, they will need to educate themselves about a complex set of financial rules; and to make decisions about health care, they will need to master statistics, decisionmaking, and the sociology of doctors' prestige.

To return to the roles of standards in the knowledge age, from this description of the knowledge age it appears that the cultures of business and technology will be joined by a third culture, a culture of "knowledge." Standards, which facilitated interactions between the cultures of the industrial age, will also facilitate the interaction among these three cultures in the knowledge age.

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[5]Teller's response: "I thank Bank of Boston for giving me a similar vivid example."

[6]See the Digital Equipment Corporation (DEC) marketing video for their new system, "Team Document Library" (CID# 5389).

[7]Kathleen Brady, Elizabeth Taylor, and James Willwerth, "Suffer the Little," *Time* (8 Oct. 1990), 39-48. The authors assume that $135 worth of sex and pregnancy education per student will reduce the chances of pregnancy.

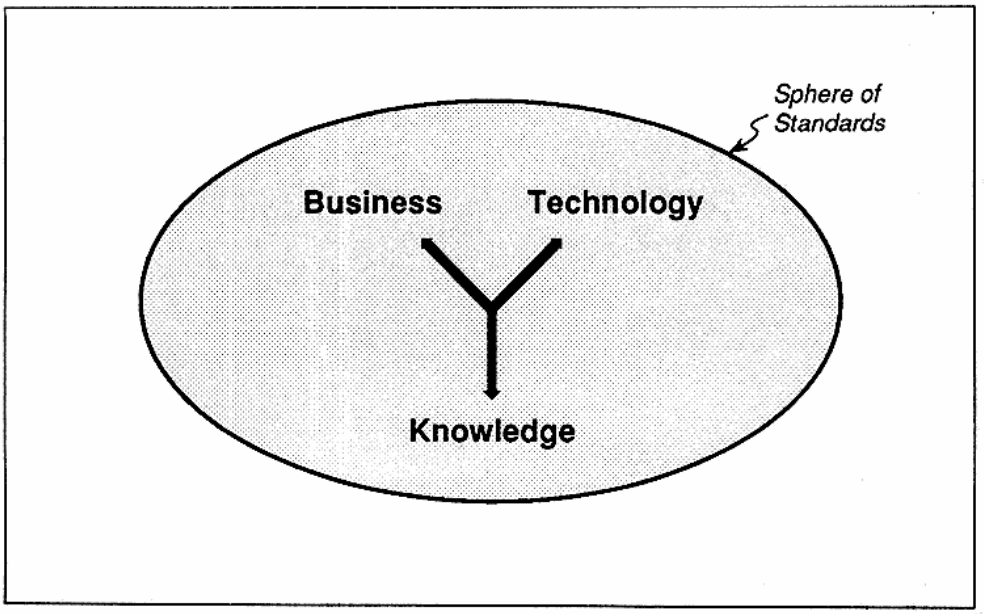

Figure 2-2

Knowledge Age Cultures in a Bigger Sphere of Standards

"Knowledge," simply put, is the direct result of learning by individuals, organizations, and even nations. Some examples of human learning are familiar: infants learn to talk, walk, and listen, as well as to cry for attention. In school, children learn to read, write, and calculate, as well as to cheat, yell, and gossip. Later, in higher education, students learn how to write papers, conduct experiments, and deal with others, as well as how to talk about a subject without fully understanding it. Working adults learn to become practitioners of various callings and to present themselves to others, as well as to work overtime deliberately. And as people grow older, they unlearn and relearn how to plan and consider, deal with failure, redefine goals ex post facto, and deal with sickness, as well as how to enjoy life in retirement places like Florida.

Why a "culture of knowledge"? Because knowledge has always provided know-how, skills, attitudes, and dispositions that help people deal with the complexities of the world. Because in the knowledge age the transfer of knowledge in formal schools, universities, boot camps, workshops, seminars, one-hour presentations, self-paced learning environments, and other arenas will be increasingly important in the development of individuals, organizations, and nations. Because learning, the transfer of knowledge, is hailed by pundits such as Michael

Dertouzos, in "Neglect of Human Resources,"[8] Peter Senge, in "Learning Disciplines,"[9] and Peter Drucker, in "Knowledge Worker,"[10] as *the* tool for dealing with the complexities of the knowledge age. According to *Time* magazine, "You either learn or perish."[11]

In summary, standards played a major, albeit behind-the-scenes role in the industrial age. In the knowledge age, it can reasonably be assumed, they will play an even greater one. The cultures of business, technology, and knowledge will demand more standards. As Alvin Toffler noted:

> The fight to control standards...is part of the larger continuing wars for the control, routing, and regulation of information. It is a key front in the struggle for power based on knowledge.... On every front—scientific, political, economic and technological—the battle over standards can be expected to intensify as the new system...replaces the fast-fading smokestack of the world of the past.[12]

2.3 Turmoil in the Standards Community

To grasp fully the scale of the change in the roles of standards requires looking into the current turmoil in the traditional standards community. This community includes private, national, and international bodies that produced the standards in the industrial age and that need to adapt to the new roles of standards in the knowledge age.

For example, the ISO report *A Vision for the Future* claimed that traditional industrial-age innovation followed a linear sequence, from scientific discovery to applied research and development, followed by production and marketing. That linear sequence, said the ISO, "must now be seen as a series of concurrent interactive processes." As a result, the report calls for structural changes in setting international standards. Thus, although in the industrial age a product was first created and then only afterward standardized, in the knowledge age often standards are needed before products. In many cases, and especially in information technology industries, compatibility with previous standards is necessary even to enter the market.

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[8]*Made in America: Regaining the Productive Edge*, edited by Michael L. Dertouzos (Cambridge, Mass.: Massachusetts Institute of Technology Press, 1989).

[9]Peter M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization* (N.Y.: Doubleday/Currency, 1990).

[10]Peter F. Drucker, *Managing in Turbulent Times* (N.Y.: Harper & Row, 1980).

[11]Sophernia Scott Gregory, "Tomorrow's Lesson: Learn or Perish," *Time* (Fall, 1992, special issue, "Beyond the Year 2000"), 59-60.

[12]Toffler, *Powershift*, 131-141.

In another example, OTA's report on *Global Standards* claimed that the "emergence of a global economy in which the United States no longer plays the predominant role" will call for more and different global standardization. It also discusses other aspects of standards in the knowledge age, such as the growth of international standardization efforts and the effect of multinational organizations.[13]

Suddenly, the standards community is being called on to develop standards in months, rather than the years standardization used to take. Official standards bodies must compete with new, ad hoc, private organizations. In the United States, "the economic competition [between groups that produce standards] is compounded by personality conflicts in the standards community." One observer mentioned in the OTA report, perhaps a frustrated user of standards, complained that "the situation is sheer madness. It has truly gotten out of hand and no longer serves our needs."[14]

This turmoil is apparent, as I learned from discussions with members of three major U.S. standards organizations. The American Society for Testing and Materials (ASTM), an oiled machine that makes and sells standards, is extremely fearful about its future. The American National Standards Institute (ANSI), a well-positioned vessel, is seeking an experienced captain to overcome years of visionless travel. The National Institute for Standards and Technology (NIST) is a well funded and respected federal agency struggling to define its role in relation to the private sector and to industrial policy.

The turmoil can be viewed as a harbinger of the roles of standards in the knowledge age. Present challenges and tensions suggest that standards will be even more important in the knowledge age, when they will "transmit information from those who have the knowledge to those who need and can use the knowledge."[15]

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[13]OTA, *Global Standards*.

[14]Ibid.

[15]Albert L. Batik, *The Engineering Standards: A Most Useful Tool* (Ashland, Ohio: Book Master-El Rancho, 1992), 2.

Chapter Three

Research Goals

The primary goal of this work is to make a consistent, complete, coherent, and forward-looking map of the land of general standards—that is, *to develop a general framework for standards*. Bearing in mind my original destination—to learn about educational standards— I decided to examine, at least in part, the potential use of the framework in education, which led to the second goal of this work, *to explore the use of a framework of standards in education*. To stimulate debate and further research, I decided to think about and document the development of the framework for standards and its initial exploratory use in education, and thus I defined the third goal of this work, *to reflect on the development and use of the framework.*

3.1 Goal 1: To Develop a General Framework for Standards

To revert to the analogy of Columbus, the first goal of this work is to map of the uncharted land of general standards. This map, or framework, will define terms and the relationships among them in order to facilitate dialogue about standards. A shared terminology will help both the producers and users of standards to exchange lessons about which standards worked well and which did not. With a shared terminology, the various actors could discuss the potential pitfalls and benefits of different standards. In particular, the map or framework should facilitate exchange among different communities and disciplines. To support such an exchange, I have tried to keep the framework itself and the whole of this work as free of false jargon as possible.

The framework should reveal, or shift the emphasis toward, a new and expanded role for standards. For example, much current research in education is aimed at developing standards for assessment and curriculum, while only little is aimed at standards for other areas. The framework developed here should highlight emerging roles standards may have in the future, particularly in relation to the use of new technological information tools. Special attention is therefore given here to innovative uses of standards.

The framework should illuminate past, present, and even future discourse about standards. By supplying a systematic vocabulary, it should expose the different, even contradictory ways in which standards have been discussed in both the practical and theoretical communities.

The framework should stimulate research about standards and enhance the links between standards practice and research. As already noted, current research on standardization does

not satisfy the needs of practitioners. Despite the need for a theory of the concept, standards have failed to accumulate sizable theoretical research.[1] As a result, on one hand, new theoretical structures that emerged in one practical setting often are useful in others. On the other, current practitioners often ignore past research, which spans more than a hundred years. To support the proposed interaction of theory and practice, I attempted to review and build on theoretical as well as practical foundations.

The challenge of the first goal is twofold. First, the framework needs a wide and stable evidential base, which should result from a logical synthesis of previous theoretical and practical sources about standards. Second, it must be presented clearly and vividly, that is, to be a practical tool it must be communicated invitingly.

The framework of standards will allow me to present and argue for an expanded meaning for standards that can be used within education. Beyond generally advancing knowledge about standards, it can also serve as a basis for pragmatic applications of standards to education, which leads to the second goal.

3.2 Goal 2: To Explore the Use of the Framework in Education

The second goal of this work—to explore the use of the framework in education—required me to find a way to demonstrate the applicability of the general framework of standards in this area.

The words "explore" and, in particular, "demonstrate" are crucial. *Proving* the usefulness of this framework to education is beyond the scope of this work. In contrast to the first goal, which calls for an evidential base, this goal calls for imagining potential uses, and to *demonstrate* these requires convincing illustrations.

Part Two presents an exploration of the framework, and in each chapter of this part the framework is applied to a particular educational issue. The issues were chosen for their relative diversity and familiarity—for example, the structure of the K-12 system, the curriculum for mathematics, and ETS—and are presented only to demonstrate how the framework works and how it can be applied to education. The issues were chosen to demonstrate the potential uses of the framework in education and are not meant to convey an

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[1]The state of standards as an academic field is summarized in *A Sourcebook of Standards Information: Education, Access, and Development*, edited by Steven M. Spivak and Keith A. Winsell (Boston: G.K. Hall, 1991), 31-92. The most telling sign of the lack of a theory of standards is the lack of academic courses in the field. No course that discusses standards is taught, for example, at either Harvard University or the Massachusetts Institute of Technology (MIT).

exhaustive examination. Instead, they are based on selected sources related to a particular issue, sources that neither cover nor fully represent that issue.

Beyond those issues, five primary uses of the framework are woven into the five exploratory chapters: (*i*) to analyze a setting that involves standards; (*ii*) to analyze a particular standard; (*iii*) to analyze views; (*iv*) to select a standard; and (*v*) to design one. These uses are intended to demonstrate the general analytic power of the framework and, more specifically, its analytic power for educational issues.

3.3 Goal 3: To Reflect on the Development and Use of the Framework

The third goal here is to reflect on the process of developing the framework and its exploratory uses in education, and it is implicit throughout (and explicit in **Part Three**). Because the proposed framework is only a starting point, the reflective comments in the text, although relatively brief, may have great significance for the discipline of standards in general and specifically for their use within education. Like all first maps of an unfamiliar land, the map proposed here risks being biased and certainly is incomplete. The reflective comments may serve future "explorers," who will want to create their own maps. Aware of actual and potential flaws in the framework, I have used the reflective comments to highlight problems I am able to recognize as well as the decisions, principles, and rationales that guided me in developing the framework and exploring its uses in education.

Chapter Four

Research Design

The research required a two-phase approach, depicted in **Figure 4-1**. The first phase consisted of collecting, grouping, and selecting sources from educational and general sources about standards. The second phase consisted of initially analyzing the sources and then synthesizing them into a framework for standards that could be evaluated. After a brief overview of the research process as a whole, the research is discussed according to its phases, in all, six steps.

In the first phase more than a hundred and twenty sources about educational and general standards were collected, from which roughly sixty[1] were selected for in-depth study. The second phase consisted of "unpacking" these sources. A term from analytical philosophy,[2] "to unpack" means to uncover, document, and critique different facets of a concept within a source, a method particularly suitable to theoretical and conceptual studies seeking to define concepts. Here "unpacking" is used to mean close reading and analysis of the discourse of the sixty selected educational and noneducational sources.

The step-by-step representation in **Figure 4-1** simplifies what was actually a complex, back-and-forth process. In actuality, the outcomes of a particular step in research usually lead to the next step, but sometimes they also lead to further work in the previous step. This nonlinearity is indicated in the figure by larger and smaller arrows. For example, step 2, the grouping of sources, led to collecting further sources in particular groups, as in step 1; similarly, synthesizing a framework, which was step 5, led back to further analysis of certain sources, as in step 4.

4.1 Step 1: Collecting Sources

Over period of four years (1990–94), both educational and noneducational sources were collected, including books, position reports, dissertations, articles, proceedings, technical reports, and trade and news clippings, all of which reflected emerging trends. Initially, the collection was inclusive, that is, an attempt was made to trace every source that discussed standards, especially those suggesting new dimensions. To assure comprehensiveness,

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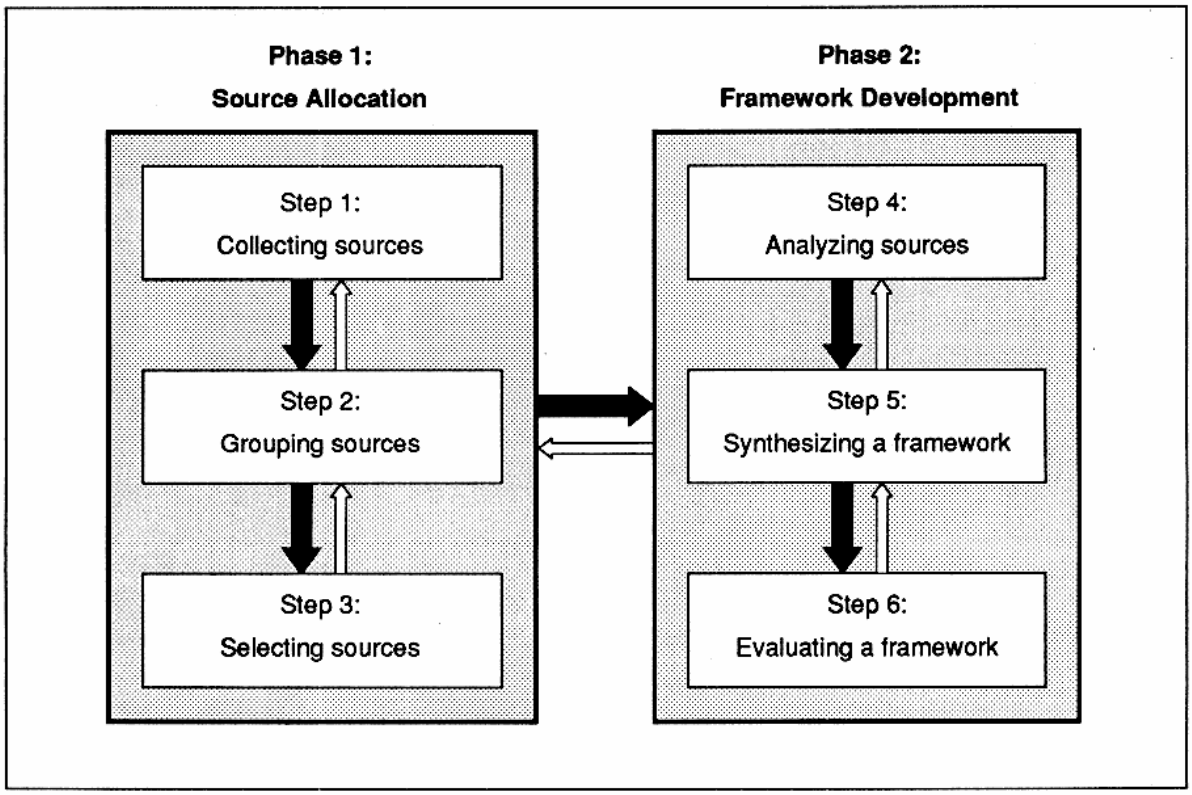
[1]This number represents a balance between reading enough sources and investing research resources.

[2]Scheffler, for example, used unpacking as a method to describe and analyze educational concepts such as teaching, human potential, and knowledge; see Israel Scheffler, *Conditions of Knowledge: An Introduction to Epistemology and Education* (Jerusalem: Y.L. Mangoes, Hebrew University, 1983 [Hebrew edition]).



Note: Black arrows indicate the order of the steps of development; white arrows indicate occasional backtracking.

Figure 4-1

Six Research Steps in the Development of the Framework

prominent researchers and practitioners were consulted.[3] To augment this collection, verify the representativeness of the sources, and obtain frequently quoted material, I visited the libraries of ISO (Geneva, Switzerland) and NIST (Washington, D.C.).

4.2 Step 2: Grouping Sources

Using the database of roughly a hundred and twenty sources, I read, abstracted, and coded the collected sources for access. Of those hundred and twenty, about two-thirds were coded as "general standards" and about one-third as "educational standards." General sources were grouped according to type of source. For a list of the groups and sources later found to

[3]Researchers consulted include David Hemenway, Harvard University, LeRoy Walser, Oklahoma University, and Dexter Fletcher, Institute for Defense Analysis (IDA). Practitioners include Lawrence Eicher, Secretary General, ISO, John Donaldson, Chief of Standards Code and Information, NIST, and Carl Cargill, at the time of our conversation in 1990, a standards manager at Sun Microsystems.

have the largest impact on the framework of standards, see the **Appendix, Grouping the Sources.**

Because a similar attempt to group the educational sources did not yield meaningful categories, instead the five groups suggested in *Raising Standards for American Education* (1992)[4] were used, augmented by a sixth group, of "reflective and miscellaneous" sources (see the **Appendix**).

To ensure a manageable scope, about a half of the hundred and twenty sources were read in depth, selected in two rounds. In the first round, two or three representative sources from the general and educational groups, thus about twenty-five in all were selected. In the second round, further sources were selected from all sources not previously selected in the first round, for a target goal of sixty sources. In both rounds, the following criteria provided general guidelines for selection:

- Often-quoted works, because authors consider them important

- Newer, innovative, or nontraditional sources, because, as they push the boundaries of traditional definitions, they may point to emerging understandings (see the **Appendix**, group 2.6, most of which were included in the final list)

- Sources that pertain to dominant standards (e.g., NCTM math standards in education, ISO 9000 quality standards outside education), because these standards have greater impact than more esoteric standards with little impact

- Survey and theoretical sources, rather than particular case studies, because the latter appear to pertain to particular settings, while reflective sources lead to general lessons, which are the concern of this work.

During the iterative research process, some of the sixty sources were found to be redundant, others more relevant. By April 1994, the final pool of sources included about 150–120 in the original database and about thirty more collected during the final analysis and writing of this work, ending July 1994.

4.3 Step 4: Analyzing Sources

All the sources were read and then analyzed to "unpack" underlying assumptions and to critique them in relation to one another. Reading was focused on the conceptual portions of sources, so that, once the main points were captured, sources repetitive in form were not read closely (some standards documents are highly repetitive). The following aims guided analysis of the sources:

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[4]See NCEST, *Raising Standards for American Education: A Report to Congress, the Secretary of Education, the National Education Goals Panel, and the American People* (Washington, D.C.: NCEST, 1992), E3.

- To uncover and critique:
  - the different meanings in which "standards" are used
  - the different purposes of standards
  - the different levels at which standards operate
  - positive and negative effects of standards
  - the different sponsors of standards

- To mark new aspects, dimensions, examples, and other interesting points

- To assess (in separate processes) the consistency, coherence, and practical import of a source in relation to other sources

4.4 Step 5: Synthesizing a Framework

The final framework was compiled from three sources: (*i*) the standards literature, (*ii*) experience gained in applying an earlier version of the framework to particular cases, and (*iii*) conversations with members of the education and standards communities, colleagues, and friends, and anyone else with something to say about standards.

Early in this step, the general structure of the framework was set; it was based on the idea that several dimensions can be used to map a complex concept such as standards. To map the concept of shirts, for example, possible dimensions might include color (e.g., black, blue, gray), type (e.g., fun shirt, work shirt, evening shirt), and size (e.g., small, medium, large). The nature of and rationale for this dimensional approach are discussed in the introduction to the framework (see **Chapter Five**). Here it is only important to note that this approach allowed gradual expansion and refinement.

Throughout this step, the results of the analysis were examined against a tentative version of the framework. At this stage, ideas for illustrations of the dimensions, for the relative importance of the dimensions, and for the wording of them, as well as for new dimensions were captured and examined against the tentative framework. Through a slow and repetitive process, the framework took final shape.

4.5 Step 6: Evaluating the Framework

The back-and-forth process of synthesis and evaluation was carried out until the results of the analysis of all sources were considered. Throughout, the evolving framework of standards was assessed according to the following expectations:

- The framework should provide an overview of the diverse meanings of the concept; by reducing confusion, it should acknowledge and accommodate considerations from research and practice of diverse disciplines.

- It should provide a tool for comparing the positions of different authors and researchers and be sufficiently comprehensive, including as many dimensions of the phenomenon of standards as the sources presented.

- It should allow classification of instances of standards, thereby creating a common nomenclature that will facilitate discussion and dialogue about the nature of different standards.

- It should clarify the links between the concept of "standards" and related concepts (i.e., quality, world-class, local vs. global, consensus).

- It should offer a guide to the significance of standards in a broad sense, summarizing the current "state of the art" and, as much as possible, point to new, emerging directions.

Bearing in mind the original destination—standards in education—the framework should combine similarities and differences in the conceptions of standards both within and outside of education.

In accord with the goal of reflection on the process, while the main work was conducted, further guidelines and insights about the development of the framework were collected that, as noted, are scattered throughout the text (and presented in concentrated form in **Part Three**).

Part Two

A General Framework of Standards

Chapter Five

About the Framework

Before the development of the framework could get underway, a format for it needed to be designed. Luckily, early in the journey, a good candidate appeared, in Lal Chand Verman's seminal work, *Standardization: A New Discipline* (1973). In this work Verman, Director General of the Indian Standards Institute in 1947–55, had proposed a three-dimensional standardization space as a "logical means of presenting standardization." This chapter presents, first, the dimensional approach to the framework for standards, then an overview of the framework.

5.1 Origin and Nature of the Framework

Verman's approach to mapping the concept of standards can best be demonstrated in a simple example. To understand the concept of "shirts"—an example used in **Chapter Four**—according to Verman, first the three major dimensions, or attributes, of shirts must be discovered. For the sake of the example, these dimensions are color (e.g., black, white, red, yellow, blue), type (fun shirt, work shirt, evening shirt), and size (small, medium, large). Following Verman, the dimensions are arranged in a three-dimensional space, so that each point in that space represents a potential question to be asked about shirts. For example, who uses a black, long-sleeved, fun shirt? Or, what can be said about work shirts in terms of color or kind? (The dimensions generate questions, not answers.)

Verman explained that the three-dimensional space should not be taken in its strict mathematical sense but more as a way to look systematically at the phenomenon of standards. He suggested adding dimensions beyond the spatial representation of the three dimensions given above. To continue with the shirts example, a fourth dimension, shape, can be added (long sleeves, short sleeves, has buttons, has pockets).

In general, frameworks like the one Verman proposed, which attempt to classify a concept systematically, are often used to create a shared map for a concept. Like other maps, they model complex concepts by capturing some of their important dimensions. The main purpose of such frameworks is to "serve as instruments of understanding," which they achieve by highlighting the critical dimensions of the land.

In education, frameworks have been used in a variety of areas. For example, Bloom and his colleagues suggested a taxonomy of behavioral characteristics that can be used to describe

and analyze educational goals.[1] Other examples include Guilford's three faces of the intellect,[2] House's three perspectives on innovation,[3] Dale's cone of media experience,[4] and Perkins's six dimensions for educational change.[5] Like other frameworks and models—or maps—that assist in the description and analysis of their respective areas, a framework of standards should create a common vocabulary and thus assist in the description and analysis of the area of standards.

Verman's dimensional approach seemed a good model. To confirm this, early in the research his approach was tested in a case study. First, on the basis of several sources, a tentative framework of standards was developed with four dimensions: Domain, Level, Purpose, and Ramifications. Each dimension included five subdimensions, or categories, that, taken together, defined the dimension. The dimensions were designed, at the price of oversimplification and even all-inclusiveness, to identify and analyze standards. Then, to test its applicability, the tentative framework was used to examine the nature and roles of standards in one organization.

This preliminary research confirmed the basic usefulness of the dimensional approach, but it also suggested limitations to Verman's spatial model when more than three dimensions were involved. Further, a verbal approach, such as Perkins's six dimensions of educational change, appeared more appropriate for a descriptive framework of standards.

The preliminary research also indicated, again, the inherent pitfalls of a framework. Like all maps, the dimensional framework has limitations: it can highlight only certain parts of the terrain and it may distort some of its features. Like the blue line on a map that marks the course of a river, which may, however, be dry, certain dimensions the framework describes in one way may look quite different in the real world. Just as it is impossible to capture the true color of any river, so it is impossible to capture the true meaning of each dimension in the real world. A map is, after all, just a map and not the actual land.

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[1]Benjamin S. Bloom, *Taxonomy of Educational Objectives: The Classification of Educational Goals, by a Committee of College and University Examiners* (N.Y.: David McKay, 1956); and Anita J. Harrow, *A Taxonomy of the Psychomotor Domain: A Guide for Developing Behavioral Objectives* (N.Y.: Longman, 1972).

[2]Joy P. Guilford, *The Nature of Human Intelligence* (N.Y.: McGraw-Hill, 1967).

[3]Ernest R. House, "Three Perspectives on Innovation: Technological, Political, and Cultural," in *Improving Schools: Using What We Know*, edited by Rolf Lehming and Michael Kane (Beverly Hills: Sage Publications, 1981), 33.

[4]Edgar Dale, *Audio-visual Methods in Teaching* (N.Y.: Dryden Press, 1954).

[5]David N. Perkins, *Smart Schools: From Training Memories to Educating Minds* (N.Y.: Free Press, 1992), 231-235.

5.2 Overview of the Five Dimensions

The principal result of this work is a framework for standards that has five dimensions, and each dimension has five categories which together explicate the dimension

Table 5-1

Summary of the Five Dimensions

Dimension 1: Level	Dimension 2: Purpose	Dimension 3: Effect	Dimension 4: Sponsor	Dimension 5: Stage
Individual	Simplification	Constructive	Devoid	Missing
Organizational	Communication	Positive	Nonsponsored	Emerging
Associational	Harmonization	Unknown	Unisponsored	Existing
National	Protection	Negative	Multisponsored	Declining
Multinational	Valuation	Destructive	Mandated	Dying

The framework can best be illustrated by showing how the five dimensions work in a real context, and, even though some categories here may seem cryptic (i.e., Harmonization) or even completely unclear (i.e., Unisponsored), this overview will show the generality, usefulness, and potential value of the framework.

First, in imagination select a standard that particularly interests you. You can use a standard presented in the Introduction or any other you see or would like to see around you. You can choose the cable standard (say, its short name is "Cable"), standards for computer-based characters ("ASCII"), the structure and size of credit cards ("Credit card"), tests such as the Scholastic Aptitude Test ("SAT"), or a male patron's need for a tie in certain restaurants ("Tie-in-a-restaurant"). You may want to select a standard from your own setting. Give the standard a name, preferably a short one (up to four words). The following paragraphs will show how to apply the Level, Purpose, Effect, Sponsor, and Stage of the standard.

The *Level dimension* prompts consideration of the users and producers of the standard. For example, if the standard selected were the SAT standard, then the users would be students (Level-individual) and universities (Level-organizational), and the producer, a single one in this case, would be ETS (Level-organizational). Who uses the standard? Is it used by individuals, organizations, even nations, or perhaps the whole world? Was it developed by an international body or by an association of companies? Or by a particular person?

The *Purpose dimension* prompts consideration of the aims, intended and unintended, of standards. For example, the "Tie-in-a-restaurant" standard is aimed at maintaining a respectable looking clientele and protecting clients who want their money's worth of genteel ambiance (Purpose-protection). Was your standard intended only to create a vocabulary, or was it intended to protect consumers from potential harm? Some standards, yours perhaps among them, although designed to support simplification, were used later to support protection.

The *Effect dimension* prompts consideration of the pros and cons, the benefits and problems, the payoffs and tradeoffs of standards. If yours were the cable standard, then one payoff might be the various channels now enjoyed (Effect-positive), and one tradeoff might be the monopolistic system in which the cable industry operates (Effect-negative). Does your standard currently have positive Effects on one organization but long-term negative, perhaps destructive, Effects on another? Or, just the opposite, might it have negative Effects now but constructive Effects in the future? Or, is basically nothing known about the Effects of the standard?

The *Sponsor dimension* prompts consideration of the origin of the standard. In the case of the size of credit cards, the sponsor is ISO (Sponsor-multisponsor). Who developed your standard? Can you identify its sponsor? Was it a single entity that makes money from the standard? Or a not-for-profit consortium of organizations? Is there a penalty attached to the standard, or a recommendation?

The *Stage dimension* prompts consideration of the process of making a standard. For example, the ASCII standard is well established (Stage-existing), and extending it to include non-Romance languages (e.g., Arabic, Hebrew) has been discussed. Does your standard already exist? Is it widely used? Is its use declining, as its negative Effects overcome its positive ones?

This imaginary experiment offers a taste of the workings of the framework, the five dimensions acting like mental prisms. Like real prisms, which are used to break down light and analyze it into basic colors, the dimensions can be used to break down an object and analyze it into its basic components. The object may be a particular standard, a setting, a view, or any target for analysis that involves standards.

With certain objects, several categories or even whole dimensions will not be applicable; yet having all five dimensions available means being equipped with a general tool. The price of generality is a lack of applicability of some dimensions to some cases. This tradeoff may explain why, in the imaginary experiment here, particular dimensions may not have related to the standard you selected.

5.3 The Structure and Spirit of the Chapters on the Dimensions

In the following five chapters systematically examine the five dimensions. In structure these chapters follow a single pattern of presentation. Each includes (*i*) a general introduction to the dimension; (*ii*) a presentation of the dimension's categories; (*iii*) a summary of and evidence for the dimension; and (*iv*) an exploratory section, in which the framework (or parts of it) is applied to an educational issue.

Put another way, first, a brief overview presents the entire dimension. Second, in greater detail, the five categories of the dimension are presented, with concrete examples, definitions, and comparisons to other categories in the same dimension. If useful, arguments about the wording of the categories are included (although a full discussion of the selection of category names appears in **Part Three**). Third, in a scholarly manner, a summary of the dimension elaborates on general points, after which an evidential base for the dimension is presented, consisting of a combination of the following three kinds of evidence:

- *The internal logic of the dimension*: The categories have an order, they cover a range of options, and they are different from one another

- *The appearance of the dimension in the standardization literature*: Either the dimension or some of its categories was mentioned or used by other authors

- *The ability of the dimension to generate insights*: The categories have generative, analytic power and can highlight nuances of the concept of standards. (Evidence concerning use of the framework is developed in the fourth section of the chapter.)

In the spirit of the second goal of this work—to explore the use of a framework of standards in education—in the exploratory sections the framework is applied to educational issues. Each exploratory section includes background on the particular educational issue, discussion of that issue, and a generalization of the exploration. Each uses dimensions previously covered, not just the dimension that is the subject of that chapter (e.g., the exploratory section of the chapter on dimension three, Effect, uses the dimensions Level and Purpose).

The next five chapters invite you to pause occasionally to examine the applicability of the categories to your own setting, which is best done after reading the sections on "categories" as well as the "exploratory" portion that concludes each chapter.

Chapter Six

Dimension 1: Level

6.1 Level: Introduction

Consider, for example, Iris, a graduate student at Columbia University, who always signs her e-mail messages "Yours, Iris." She uses the University's electronic mail system to send, receive, and store e-mail. The University is also connected to an external network, the Internet, which links it to many other universities and organizations. Initially conceived to link U.S. defense-related computers, the Internet has become a national and even international standard as, first, academic users and, then, nonacademic users worldwide began exchanging electronic mail on it.[1] As a result, Iris, from her desk at home or at the University, can send e-mail to friends in any other town, city, or country that has a computer network system connected to the Internet.

Table 6-1

Dimension 1: Five Categories of Level

Dimension 1: Level	Dimension 2: Purpose	Dimension 3: Effect	Dimension 4: Sponsor	Dimension 5: Stage
Individual	Simplification	Constructive	Devoid	Missing
Organizational	Communication	Positive	Nonsponsored	Emerging
Associational	Harmonization	Unknown	Unisponsored	Existing
National	Protection	Negative	Multisponsored	Declining
Multinational	Valuation	Destructive	Mandated	Dying

This case demonstrates standards operating at different Levels: the typical closing sentence is an individual standard; the university e-mail system is an organizational standard; the Internet linking universities and other organizations is an associational standard; and the adoption in the United States and throughout the world of the Internet is considered, respectively, a national and a multinational standard.

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[1]In June 1969 there were three Internet hosts; in June 1994, 2.3 million. For information on the Internet and for other Internet tidbits, send e-mail to http://www.openmarket.com/info/internet-index/current.html. [Internet Index 2 Aug. 1994, Edupage Service]

More generally, standards are developed by the people for the people (although, at times, it does not feel that way). For every standard the question can be asked, "How many people participated in its making?" and "How many are affected by it?" In most cases, although not all, a greater number of people are linked to a higher Level. Although most standards are associated with a certain Level, a standard can affect, at least indirectly, other lower or sometimes higher Levels. This dimension (and its five categories) was designed to capture the Levels where standards are produced or used.

6.2 Level: Categories

6.2.1 Level 1: Individual

Individual people are the ultimate users of standards. Most homes (assuming they are situated in the industrial world) use a standard metal prong to connect electrical appliances to the current, a standard cable box to feed the TV set, and a standard telephone system to talk with family and friends. In the workplace, too, individual people are subject to standards. Some go to work at a set hour, others have flexible hours. Some are subject to a dress code, others are permitted a more casual style. Yet all workers who work for others, and even most who are self-employed, use rules and structures to define their working conditions.

People are also developers of standards for their own use. Usually before the age of eighteen, a person will develop a typical individual signature. People establish routes between home and work. They subscribe to certain newspapers and cable channels. If they have a programmable telephone and use its storing capabilities, they need to select numbers to store and use automatically.

For example, I use my Panasonic programmable phone to program an eight-digit banking code into a button labelled "BC" (for bank code). When I call the automatic bank service and a computerized voice asks me to "enter the eight-digit code," I press the BC button and—presto!—the bank code is entered. I do not need to remember the code or where I may have written it down.[2]

Each time a process is defined, specified, or developed to use more than once, a standard is being developed for individual use. In contrast, the development of a standard to be used also by others moves into the arena of the organizational Level.

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[2]Any programmable telephone can be used for this purpose. The bank's computer is simply identifying tones the telephone is transmitting, whether they come from the keypad or from telephone memory.

6.2.2 Level 2: Organizational

Discussions of the Level dimension have often prompted interesting questions. One person, who said that at home he uses the refrigerator door to post important messages, asked, "Would this be considered an individual standard?" "If you live alone, it indeed is," I answered, "but if there are roommates or a spouse, kids, or any others living with you, then it has become an organizational standard."

For the purpose of this work, an organization is a collection of individuals with a common mission, and organizations, like individuals, can be both the producers and users of standards. The literature, especially industrial age literature, uses other terms, such as "factory," "company," or "industry," to describe this Level. The term "organizational" is used here, because it denotes all kinds of groups—service organizations, nonprofits, and many others. This Level includes: (*i*) industrial organizations, such as factories, which produce goods (e.g., cars, pencils, and lamps); (*ii*) organizations that offer services (e.g., banks, hospitals, universities, schools); and (*iii*) new types of organizations (e.g., software houses that both develop products—if a diskette containing software is a product—and sell services—such as a telephone help line.

All organizations have a purpose—even, sometimes, simply the survival of the organization. They have members organized in a structure. As at the individual Level, organizations can both produce and use standards. Organizations often by themselves produce standards for the other Levels, although they may choose to produce standards in association with other similar organizations.

6.2.3 Level 3: Associational

When organizations with common interests join to define standards, they combine cumulative skills, knowledge, and clout to produce a standard that will help all of them. Historically, standards in the industrial age were produced mostly were produced by and for the associational Level. In the United States, ASTM, since its founding in 1898, has grown into the largest voluntary standards development organization in the world. A nonprofit organization, it provides a forum for producers, users, consumers, and other parties, such as government and academia, to develop and publish standards for materials, products, systems, and services. Through 30,000 individual members working in technical committees, it produces, examines, and approves more than 8,500 different standards, published in the sixty-eight volumes of the annual book of ASTM standards.[3]

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[3]I had a direct opportunity to learn about the ASTM when invited in 1992 to its meeting of the Committee on Research and Technical Planning (CR&TP). In a talk I named "How Education Can Use the Other Standards," I called on ASTM to enter the education market in full force. Historical references here are from ASTM public relations materials. For further information, call ASTM at 215-299-5400. See the American Society for Testing

In most respects, ASTM represents a typical standards-producing entity at the associational Level. In other respects, it is a rare bird in the standardization community. First, ASTM derives most of its income (80 to 85 percent) from the sale of its publication and the rest from investments, annual fees, and private and public grants (typically other organizations are funded by membership dues).[4] Second, ASTM is one of the best oiled machines for dealing with standards. Known fondly as "All Standards That Matter," ASTM exemplifies what a good association should look like.

Most associations have a more focused and limited agenda than ASTM. They can be user-driven, producer-driven, even self-driven. They can be based on geographical interests (all businesses in a certain area), on professional interests (e.g., teachers unions, fire prevention), or on other interests (e.g., veterans groups). Sometimes competing organizations and even fierce rivals join forces to set standards—for example, to prevent too much diversity, which might intimidate customers (imagine ten different sizes of video cassettes)—or to enhance the professional image of their membership (e.g., certification processes for lawyers and doctors). At still other times, rivals may join to defeat a rising challenger.

6.2.4 Level 4: National

In the terminology for the Level, associations that promote their standards to wider audiences, such as an entire nation, are considered to be at the national Level. National Standards Bodies (NSBs) were the major force in industrial age standardization (see **Table 6-2**). ANSI in the United States, Brith Standards Institute (BSI) in the United Kingdom, and Deutches Institut für Normung (DIN) in Germany, played important roles in setting national standards.

In most cases, NSBs are responsible for (*i*) developing or setting national standards; (*ii*) representing national interests to outside entities, such as other nations, the ISO, or multinational companies; and, reciprocally, (*iii*) representing outside entities within their own nations, especially the ISO and other NSBs.

There are no standards for NSBs. Their structures, funding, and methods of operation vary from nation to nation. For example, ANSI does not develop standards at all, but serves as a clearinghouse for smaller associations that actually make the standards. In another example, the Israeli NSB, operates as a national testing laboratory, where products receive a certification symbol, which in Hebrew is *tav teken*, literally, a "mark of standard."

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and Materials, *Annual Book of ASTM Standards* (Philadelphia: ASTM).

[4]According to ASTM, 85 percent of the Association's income comes from sales. In 1992, OTA reported 80 percent; see *Global Standards*, 51.

Table 6-2

Selected National Standardization Bodies (NSBs)

AFNOR	Association Française de Normalisation	France
ANSI	American National Standards Institute	United States
BSI	British Standards Institution	United Kingdom
DIN	Deutsches Institut für Normung	Germany
DS	Dansk Standardiseringsraad	Denmark
NNI	Nederlands Normalisatie-Instituut	Netherlands
NSF	Norges Standardiseringsforbund	Norway
SANZ	Standards Association of New Zealand	New Zealand
SII	Standards Institute of Israel	Israel
UNI	Ente Nazionale Italiano di Unificazione	Italy

The national Level can be used, beyond classical references to NSBs, to capture nonformal standards that stem from culture, tradition, and history. For example, in the United States, the metric system has never caught on; or, in a more mundane example from sports, in the United States "soccer" is used to describe what is known everywhere else as "football."

6.2.5 Level 5: Multinational

If "No man is an island,"[5] then, by extension, no nation can survive without other nations. This is not a cliché with the opening of the knowledge age. Historically, from ancient Greece and Rome to present-day United States and Japan, commerce among nations has been responsible for the wealth of nations, and commerce now is becoming even more critical. The term "global village" is no longer a future vision but a gold mine for those ready for it (or a mine field for those who are not).[6] With the growth of global telecommunications, for example, software can be developed in India or Russia for a mere $1,000 a month per person instead of the $10,000 a month per person it costs in the United States. (A less costly labor force now can handle what once was considered highly skilled work.)

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[5]John Donne, "Devotions upon Emergent Occasions," Meditation XVII, *The Norton Anthology of English Literature*, Vol. 1, edited by M. H. Abrams et al. (N.Y.: W.W. Norton, 1962, revised ed. 1968), 917.

[6]The term "global village" is usually associated with Marshall McLuhan; see his *Understanding Media: The Extensions of Man* (N.Y.: McGraw-Hill, 1964).

In the knowledge age, standards at the multinational Level are supposed to have their greatest value. At this Level, much more work is needed, which probably will be done both by traditional standards bodies and by new bodies.

The prime candidate to take on this work is the ISO, a worldwide federation of national standards bodies from some ninety countries that

> promotes the development of standardization and related activities...with a view to facilitating international exchange of goods and services, and to developing cooperation in the sphere of intellectual, scientific, technological, and economic activity. The results of ISO technical work are published international standards.

The ISO covers all fields, except electrical standards, which are the responsibility of a related organization, the International Electrotechnical Commission (IEC).[7]

Another traditional international organization is the International Telecommunication Union (ITU), an agency of the United Nations, with more than a hundred and sixty member countries. One of its bodies is the ITU-T, for Telecommunication (formerly the Consultative Committee for International Telegraph and Telephone, or CCITT). Every few years, an ITU-T assembly draws up a list of "questions" about possible improvements in international electronic communications. Working in study groups, experts from different countries develop "recommendations," which are voted on and then published. Examples of ITU-T standards include the V series for modems (e.g., V.32, V.42), the T series for text communication (e.g., telex, facsimile [fax], videotext), and (among its lesser known standards) the H series for digital sound and video encoding.[8]

Beyond traditional international bodies, the multinational Level also includes newer efforts and players, for example, European efforts to create pan-European standards. This effort dates back to the formation in 1965[9] of the Comité Européen de Normalization (CEN) and the Comité Européen de Normalization Electrotechnique (CENELEC), which deals with electromechanical standards. The goal of both organizations is to unify the members of the European Union (EU) under one set of standards. Such regional organizations may provide a model for other future cross-national efforts.

The youngest force at the multinational Level may be multinational companies. Conglomerates influence world standardization in at least two ways. First, because of their presence in many nations, they often become national representatives to international

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[7]*ISONET Guide* (Geneva: ISO, 1989).

[8]Markus Kuhn, *Standards FAQ [Frequently Asked Questions]*, 1993. Gopher document accessed via Veronica.

[9]*Global Standards*, 69.

standardization bodies (such as the ISO). For example, IBM Europe is an active member in CEN efforts. Second, global companies, especially in newer fields, can become aggressive worldwide monopolies, which would give them control over worldwide de facto standards. Microsoft owns a large fraction of the operating systems market worldwide. Cable News Network (CNN) is the world's largest supplier of news. And certain brand names—Ikea, Coca-Cola, Pepsi, McDonald's and Burger King—have been globalized.

6.3 Level: Summary and Evidence

A dimension called Level first appeared in Verman's *Standardization: A New Discipline*, but I differ with him on the meaning of the category of "individual." Verman uses individual standards for nonrepetitive situations.[10] To him, any case that is singular in any way can be considered an individual standard; thus, if a company develops specifications for a new factory, they would be at the individual Level. For Verman, the design of a ship or city or the construction of an information highway could be considered individual cases. The key to his definition and his use of the individual Level is that the standard occurs once, whereas in this work individual is used to mean that one person can use the standard many times.

Although Verman's definition is intellectually appealing, it is lacking in two respects. First, many cases that seem to occur only once can, and often do, become more general cases. The design of a ship, for example, can serve as the basis for another design, the design of a city can be compared to designs of other cities. If something can be generalized, the chance exists that someone will want to do so. Second, Verman's definition does not seem workable for novice users. People seem to prefer a coherent, more specific way to distinguish among the categories of the Level dimension. In contrast, as will be explained later, the criterion of "size" (i.e., the number of people affected by the standard) is adopted here, which works the same way across all categories from the individual to the multinational. Logically, the Level dimension uses a simple order of size. An organization usually involves many individuals, and a multinational effort usually involves many national players. In general, each Level involves several members of the previous Level.

In addition to this change in the logic of one category, two other changes in wording have been made here.[11] Verman's "company" has been replaced by the term "organizational," because the latter is broader, and his "international" has been replaced by

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[10]Verman, 76.

[11]In a third change, for esthetic reasons, all categories have been adjusted to incorporate the suffix "-al." This change required the creation of the word "associational," which seemed to generate no complaints when the framework tested with lay people and with experts. The word simply makes sense.

Table 6-3

Summary of the Level Dimension

Dimension 1: Level	The Level has to do with:
Individual	an entity, usually a person who develops or uses the standard.
Organizational	a number of individuals with a common mission who develop or use the standard.
Associational	a number of organizations or individuals with common interests who develop or use the standard.
National	a political entity, usually centrally governed and geographically bound, that develops or uses the standard.
Multinational	an association or organization spanning more than one nation that develops or uses the standard.

the term "multinational," again because it is broader and includes regional as well as other cross-national activities.[12]

When applying the Level dimension you need to examine the issue in question in relation to all categories. A standard developed by a local company (organizational), for example, can become a national or even an international standard. Such a standard may harm other organizations in the same field or affect individuals. As with all the other dimensions, the applicability of certain categories depends on both the kind of analysis and the kind of setting.

6.4 Exploration: The Use of the Framework in Education

Now to shift gears, from the theoretical presentation of the framework to an exploration of its practical use in education. As already noted, the challenge for the exploratory sections is to demonstrate the potential use of a general framework of standards in education. Here, the Level dimension—the first of the five dimensions—is used to analyze the structure of the K-12 setting. The cursory and limited analysis demonstrates how the framework can be used to analyze a setting that involves many standards.

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[12]A reference to the Level dimension was published by the ISO in 1972, a year before Verman's work appeared; in *The Aims and Principles of Standardization*, T. R. B. Sanders identified Verman as the originator of the Level dimension, although Sanders's book includes only four of Verman's categories (company, national, regional, and international)—a change that may be laid to the national focus of the ISO.

6.4.1 Background: Schools as the Creation of the Industrial Age

Since most people attend school, there is no need to spend time here on the nature of schools, but here are some of the many standards a typical student meets in a typical school.

A typical student, say, Sam from New York City, will start school at the age of six. For the next twelve years, he will study according to more or less a single format. That is, he will arrive at school in the morning, spend several periods learning, or at least being taught, and then go home. The students in Sam's class will be clustered according to age in groups of thirty to fifty students per class. Despite differences in learning styles, abilities, mood, and previous short- and long-term backgrounds, the students will be expected to learn the same content, from the same teacher, in the same period (about forty-five to sixty minutes).

What epitomizes the sameness in the look and feel of schools is the use of schoolwide sound systems (traditionally, a bell) to signal the beginning and end of class periods. The bell, whistle, or more recently the loudspeaker hint at the source of the sameness: the industrial age. That age not only led to the creation of schools, it also gave schools their structure. Much like factories of the industrial age, schools used management techniques to organize—some say slice and dice—the educational process. Students were organized into age groups, learning was organized into subject matter, the learning year was organized into semesters or terms, and the learning day was organized into periods. For better or worse, the current prevailing school structure has its origins in the philosophy and practice of the industrial age.[13]

Sam's thirteen-year school experience—some say ordeal—should be familiar to most people. The structure, look, and feel of schools across industrial nations is stunningly similar. These similarities can be seen in the K-12 system by using the prism of standards. Specifically, in the following discussion the Levels are used to present the different entities operating in a typical industrial age K-12 system.

6.4.2 Discussion: Multiple Views of the K-12 Setting

To portray similarities within industrial age K-12, the five Level categories were used to generate questions about the K-12 setting, such as, "What could be the meaning of the individual Level for the K-12 setting?" or "What could be the meaning of the organizational Level for the K-12 setting?" To make the process even more generative, three points of view were selected—the student's, the teacher's, and the family's. For each point of view, the

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[13]See Edward B. Fiske, *Smart Schools, Smart Kids: Why Do Some Schools Work* (N.Y.: Simon and Schuster, 1991), and David B. Tyack, *The One Best System: A History of American Urban Education* (Cambridge, Mass.: Harvard Univ. Press, 1974).

question of the meaning of the different categories was raised, with the answers shown in **Table 6-4.**

Table 6-4

Three Potential Educational Levels

Levels	Three Possible Views		
	View 1: Student	**View 2: Teacher**	**View 3: Family**
Individual	Student	Teacher	Parents and their kids
Organizational	School	District	Private or public schools
Associational	District	State	State universities
National	State	United States	Employment in the United States
Multinational	Not applicable	World	Compare to other nations

The three views highlight several general qualities of using a dimension to generate values for a setting, particularly the following differences:

- Although the student's view ignores multinational considerations (which therefore are noted as "not applicable"), the teacher's and family's views include them, if in different terms.

- While the student's view lists "state" at the national Level, the teacher's and family's views list it at the associational Level.

- While the student's and teacher's views use the term "district," denoting the public school system, the family's uses both private and public schools.

- While the student's and teacher's views use generic terms, the family's view takes a more focused approach to the categories (the family's view is assumed to include the student's job prospects).

As these differences suggest, the results of the analytic process depend on setting and point of view. No view is the correct or best one. Experimenting with several views and then comparing the values in them may reveal hidden features of the setting.

With these results in hand, further analytic questions can be asked about the setting—

about who makes standards at each Level, what the Effects of the standards are on the other Levels, whether users participate in making decisions about the standards, and so on. The answers can be compared to these answers in similar settings. For example, what tests do other districts use, what salary scales do other states use, what is the average number of students per class in other nations.

These questions are not new. Researchers, practitioners, and policymakers at all Levels have often asked them. What is new is the systematic view that the Level dimension facilitates and encourages. That is, the Level dimension requires the observer to look at the big picture. For example, a superintendent faced with a complex decision might be prompted by the Level dimension to consider arguments and forces from higher and lower Levels, which might otherwise have gone ignored. A teacher trying to explain to students why they should learn "long division" when a calculator can perform the same task more efficiently might want to remind the students that some areas of the world do not have calculators. A parent trying to decide how to vote for the best school board member might want to develop criteria from the workings of school boards in other districts.

"Big picture" questions can originate from other directions, not necessarily only from the standards direction. The dimensions of standards, as the discussion of the Level suggests, can foster asking probing, "big-picture" questions in a relatively concrete and direct manner. The question, "what standards operate in the district Level?" is more concrete than "what forces operate in the district Level?" In general terms, considering the various reasons, forces, and arguments that affect standards at all Levels may lead to an understanding of the "big picture" itself and, ultimately, to manipulation of it.

6.4.3 Generalization: Analyzing Settings with the Framework

The Level dimension has been used here as a checklist to generate three contextual profiles according to the categories of the dimension. In applying the dimension this way, concrete values that stemmed from the issue selected here—the K-12 system—were assigned to each of the Level categories. In more general terms, such assignments are needed, because the dimensions, which were designed to be used across various settings, use generic nondomain-specific terms. By assigning domain-specific values to the categories, the entire framework becomes clearer and more meaningful. As with any new framework, assignment is especially beneficial for novice users in their initial attempts to use the dimensions. After a few uses, as novices assimilate the vocabulary, they can discuss the issue in the generic terms of the framework.

The introduction (**Chapter Three**) suggested that the general framework of standards can be used to (*i*) analyze settings, (*ii*) analyze standards, (*iii*) analyze views, (*iv*) select standards, and (*v*) design standards. This section demonstrates the first use of the framework,

using only one dimension (Level) to analyze a setting. In general, settings do not need to be so comprehensive as the entire K-12 field; the framework can be applied as an analytic tool to smaller settings—a school, even a classroom. In a smaller setting, however, some categories will not be applicable (such cases are noted as To Be Determined [TBD] or Not Applicable [NA].)

The assignment, including that of values Not Applicable, is relevant to all the dimensions. It originated in the abstraction purposely built into the framework to support applicability across disciplines. The user should change the somewhat abstract category names into meaningful and more concrete ones in order to bring the categories to life and enhance their ability to generate insights. But concrete values are not the end goal of the framework, which is the improved decisionmaking that stems from greater awareness of the growing forces of standards.

Chapter Seven

Dimension 2: Purpose

7.1 Purpose: Introduction

Standards, as may be clear by now, can do different things for different entities. Thanks to an agreement about structure, all credit cards are the same size. Thanks, again, to an agreement about structure, this time, a compact disk (CD) player made in Japan can play a CD made in Israel or in the United States. Until recently, thanks to a strict Japanese standard for rice, U.S. farmers could not sell rice to Japan, thus Japanese farmers were protected from foreign competition.[1] Last, thanks to a legal mandate about elevators, passengers are protected, although purchasers of elevators have to pay for yearly inspection.

Table 7-1

Dimension 2: Five Categories of Purpose

Dimension 1: Level	Dimension 2: Purpose	Dimension 3: Effect	Dimension 4: Sponsor	Dimension 5: Stage
Individual	Simplification	Constructive	Devoid	Missing
Organizational	Communication	Positive	Nonsponsored	Emerging
Associational	Harmonization	Unknown	Unisponsored	Existing
National	Protection	Negative	Multisponsored	Declining
Multinational	Valuation	Destructive	Mandated	Dying

The Purpose dimension is designed to map the many aims and functions of standards into five categories. Selecting only five Purposes and then naming them involved grueling simplification (see section 7.3). By the end, a common language emerged, which can facilitate communication about the Purposes of standards, facilitate building more complex structures, and enable harmonizing competing, often conflicting, opinions. A common language offers protection against term-related misunderstandings. For volatile issues, such as abortion or discrimination, a common language alone is not enough to bridge all differences; what is needed is to dig and seek the values underlying different positions.

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[1]Stephanie Anderson Forest, "Finally, Yankee Rice for Japanese Plates," *Business Week* (8 Aug. 1994), 6.

Offering an intuitive sense of the nature of the five categories of the Purpose dimension, the paragraph above uses all of them to describe difficulties encountered composing the dimension. As is true for the other dimensions, a particular standard or situation can be related to several categories, and this is especially true for the Purpose dimension because standards usually have two or three purposes.

To arrive at the five categories, dozens of standards were examined and many authors who have written on them were consulted. In contrast to the simple logic of the Level dimension—where the order of categories stems from the meaning of the dimension—the Purpose dimension has no inherent sequence, because the categories stand by themselves. Lacking substantive, ordinal logic, the categories are ordered according to a lay person's "grasp-ness"—that is, the first category, simplification, is the easiest to grasp and the last one, valuation, the most problematic.

7.2 Purpose: Categories

7.2.1 Purpose 1: Simplification

Initially, standardization should be considered a process of simplification, intended to combat an ever increasing flood of complexity. Standardization controls the flood, directing it into appropriate channels for the benefit of all concerned.[2] Verman called simplification "variety reduction, a form of standardization consisting of the reduction of the number of types of products within a definite range to that number which is adequate to meet prevailing needs at a given time."[3]

In the early 1920s, Henry Ford, with his any-color-as-long-as-it's-black Model T, was one of the first to use massive simplification. More than any other industrialist of his time, he advocated that "less is more." Why? Because less variety reduces lead time, idle-machine time, needed storage, needed stock, needed spare parts, and tied-up capital. Less variety can benefit both consumers (for example, by lower prices and better interfaces) and producers (yesterday's mass production and today's just-in-time flexibility).[4]

Mass production occurred even earlier, in 1798, when Eli Whitney demonstrated the manufacture of standard musket rifles. In the presence of government experts, Whitney, using

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[2]Sanders, *The Aims and Principles of Standardization*, 6.

[3]Verman, *Standardization: A New Discipline*, 25.

[4]ISO, *Benefits of Standardization*.

materials in ten identical barrels, assembled ten identical stocks and ten identical triggers, producing the first ten standardized rifles.[5]

Beyond manufacturing, simplification is important to the way humans process information. A desire for simplification can arise when visiting, for example, a new Hungarian restaurant. If the menu offers too many items, especially dishes never previously heard of, confusion reigns. With too many items to choose from, especially when the diner is very hungry, "menu culture shock" hits.

The need for simplification is rooted in the way the human mind works. Standards, when they simplify, collapse complex reasons and competing forces into digestible chunks, thereby reducing the cognitive overload associated with complexity.

7.2.2 Purpose 2: Communication

Standards facilitate communication by allowing different people, organizations, and nations to link with one another and interact. Communication standards are comparatively widely known and appreciated. Examples include tape recordings, video standards, fax standards, drafting symbols, traffic signs, even language itself.

One family of communication standards, often called "basic standards," is used to define terms, words, concepts, symbols, and the like. These standards serve as a uniform base for human communication. Examples include systems of units (e.g., the metric system), initials (e.g., FBI for the Federal Bureau of Investigation, or SAT for the Scholastic Aptitude Test), and graphic symbols (e.g., the stop sign or various recycling symbols).[6]

Another family defines languages and interfaces. Languages range from natural, which includes spoken, written, formal, and conversational human languages, to artificial, which includes computer programming languages and musical notes, among others. Interfaces range from the standard faucet-closing motion (turn clockwise) to the graphical user interfaces (GUIs) for computers.

Numerous interfaces allowed me on Monday, 13 May 1991, to talk in Arlington, Massachusetts, to my sister in Ramat Hasharon, Israel. I used my Panasonic telephone, linked to the NYNEX line linked to the MCI long-distance line linked to a satellite linked by Bezek, the Israeli telephone company, to my sister's AT&T phone. Such connections, which occur

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[5]The example of Eli Whitney has often appeared in the literature to demonstrate early mass production. One source, cited by Verman, is S. K. Sen, "Defining Standardization," *ISI Bulletin* [Indian Standards Institute] 23 (1971), 389-390; another is *Through History with Standards*, a booklet published by ANSI and quoted by Glie Rowen in *Speaking of Standards* (Boston: Cahners Books, 1972).

[6]Verman, 60.

daily for millions all over the world, demonstrate communications standards between people (my sister and me), machines and people (my telephone and me), and between machines (the NYNEX and MCI lines). The example also demonstrates the cumulative benefit of several standards working in tandem, which is the defining feature of the next category.

7.2.3 Purpose 3: Harmonization

Simply put, harmonization—which has many other names, such as compatibility, interconnectivity, or interoperability—has to do with systems working with other systems. Continuing the theme of telephones, a call from my office in Cambridge, Massachusetts, to the offices of the ISO in Geneva, Switzerland, involves the Merlin phone, my MCI calling card, the city telephone lines, the MCI long-distance lines, a satellite (perhaps AT&T's) and the ISO's corresponding systems.

With such harmonization standards, a file written on an IBM Think-Pad diskette can be read by an Apple Macintosh computer; e-mail can travel between systems; faxes can move across countries and oceans; an RCA television can generate sound through a Sony stereo system; and my new Kenmore dishwasher could be installed in place of my old kitchen cabinet (because both conform to the 24 inch-width standard).

In many ways, harmonization is an extended case of communication. With harmonization standards, systems can consider other systems as black boxes, ignoring internal operation and concentrating on external input and output. In short, harmonization allows systems to work with other systems, which is what is increasingly needed in the knowledge age.

Unfortunately, a lack of harmonization can be devastating, as was demonstrated during the fire of 1904 in Baltimore. The fire broke out on Sunday the seventh of February and quickly overwhelmed local firefighters, who immediately called for back-up. Fire companies from as far as a hundred and fifty kilometers away (roughly a hundred miles) came to the stricken city but, once there, were unable to help. While firefighters watched powerless, the city burned. When it was over, an estimated one-third of the city was gone. The reason the neighboring firefighters were powerless was that there were no standard hose couplings.[7]

Today, such problems seldom occur. The National Fire Protection Association has developed and published standards that harmonize all firefighting equipment. The primary Purpose of the standards is to guard people and property, which leads to the next Purpose.

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[7]The fire of 1904 is one of the horror stories often cited in the literature. See, for example, *Through History with Standards*; Rowan, *Speaking of Standards*, 60; Batik, *The Engineering Standards: A Most Useful Tool*, 8; and OTA, *Global Standards*, 43, 45.

7.2.4 Purpose 4: Protection

At precisely 5:27 p.m., on 9 November 1965, electric power in the northeast United States suddenly went off. Although more than ten thousand elevators were suspended in midair, not a single one fell. Not a single person was injured or killed in an elevator accident. Everyone was "saved" by a 534-page document called *Safety Code for Elevators and Escalators*, published by the American Society of Mechanical Engineers (ASME). Every elevator designed, manufactured, installed, or operated in the United States must conform to this standard. Of all those trapped that November day, probably fewer than twenty-five knew what saved their lives.[8]

Standards facilitate protection when they safeguard us against potential harm from others and ourselves. Although not so widely known, many other such standards operate behind the scenes of our lives.

Recognizing the protection Purpose of standards can be beneficial, as the following personal example suggests. While writing this work I endured a typical New England heat wave humming outside the house where my wife and I live. Four years ago, to combat a similar heat wave, we purchased a giant air conditioner. Streams of cool air now fill the house on demand. Unfortunately, there is a problem. Occasionally, and randomly, our giant air conditioner overloads the fifty-year-old electrical circuits of the house, and then the entire house suddenly loses power. Imagine the effect of a random disaster on my computer! But I am protected: a battery-powered laptop is the base of my computer system, so that, when the power dies, the battery kicks in. I have yet to lose data from electrical spasms caused by the giant air conditioner.

In the United States, the late 1960s and early 1970s saw the creation of many protective federal agencies, including the Occupational Safety and Health Administration (OSHA), the Consumer Product Safety Commission (CPSC), and the Environmental Protection Agency (EPA). In those areas, so the government claims, private forces were not strong enough to self-regulate. In contrast, other areas—such as gas stoves, extension cords, x-ray equipment, and automobiles—are regulated by the safety standards of private associations.[9] (For a discussion of the distinction between private and public standards, see **Chapter Nine**; for now, note that while protection standards, like all others, can emerge from any Level, governments on the national Level often actively advocate, initiate, and enforce protection standards.) In contrast to the previous categories of Purposes (simplification, communication, and harmonization), protection standards frequently are controversial in relation to the depth

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[8]Batik, 5.

[9]Cheit, *Setting Safety Standards*, 3.

and the precise nature of the protection. The reason for this controversy is that protection standards often raise questions of value, which is the realm of the next category.

7.2.5 Purpose 5: Valuation

To obtain a driver's license an applicant must take a written test; to get into most master's degree programs a student needs to have a bachelor's degree; and to practice law a lawyer must pass the bar exam; or, peanut butter must consist of at least 90 percent peanuts by weight, and an orange drink must contain at least 10 percent orange juice.[10]

Why does 10 percent of an orange drink need to be orange juice? Why not 15 percent? or 5 percent? Why does a student need a bachelor's degree to enter a master's program? More generally, why these standards and not others?

One answer, at these instances, is related to decisions on value. Someone decided that for a drink to be called "orange" 10 percent of it must be orange juice, and someone else decided that for a spread to be called "peanut butter," 90 percent of it must be peanuts. These examples may be mundane, but other value standards can be extremely volatile. Sexual harassment, homelessness, homosexuality, and other issues all can be considered value-driven.

Similar values were the focus of the influential 1989 publication, *Curriculum and Evaluation Standards for School Mathematics*, developed and published by the National Council of Teachers of Mathematics. According to the introduction of this two-hundred-and-fifty-page document, "A standard is a statement that can be used to judge the quality of a mathematics curriculum or methods of evaluation. Thus, standards are statements about what is valued."[11]

Another example of valuation, one personally observed at Harvard, is that of the tenured professor who wanted an easy-to-use phone. The incident, or, rather, the spat, started when the professor was asked by administrators who valued protection against unauthorized use of the phone to use a ten-digit Personal Identification Number (PIN) for long-distance calls. Faced with cumbersome dialing procedures, the professor requested—actually, demanded—a standard, simple, dial-1 service, like "the one I have at home." By clearly defining the service he valued, he was able to cancel the need for a PIN. The professor got his wish, because the Harvard phone system allowed it. From the perspective of valuation, the phone system can be said to support both the conflicting values of both the administrators and the professor.

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[10]Hemenway, *Industrywide Voluntary Product Standards*, 9.

[11]NCTM Commission on Standards for School Mathematics, *Curriculum and Evaluation Standards for School Mathematics* (Reston, Va.: NCTM, 1989).

The standardization community does not use the term "values." It uses different terms, the trendiest one currently being "quality." Quality standards define what is better or worse, good or bad.[12] Quality issues are related to the Total Quality Management (TQM) movement, which, in turn, is related to the ISO 9000 series of quality standards. Quality is the biggest boom for the standardization community in the 1990s.[13] Yet here I prefer the term "valuation," because it escapes trendiness and focuses on value and its critical role.

7.3 Purpose: Summary and Evidence

Several authors have shown that standards have different Purposes, although they use different terms, such as "goals," "functions," or "aims." Only Sanders, in *The Aims and Principles of Standardization* (1972), has tried to define distinct categories for what he calls the "aims of standards." His categories include:

(*i*) simplification of the growing variety of products and procedures in human life
(*ii*) communication
(*iii*) overall economy
(*iv*) safety, health, and protection of life
(*v*) protection of consumer and community interests and
(*vi*) the elimination of trade barriers.[14]

An examination other sources and an analysis of the Purposes of several standards shows that Sanders's categories, while clearly a reasonable set of Purposes, called for some modifications, merging, and additions. I eliminated, first, the "overall economy" category, because it seems too broad to be a Purpose (and can be included in the Effect dimension). Second, I eliminated the "trade barriers" category, because it is too specific and probably stems from the international focus of Sanders's book. Third, I merged "safety, health, and protection of life" with the "protection of consumer and community interests" to make a single protection category. Last, in a move that calls for further argument, I added the categories of harmonization and valuation.

The category of harmonization originated in the movement of the EU to harmonize national systems of standards, so that, in concrete terms, the same standards will be applied

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[12]Hemenway, 8.

[13]In 1987, ISO published a series of five standards (9000, 9001, 9002, 9003, and 9004) that, together with ISO-8402 (which defined terminology for quality) provide a structure for evaluating qualities of organization. For information about ISO 9000, see Maureen Breitenberg, *Questions and Answers on Quality: The ISO 9000 Standard Series, Quality System Registration, and Related Issues* (NISTIR 4721) (Gaithersburg, Md.: NIST, 1991). An interested reader may also contact the American Society for Quality Control (ASQC) at 414-272-8575.

[14]Sanders, 11.

Table 7-2

Summary of the Purpose Dimension

Dimension 2: Purpose	The Purpose of the standard is:
Simplification	to reduce variety and complexity.
Communication	to act as a language within the different Levels and allow human beings and machines to exchange information.
Harmonization	to support systems working in harmony.
Protection	to protect, secure, and safeguard.
Valuation	to define values and needed performance.

across member countries. The term is used here in an expanded sense, to highlight the growing role standards will play in supporting complex systems involving people and machines, for which other names used in the standardization community, such as compatibility or interoperability, seemed too technical or narrow.

Another reason for this category is the trend to what Alvin Toffler, in *Powershift*, calls "standards-for-standards," such as the international effort to define open standards for computer systems. Open Systems Interconnection (OSI) defines seven theoretical levels between users and machines.[15] Uniquely, OSI does not define any particular implementation. In the standardization community, OSI is called a "standards reference model," that is, a standard that allows several profiles of implementation. Currently, most reference standards, like OSI, are related to information technology, but they can be expected to emerge in other areas because standards-for-standards allow users to deal with the complexities of the knowledge age.

Although the term "harmonization" is problematic because it is new to most people, "valuation" is problematic because it is well known. From the responses it engendered, for most of those who reviewed the framework, valuation was, of all the categories, the one most difficult to swallow. Although the word itself is clear, its precise meaning in the contexts of both standards and Purpose may seem odd. Usually, a problem of this sort would require a

[15]Martin C. Libicki, *The Common Byte, or Why Excellent Information Technology Standards Are Both Absolutely Essential and Utterly Impossible* (Cambridge, Mass.: Program on Information Resources Policy, Harvard University, 1993), 75. For an expanded version of this draft report, see Libicki, *Information Technology Standards: Quest for the Common Byte* (Newton, Mass.: Butterworth-Heinemann, 1995).

change, even the cancellation, of a category, but, in spite of its troublesome name, the category of valuation was maintained.

The distinction that led to maintaining it here is that between what can be called "common-term" standards and "value-term" standards. Common-term standards stem from the need to agree, whereas value-term standards emphasize value judgments, decisions about good or bad, better or worse. Another mental experiment helps to explore this critical distinction more fully.

Let us assume that you and I are arguing about, say, the relative merits of microwave cooking versus thermal heat cooking. After a few minutes, we both step back and reflect on the respective arguments being put forth and also about the goals of the argument. We ask ourselves, how important is it that we should agree? If agreeing is more important than what we would agree on, then the argument is about common-terms. But pushing our individual opinions is more important, then the argument is about value-terms. (Naturally, the pivot is emphasis, because most arguments involve value-terms as well as common-terms.)

Although the term "values" is not used in the standards community, in the education community it is used extensively—indeed, standards often are associated with values in education.[16] The standards community seems to want to ignore, or hide, that standards often carry values. Waving the flag that says "let's agree on common-terms" is easier than waving the one that says "let's agree on what I/we value." Again and again, in my experience, the mere mention of "value" generates strong emotion.

For that reason, "valuation" is an important Purpose of standards. Producers of standards must consider the different values that influence making standards. Users of standards must remember that standards can represent "common-terms" or mirror particular "value-terms."

Of all the dimensions, Purpose is, to me, the least satisfying. Further work needs to be done to differentiate its five categories; and the price of having only five comes especially high. Last, the lack of inherent order in the dimension may be problematic. Yet, even though the dimension may still be unsatisfactory, the current categories can lead to important insights.

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[16]Chapter Thirteen offers a brief discussion of the issue of standards and values in education.

7.4 Exploration: The Use of the Framework in Education

This section explores another potential use for the framework of standards, that of the Purpose dimension to analyze a landmark of the educational frontier in the United States.

7.4.1 Background: The NCTM Math Standards

In March 1989, the National Council of Teachers of Mathematics published *Curriculum and Evaluation Standards for School Mathematics*. The NCTM math standards, as they are known, became a model for subsequent efforts in subject matter, in science, social studies, history, civics, geography, language arts, the arts, foreign languages, physical education, and workforce skills.[17] Beyond their impact on math education, the NCTM math standards proved, at least to those following in the NCTM's footsteps, that making standards for curriculum is worthwhile and, more important, possible.

The NCTM math standards start with broad goals that have their origin in what NCTM called new societal goals in the information society. In their words:

> the social and economic shift...[that] has dramatically changed the nature of the physical, life, and social sciences; business; industry; and government...is no longer an intellectual abstraction. It has become an economic reality. Today, the pace of economic change is being accelerated by continued innovation in communication and computer technology. Schools, as now organized, are a product of the industrial age.... The educational system of the industrial age does not meet the economic needs of today. New social goals for education include (1) mathematically informed workers, (2) lifelong learning, (3) opportunity for all, and (4) informed electorate.[18]

This broad vision was broken down by NCTM into five general educational goals that call for students to value mathematics; to become confident in their ability to do mathematics; to communicate mathematically; to become mathematical problem solvers; and to reason mathematically. The standards also call for shifts in teaching, from memorizing algorithms to conjecturing, testing, and constructing concepts; from teachers teaching answers to teachers providing opportunities for students to develop their own answers. Students are asked not only

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[17]For a comprehensive comparative analysis of content standards in the United States, see John S. Kendall and Robert J. Marzano, *The Systemic Identification and Articulation of Content Standards and Benchmarks (Update)* (Aurora, Colo.: Mid-Continent Regional Educational Laboratory, 1994).

[18]*Curriculum and Evaluation Standards for School Mathematics*, 3.

to give answers but also to "make connections among key concepts, learning to solve practical problems, and conduct reasoned arguments with mathematics."[19]

Structurally, the NCTM document presents fifty-four standards in four chapters. The first three chapters, which discuss curriculum standards for kindergarten through grade four, grades five through eight, and nine through twelve, are all presented in the same way. Each chapter includes, in the following order, a brief overview of and background for the grade levels, a list of concepts deserving increased attention and a list of concepts deserving decreased attention, and a presentation of the actual standards, with many verbal and graphic examples. The fourth chapter, the evaluation chapter, has a different structure to match different goals. It includes three general assessment standards, seven student assessment standards, and four program evaluation standards.

7.4.2 Discussion: The Many Purposes of Standards

The discussion of the Level dimension and the K-12 setting in section **6.4** included the notion of an analytic checklist, and the categories of the dimension were used there as a checklist to analyze a setting. Here a dimension is used as a checklist to analyze a standard, namely, the NCTM math standards.

Each category of the Purpose dimension was used to generate analytic points about the NCTM standards. Points of greater interest are presented below, according to the five Purposes.

Simplification. For the first time, teachers, parents, and students can know and access the state of the art in math education. For all grades, one source defines what math education should be. For the first time, research from the domains of mathematics (what to teach), education (how to teach), psychology (how students learn), and futurology (what the future may look like) are packed into a single coherent form to be used by curriculum makers, department chairs, testing companies, and other interested parties.

Communication. The NCTM math standards support communication, among teachers ("What did you use to teach standard No. 17?") and curriculum developers ("In your book, how did you deal with standard No. 2?") as well as discussions focused on testing ("Our test deals with directly with standards 3-8 and indirectly with standards 9-11."). Communication is supported further, because the NCTM math standards define such terms as mathematical thinking, models, and predictions. In contrast to many other standards, however, the NCTM

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[19]Martha Stone Wiske, Cynthia Y. Levinson, Paul Schlichtman, and Walter Stroup, *Implementing the Standards of the NCTM in Geometry* (Cambridge, Mass.: Educational Technology Center [ETC], Harvard Graduate School of Education, TR92-1, 1992), 1.

standards do not provide either a glossary of terms or an index, both of which, especially a glossary, could enhance communication about math education.

Harmonization. The NCTM math standards support harmonization, in this case, future standards, products, and processes stemming from the original work. In 1991, two years after the publication of its curriculum and evaluation standards, the NCTM published a companion source, *Professional Standards for Teaching Mathematics*.[20] A third book, *Assessment Standards for School Mathematics*, which expands on the last part of the original book, appeared in 1995.[21] Other offspring include textbooks that build on, or at least refer to, the NCTM standards, research efforts in the area of assessment,[22] and, of course, use of the NCTM math standards as a model (e.g., science, geography, history, etc.).

Protection. The NCTM standards support the protection Purpose, in that the standards are supposed to provide "opportunity for all" to learn mathematics. The NCTM math standards are designed to create "a just society in which women and various ethnic groups enjoy equal opportunities."[23] Some people doubt the capacity of the standards to achieve social re-engineering, some even doubt the need for all people to know the math that the NCTM claims "all" should know.[24]

Valuation. All the other Purposes are dwarfed by the valuation Purpose. To quote from the NCTM Standards, a standard is a "statement that can be used to judge the quality of a mathematics curriculum or methods of evaluation. Thus, standards are statements about what is *valued* [emphasis added]." What clearly makes the NCTM standards valuation standards is that the users are told what they should and should not do. For example, regarding problem-solving skills in grades five through eight, the NCTM standards emphasize "pursuing open-ended problems and extended problem-solving projects" and de-emphasize "practicing routine, one-step problems." The decision to prefer "smart" problems over "routine" ones is a value judgment. Other educators may claim that enforcing basic skills is practical and necessary as a critical base for more abstract mathematics. It is necessary—indeed, essential—to remember that values in math education may change, as they did with the sinking of that Titanic-like movement in math education, the "new math."[25]

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[20](Reston, Va.: NCTM, 1991).

[21]*Assessment Standards for School Mathematics*, prepared by the assessment standards working groups of the National Council of Teachers of Mathematics (Reston, Va.: NCTM, 1995).

[22]For a detailed description of a research effort, see the exploration section (10.4) of the discussion of the Stage dimension.

[23]*Curriculum and Evaluation Standards for School Mathematics*, 4.

[24]Chester E. Finn, "What if Those Math Standards Are Wrong," *Education Week* (20 Jan. 1993), 26, 36.

[25]Morris Kline, *Why Johnny Can't Add: The Failure of the New Math* (N.Y.: St. Martin's Press, 1973).

The value decisions made by NCTM cause various kinds of problems, problems Michael W. Apple has discussed at length.[26] In Apple's words, "the standards do not exist in an ideological vacuum." They are—if not primarily—about power, policy, and the general practice of teaching. In this context, Apple raises global issues regarding class, race, and gender in the classroom; the use of mathematics as symbolic of a status not everyone will be able to attain; and the intensification of teachers' work. In the terminology of the framework, according to Apple the NCTM emphasis on "valuation" is the source of many problems.

Is it possible to have curriculum standards without values (since the values often interfere with the adoption of certain standards)? Although curriculum standards will always have a valuation component, it is possible, and desirable, to minimize that component, especially in such large-scale efforts as the NCTM math standards. A hypothetical description here will argue for the possibility of nonvaluation math standards. Surprisingly, much of the format and content of the current NCTM valuation standards would find its way into the nonvaluation math standards. The major change would be in presentation. Sentences such as "This should receive increased attention" or "That should receive decreased attention" would not be included. Instead, all content, which is now presented as the desired or the undesired, would be listed with concrete examples of both views. The nonvaluation math standards could serve as a dictionary of math content, rather than a manifesto of what math education should be. Both the NCTM and other stakeholders—curriculum makers, states, and testing companies—might then refer to the nonvaluation math standards by suggesting profiles of content. Apple's global issues would not be solved by these hypothetical nonvaluation math standards; at best, these standards might focus the discussion on math and allow others to discuss Michael Apple's "big" issues.

7.4.3 Generalization: Analyzing Standards with the Framework

This discussion demonstrates the way one dimension, here Purpose, can be used to analyze a standard. In presenting hypothetical nonvaluation math standards, the discussion demonstrates the way the categories of a dimension can be used also to imagine variations on existing standards.

As with the Level dimension and the other dimensions, a particular object of analysis, here a standard, can be viewed according to several Purposes. Unlike for the Level dimension, in most cases finding concrete meanings for categories of the Purpose dimension is easy. The categories here are broad enough to generate analytic points for all but the smallest and most highly focused standards. Further insights can be gained by using several points of view, similar to the views of the student, teacher, and family used in the discussion the Levels

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[26]"Do the Standards Go far Enough? Power, Policy, and Practice in Mathematics Education," *Journal for Research in Mathematics Education* 23, 5 (1970), 412-431.

of the K-12 system. As with the Level dimension, the Purpose dimension was used as an analytic checklist, and in both cases one dimension was used as a template to generate and prompt systematic thinking.

Chapter Eight

Dimension 3: Effect

8.1 Effect: Introduction

Few in the United States today think about the width of railroad tracks. Since the width was standardized by federal? legislation in 1864, at 4 feet and 8.5 inches, cargo can move smoothly from coast to coast. As with other standards, especially technological standards, one result often is loss of jobs. For example, in 1853 bloody riots erupted in Erie, Pennsylvania, as hundreds of railroad workers were about to lose their jobs. When a mob of angry women took sledge-hammers and began tearing up railroad tracks, federal marshals had to be called in to stop them because the workers were supported by city officials as well as the governor. The workers were victims of a massive effort to standardize the width of both railroad tracks and cars, an effort that cost Erie a great many respectable jobs loading and unloading cargo while trains switched from one width to another.[1]

Although many people would like to think standards are a magical answer to every problem, that is not so. Standards often cause major problems. Worse, at times they perpetuate problems by preventing solutions. As shown in **Chapter Seven**, on the Purpose dimension, though they can be positive and constructive, they can also be negative and even destructive. In the words of one standardization practitioner, a standard, "much like Frankenstein's monster...may be initiated with good intentions but end up destroying its creator."[2]

This dimension, with its five categories, was designed to capture these Effects. Deviating from the format of previous chapters, in which the categories are presented one by one, this chapter begins with an elaboration of the general good and bad sides of standards, then proceeds to a brief discussion of the separate categories. This deviation stems both from the inherent symmetry of this dimension (from "constructive" to "destructive" with "unknown" in the middle) and from similarities at both ends of it.

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[1]Achsah Nesmith, "A Long, Arduous March Toward Standardization," *Smithsonian* **15** (March 1985), 182.

[2]Carl F. Cargill, *Information Technology Standardization Theory, Process, and Organizations* (Bedford, Mass.: Digital Press, 1989), 76.

Table 8-1

Dimension 3: Five Categories of Effect

Dimension 1: Level	Dimension 2: Purpose	Dimension 3: Effect	Dimension 4: Sponsor	Dimension 5: Stage
Individual	Simplification	Constructive	Devoid	Missing
Organizational	Communication	Positive	Nonsponsored	Emerging
Associational	Harmonization	Unknown	Unisponsored	Existing
National	Protection	Negative	Multisponsored	Declining
Multinational	Valuation	Destructive	Mandated	Dying

8.2 Effect: Categories

The discussion of the Purpose dimension showed that standards can have tremendous benefits. Using a cross section of the five Levels and the five Purposes, at least twenty-five potential areas can be identified where standards can support (but also hamper) human activity.

One important benefit of standards (not highlighted in the previous chapter) concerns the side effects of the process of producing them. In the traditional standards community, the process of making a standard is often considered as beneficial as the actual standard. For example, the design of safety standards for children's toys (e.g., ASTM F963), is a meeting ground for parents, toy manufacturers, doctors, injury and fire experts, and others who want to share their thoughts on such products. Meetings offer informal opportunities to discuss, understand, and join with interested parties. Further, the need to arrive at concrete ways to phrase, measure, and define a standard forces people with different points of view to communicate. These side benefits, which are beyond the focus of this work, clearly point to where further understanding should be sought.

To understand the product of the process—standards—fully means understanding that standards can and do have negative and destructive Effects, which are the focus of this chapter.

8.2.1 Standards: The Bad Side

Because standards, like most instruments of civilization, can be good or bad, studying their impact requires considering their potential problems and tradeoffs. Consider the following three issues.

Monopoly. Whether or not a monopoly is natural is a critical issue in standardization. In recent years, in the area of personal computers (PCs), Microsoft has often been regarded as the "bad guy" that uses standards unfairly. In 1992, *Business Week* reported:

> the Federal Trade Commission (FTC) case against Microsoft...is based partly on the software giant's massive market power.... The feds found fault with Microsoft's bare-knuckle competitive tactics, which they believe are an example of so-called "exclusionary behavior."[3]

The FTC claimed that Microsoft used its control of market standards to benefit itself.[4] To Lord Acton's aphorism, "Power tends to corrupt [and] absolute power corrupts absolutely," can be added, power with standards can corrupt even faster.

Innovation. The oft cited QWERTY keyboard standards issue demonstrates the Effect well-established standards can have on innovation. This keyboard was created in the late nineteenth century as a way to keep typewriter bars from jamming. It became familiar to tens of thousands, then tens of millions, of trained typists. Technology eventually solved the jamming problem, but as one author noted, "QWERTY faced no serious competition.... The system maintains near-universal domination."[5]

Junk mail. This phenomenon, which my wife and I first experienced when we came to the United States, gains in importance as information technologies capture larger parts of daily life. In our first month in the Boston area, my wife and I received only a few letters, most from Israel. Soon, we started to receive more mail, mainly aimed at new students. Once we subscribed to *Time* magazine, joined the American Automobile Association (AAA), and got a Visa credit card, we began to receive more and more mail, until, after a year, our mailbox was filled every day with "junk mail." Junk mail shows the way information links based on standards intrude into privacy. With advances in data storage, networks, and sophisticated

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[3]Kathy Rebello, "Did Microsoft Shut the Windows on Competitors? The FTC May Charge the Software Giant with Exclusionary Behavior," *Business Week* (28 Sept. 1992), 32-34.

[4]In a later development, in 1994 the FTC closed the case against Microsoft after the company promised to "behave."

[5]Walt Crawford, "Problems and Dangers of Standards," in *A Sourcebook of Standards Information: Education, Access and Development*, edited by Steven M. Spivak and Keith A. Winsell (Boston: G.K. Hall, 1991), 281.

searching techniques, personal data (e.g., shopping habits, travel plans, even financial transactions) become widely available.

My research discovered hundreds of other standards with negative Effects for a variety of reasons—too many standards, premature standards, those too frequently used, others overly rigid, overly detailed, or those at the wrong Level, those with no clear scope, those that solve no problems, those developed with limited knowledge, those that are outdated—and all can be detrimental to the users and producers of standards at all Levels.[6]

Special attention should be given to cases in which the same standards have positive Effects in some situations and negative Effects in others. Such standards can continue to cause havoc for a long time, as they widen the gap between those who enjoy them and those who suffer from them. These Effects provide ample reason to dig deeply into the concept of standards—with the help of this dimension and with the other dimensions of the framework of standards.

8.2.2 Effects 1 and 2: Constructive and Positive

A simplified example from the computer industry helps flesh out the distinction between the categories of constructive and positive. The Small Computer Systems Interface (SCSI) standard was designed (in 1985) to allow computer users to connect different external memory devices. Users can connect hard disks, of different sizes and from different vendors, to their original system. In the early 1990s, however, when SCSIs became common in the market, vendors began to offer new kinds of devices that use SCSI standards. Although the original goal of the SCSI was primarily to support storage devices, it is now used also to connect scanners and even to connect computers to other computers. "Going the next step," that is, moving beyond the stated Purpose of the standard, may be considered a "constructive" Effect.

Put another way, a standard is said to have a "constructive" Effect if it goes beyond an intended positive Effect. This is a matter of degree and involves some subjectivity. As with all the dimensions, a measure is needed to distinguish between constructive and positive Effects. One measure is whether the standard is *essential* to the particular mission. If the need is to talk, there must be a common language, so for talking, language is a constructive standard. The medium of the discussion can vary, such as either talking face to face or over the phone. If the telephone is used, then the phone standard, one medium out of the many possible, is a positive standard.

Another measure that may be used to distinguish between positive and constructive Effects was suggested by the ISO in *Benefits of Standardization*, which recommends

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[6]Ibid.

calculating the contribution of standards according to the cumulative effects of the different Purposes. Adopting this "counting" method, a standard can be considered "constructive" if the number of entities it affects in a positive way is relatively large. Counting requires two conditions: first, a good way to value the contribution and, second, a critical point beyond which a standard will be considered constructive. The ISO's *Benefits* book lists both qualitative and quantitative methods ways to value the contribution of a standard; the qualitative method is based on considering the contribution in some systemic way, and the quantitative method is based on an economic analysis. The second condition brings in individual judgment.

Both the "essentiality" and the "counting" measures depend on setting and on frame of mind. The difference between them is that in the first a single criterion (is the standard essential?) is used, while in the second several factors are counted and calculated.

8.2.3 Effects 4 and 5: Negative and Destructive

Like the shift from positive to constructive, the shift from negative to destructive Effects depends on the degree of harm the standard causes and, as in counting, on situation and point of view. For example, in Erie the Effect of the rail width standard on railroad workers who lost their jobs was destructive, but it was only negative for shopkeepers there, who saw a decline in sales but were able to stay in business. Destructive Effects are often associated with an accumulation of bad Effects, or with the longer term damage standards may cause.

The "counting" measure is applicable here, because bad Effects can simply be counted, to see whether they go over a certain threshold. The "essentiality" test also can be used, but in reverse: if the standard is the key hampering factor and removing it will allow the activity to proceed, the standard can be considered destructive.

8.2.4 Effect 3: Unknown

Beyond introducing an "unknown" category to make this dimension structurally similar to the other dimensions (all have five categories), there are two substantive reasons for including it. First, the unknown category can be used to compare the Effects of standards on different entities. Assume that a federal agency stipulates that across the United States, Channel 10 must always broadcast local weather information. As a result, selecting Cannel 10 on the cable box anywhere will yield information on local weather. This standard would probably have positive Effects on individual travelers, but negative ones on local stations because fewer viewers would watch them. Customers without cable would not be affected. The "unknown" category, then, is handy, because it includes the case of no currently known effects.

Second, bearing in mind that standards are by nature dynamic, the unknown category can be used to mark a current situation that may change in the future. Using the example of Channel 10, although the standard might be mandatory in the United States, it would have no Effect on cable operators in, say, Mexico or Canada. If it were to become valuable—for example, if advertisers were to discover that Channel 10 was drawing business travelers—then the standard could be adopted outside the United States. In the terminology of the Effect dimension, the Channel 10 standard could be said to have unknown Effects on cable operators worldwide. If the channel's advertising value were to become established, the standard might have positive Effects on those operators.

The presence of the unknown category is a reminder that a standard with no current positive or constructive Effects, and no prospects of having such Effects in the future, may end on the other side, causing negative, even, in the long run, potentially destructive Effects.

8.3 Effect: Summary and Evidence

The Effect aspect gives equal representation to the positive and negative Effects of standards. Potentially negative and even destructive Effects frequently are forgotten by standards advocates. Because this dimension caters to intuitive concerns which those new to the field have expressed about standards, it can reveal the true nature of a standard, with its payoffs and tradeoffs.

As previously noted, Crawford's "Problems and Dangers of Standards" offers a detailed discussion of negative and destructive Effects of standards and includes a comprehensive list of them. Crawford describes most of the general problems associated with standards. His context is libraries, but his arguments are easily generalized and transferred to other fields, such as education.

In contrast, sources that originate in official standards organizations normally stress the positive and constructive Effects of standards. For an account of the point of view of the ISO, see Sanders's *The Aims and Principles of Standardization*; for ANSI, see Toth's *Standards Management: A Handbook for Profits*[7]; and for the U.S. Department of Defense, see *Benefits of the Defense Standardization Program.*[8]

The internal logic of the Effect dimension is straightforward, from very positive to very negative, in five steps. Of all the dimensions, Effect has the strongest internal logic, which

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[7](N.Y.: ANSI, 1990).

[8]Jordan W. Cassell and Robert L. Crosslin, *Benefits of the Defense Standardization Program* (Bethesda, Md.: Logistics Management Institute [LMI], 1991).

Table 8-2

Summary of the Effect Dimension

Dimension 3: Effect	The Effects of the standard are:
Constructive	very positive. They are critical, essential. They will facilitate long-term benefits.
Positive	positive. They facilitate links, actions, efforts. They facilitate current benefits.
Unknown	nonexistent. They make no or a negligible difference. Currently there are no Effects.
Negative	negative. They impede links, actions, or efforts. They cause waste, inefficiency, or damage.
Destructive	very negative. They are detrimental, harmful. They will cause waste, inefficiency, or damage.

dictated its word choice. Following the selection of positive and negative, which seemed most natural, a pair of contrasting words was needed that would highlight stronger positive and negative Effects, and, if possible, for esthetic reasons, words that would end with the suffix "-tive." The present constructive-destructive pair, which has the right meaning, is symmetric—and ends with "-tive."

Originally, there were other possible terms for what is now the "unknown" category: "zero" worked well with positive and negative, and "missing" was considered, which is now used in the Stage dimension, and "none," which, like the other categories, ends with "-e." The trigger for choosing "unknown" involved using the Effect dimension as a graphic analytic tool (a use since abandoned), which required different first letters for the categories (the "n" of "none" collided with the "n" of "negative"). The result was "unknown," which now seems best for portraying the nature of the middle category: it denotes the presence of Effects, even if they cannot yet be measured.

8.4 Exploration: The Use of the Framework in Education

This section demonstrates the way three (Level, Purpose, and Effect) of the five dimensions of the framework in a juxtaposition—that is, in an "analytic matrix" (see section **8.4.2**)—can generate insights. Here the dimensions are used to analyze David Owen's view of

ETS, expressed in his book *None of the Above: Behind the Myth of Scholastic Aptitude*,[9] and applied to several claims he makes there. In some cases, to demonstrate the generative power of the framework, the claims are expanded on, but this demonstration is not intended as a complete analysis of Owen's work, nor of ETS.

At the outset it must be noted that Owen's view of ETS is biased. Besides attacking the general practice of multiple-choice testing, in the introduction Owen claims that:

> from the moment of its founding in 1947, ETS has set the standards, the tone, and the agenda for standardized testing in America. More than any other organization, it has been responsible for maintaining the cult of mental measurement.... Many people think ETS is a government agency. It is not. Many others think it is a subsidiary of Princeton University. There is no connection.[10]

Yet Owen's opinions of ETS (and even my own) are not at issue. Rather, the issue is how the dimensions of standards appear explicitly and implicitly in his book. Beyond occasional uses of other sources, the vast literature about ETS, or on testing, is not tapped here,[11] nor developments since publication of Owen's book. Although as the basis for analysis this is somewhat outdated, from a historical point of view, it nevertheless still exposes some crucial issues in education.

8.4.1 Background: The Educational Testing Service

The Educational Testing Service, located in Princeton, New Jersey, is a private, nonprofit organization established to research and administer educational testing. Founded jointly by the American Council on Education, the Carnegie Foundation for the Advancement of Teaching, and the College Entrance Examination Board, ETS administers more than five hundred tests, including the Scholastic Aptitude Test (SAT), the Graduate Record Examination (GRE), and the Law School Admission Test (LSAT). Other ETS activities include K-12 tests, preparation of standardized financial-aid applications for different levels of schooling, and distribution of information about forms of financial aid. Its international activities include Peace Corps assessment and the design of tests for developing countries. It also conducts research on child development, educational practices, and urban and minority education.[12]

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[9](Boston: Houghton Mifflin, 1985).

[10]Owen, xx.

[11]See *The Prices of Secrecy: The Social, Intellectual, and Psychological Costs of Current Assessment Practice*, edited by Judah L. Schwartz and Katherine A. Viator (Cambridge, Mass.: Educational Technology Center [ETC], Harvard University Graduate School of Education, 1990).

[12]*Grolier Encyclopedia*, CD-ROM Macintosh v. 6.0.2.

For this discussion, the focus will be on the SAT, the ETS's best-known test.[13] According to Owen, ETS maintains that any SAT score can be compared with any other SAT score from any year. "The process by which this uniformity is accomplished," Owen writes, "is called equating.... Every SAT...can be traced back to the great-granddaddy of all equated SATs, the test given in April 1941." Further, in what Owen considers ETS's most ambitious claim, SAT scores are said to represent the innate ability of a person to learn. Owen quotes an official ETS position paper that states that SAT scores are "a product of two things: the student's native ability—'the brains that he was born with'—and the opportunities for mental exercise that he finds in his school, his home, and his community."[14]

Table 8-3

Analytic Matrix of Level and Purpose

Purpose	Levels (Levels in ETS are in parentheses)				
	Individual (Student)	Organizational (Universities or ETS)	Associational (Higher Education Systems)	National (United States)	Multinational (World)
Simplification	1	2	3	4	5
Communication	6	7	8	9	10
Harmonization	11	12	13	14	15
Protection	16	17	18	19	20
Valuation	21	22	23	24	25

Note: The matrix consists of 25 cells, each indicated by a reference number.

From the point of view of satisfied users (users being students, colleges and universities, and other organizations, such as CAI), SAT scores are a simple, one-number, easy-to-compare summary of complex educational processes. The SAT has become the de facto standard for undergraduate admissions. Although not all colleges and universities use it as part of their admission process, and although those that do use it do so in different ways, the SAT remains one of the most commonly used criteria across colleges and universities in

[13]OTA, *Testing in American Schools: Asking the Right Questions* (Washington, D.C.: OTA, 1992).

[14]Owen, 89.

the United States. In addition, some guides, for example *Peterson's Competitive Colleges*,[15] use SAT scores as part of the college profiles.

8.4.2 Discussion: Technical Analysis of *None of the Above*

The discussions of the Levels of the K-12 setting (section **6.4.2**) and of the Purposes of the NCTM math standards (sections **7.4.1** and **7.4.2**) used the analytic checklist. Here a different tool is introduced, the "analytic matrix," which is a table that uses two dimensions at the same time, creating twenty-five analytic cells that generate questions about the object of analysis.

To analyze Owen's view of ETS, the analytic matrix of Level and Purpose can be used to generate questions and, to prompt further insights, the Effect dimension applied for each cell. For example, cell 8 (Associational–Communication) prompted the question, "What are the positive and negative Effects of the SAT score in relation to communication?" Cell 16 (Individual–Protection) prompted the question, "How are individual students protected by the SAT, and what are the Effects there?" For all questions, the answers, or seeds of answers, are extracted from Owen.

This analytic matrix captures three dimensions—Level, Purpose, and Effect—at the same time. Several other analytic points some related to all three dimensions and some only to the first two, some trivial and some more interesting, are arranged below according to their cells.

• Cell 1: Individual–Simplification—SAT scores measure, perhaps, as Owen claims, in a misleading way, a person's scholastic ability.

• Cell 3: Associational–Simplification—The SAT is used by and stems from an association of universities and has become the de facto national standard for U.S. high school students.

• Cell 2: Organizational–Simplification; Cell 7: Organizational–Communication; and Cell 13: Associational–Harmonization—Owen describes in great detail how the bulk of ETS's products, like the SAT, fall into the category of mass-administered, multiple-choice tests. These tests share many characteristics: for example, they are composed of several questions; test takers must use a number two pencil to mark answers on separate answer sheets; and the answer sheets are collected and, then, processed using automatic optical-scoring machines. By using the same standardized method in developing, administering, and scoring tests, ETS extended the standardized process to many fields.

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[15](Princeton, N.J.: Peterson's Guides, 1990).

Cell numbers (1, 2, 3, etc.) link each point to the big picture, represented in the matrix. To further emphasize the roles of the cells, and to present further relations among cells, in the following analytic points I will use the cell numbers without the cell names. This will probably involve some movement back and forth between text and matrix, which I want to encourage.

• Cells 5, 10, 15, 20, and 25: The entire multinational category, initially considered "Not Applicable," revealed a lesser known facet of ETS. Although ETS is a U.S. organization, its tests are used worldwide. Owen reports that students applying to study in most U.S. business schools must take the Graduate Management Admission Test (GMAT), which can be made available in their home country. Beyond this domestic use, the GMAT is also used by some non-U.S. universities and even some non-English-speaking ones; for example, applicants to Tel Aviv University business school are required to take it.

• Cells 5, 15, 20, but not 25: There are several possible reasons why Tel Aviv University uses the GMAT to test prospective students for an Israeli program, all of which stem from the test's basic ease of use, rather than any educational reason. By employing such a widely used test, Tel Aviv University does not need to bear the costs of developing and deploying a test. And by choosing the GMAT as the admission test, thus using the ETS network of testing sites, students from all over the world to apply to the University, without needing to be tested in Israel.

• Cell 21 versus Cell 16: Owen attacks ETS's claims for the power of the SAT to measure innate ability, ignoring social, racial, and gender differences: "ETS perpetuates the very inequalities it sometimes claims to eliminate and sometimes claims merely to measure."[16]

The issue of inequalities seemed critical to understanding the impact ETS has had on U.S. education. Owen described a set of studies that examined the influences of coaching on SAT scores, most of them, including those done by ETS, demonstrating that coaching improved SAT scores by as much as a hundred points.[17] As Owen points out, there is nothing wrong with the effect of coaching—the SAT is, after all, supposed to measure learning capabilities—but, in what he calls "perpetuating inequalities," the economically underprivileged, who cannot afford coaching, cannot enjoy its benefits. Thus, contrary to ETS's claim, those who cannot pay are not equal in the eyes of the SAT.[18]

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[16]Owen, 266.

[17]Grading of SAT scores runs from 200 to 800.

[18]Owen develops the issue of "perpetuating inequalities" by listing the effects of different kinds of coaching (i.e., for the math section, for the verbal section, and for general test techniques) on different groups.

Overall, the technical analysis of Owen's work disclosed a puzzling, meta-analytic point: the many positive Effects of the SAT somehow seem to overshadow its negative Effects. In other words, although some arguments against certain elements of the SAT are convincing, no large-scale efforts have been made to study these elements, let alone to take remedial action.

8.4.3 Generalization: Analyzing Views with the Framework

The analytic matrix discussed above can be generalized to incorporate any three of the five dimensions (Level, Purpose, Effect, Sponsor, Stage) of the framework. Two dimensions are necessary in order to create a matrix, then a third, to analyze each cell further. Even though the analytic matrix was not fully evaluated as a tool, the initial application of matrices for educational and noneducational issues generated ample analytic points.

This technical analysis of the Effect dimension suggests that one standard can have several Effects at the same time on different users, that effects can change over time, and that, at times, positive effects can overshadow otherwise obvious negative effects. This chapter has demonstrated the third use of the framework, to analyze a view. In performing the analysis, the claims and arguments of the view are rephrased, using the vocabulary of the dimension. Further analysis can be made by comparing the view to other views or by contemplating the possible meaning of the view in other settings. As with the first two uses of the framework, beyond illuminating the concept of standards, the framework can, if used correctly, elicit a systematic analysis of views.

This analysis has also demonstrated a few kinds of potential insights that result from using the framework, including an important, yet hidden, property of a setting (that ETS appears to enjoy a kind of reinforcing interaction between its national and international operations); a new way to view one of the most perplexing and highly debated points regarding the setting (the inequalities ETS "sometimes claims to eliminate and sometimes claims merely to measure"); and one meta-analytic point (that the many positive Effects of the SAT overshadow its negative Effect).

At the root of these features of ETS, at least according to Owen, is that ETS is "probably the most powerful unregulated monopoly in America.... [People] have no choice but to pay its fees and take the test."[19] That claim leads to the Sponsor dimension discussed in the next chapter, which deals with such issues as monopoly, public scrutiny, and social and economic power.

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[19]Owen, 7.

Chapter Nine

Dimension 4: Sponsor

9.1 Sponsor: Introduction

Compare the following two standards: brushing teeth daily and stopping at a stop sign. The first standard is recommended by dental associations (e.g., the American Dental Association), the second is mandated by law. Although both result from processes of agreement, there is a distinct difference in enforcement. If people do not brush their teeth daily, they will probably suffer in the future but they will not go to jail. The "tooth brushing" standard is often called "voluntary," as opposed to the "stop sign" standard, which is called "mandatory."

Another comparison, this time between the Microsoft Basic programming language and the ANSI Basic programming language. The de facto standard for PCs in the 1980s, Microsoft Basic was considered by many a superset of ANSI Basic, although there were differences. The ANSI standard was developed through a consensual process, in which computer makers and users of computers and other concerned parties voiced concerns about the standard. In contrast, Microsoft Basic was developed by William (Bill) Gates, the head of Microsoft, and his team. ANSI Basic, like ervery ANSI standard, was subject to the scrutiny of all concerned, while Microsoft Basic was not subject to any scrutiny at all (beyond, perhaps, customer pressure, which Microsoft often chooses to ignore).

The difference between the "tooth brushing" and the "stop sign" standards is enforcement or punishment. The difference between ANSI Basic and Microsoft Basic is public versus private ownership of the standard.

The Sponsor dimension, and its five categories, was designed to capture these and other related differences. Like the categories of the Purpose dimension, although not to the same extent, those of the Sponsor dimension could have been arranged in several ways. The logic of "a critical question per category" led to the order used here, as well as to the selection of the names of the categories (which may seem odd, especially the middle three—nonsponsored, unisponsored, and multisponsored). For example, the critical question for the devoid category is, "Is this a standard?" The critical question for the mandated category is, "Is there a sanction associated with the standard?" As will be seen, such questions allow distinctions among the middle categories and led to the prefixes "non-," "uni-," and "multi-."

Table 9-1

Dimension 4: Five Categories of Sponsor

Dimension 1: Level	Dimension 2: Purpose	Dimension 3: Effect	Dimension 4: Sponsor	Dimension 5: Stage
Individual	Simplification	Constructive	Devoid	Missing
Organizational	Communication	Positive	Nonsponsored	Emerging
Associational	Harmonization	Unknown	Unisponsored	Existing
National	Protection	Negative	Multisponsored	Declining
Multinational	Valuation	Destructive	Mandated	Dying

9.2 Sponsor: Categories

9.2.1 Devoid

I have no standard lunch hour. Sometimes I eat at noon, like many of my colleagues. Other times, when I forget to eat breakfast, I eat lunch as early as 11:00 a.m. And still other times, I eat lunch as late as 5:00 p.m., in which case, I'm told, I am actually skipping lunch and merging it with dinner. This is a case where the potential Sponsor cannot find a reason to standardize lunch hour.

The devoid category distinguishes cases where there are no standards at all. Many aspects of life lack standards, cases lacking any apparent need for a standard or where a need exists but no Sponsor with the incentive or power to satisfy that need, or both.

One place where standardization is needed is cable service, specifically, for channel selection. The same cable stations are selected by different channel numbers in different places in the world, even in different parts of the same metropolitan area. For example, in Arlington, Massachusetts, CNN appears on Channel 10, while in nearby Acton it is on Channel 8. It would seem preferable to find CNN on the same channel everywhere.

It would be even nicer to receive an on-screen pictorial menu of all current cable channels (like the common textual menu). Newer cable systems, such as one that started service in Israel in 1991, offer such a service in the form of a "menu" channel. When the

user selects this channel, usually Channel 1, thirty-six moving miniscreens appear representing the thirty-six channels. Another channel could be created, say, Channel 2, for the next thirty-six channels, and so on. The options, especially with the advent of computers, are almost limitless. From the Sponsor point of view, in contrast to a lunch hour, which I could standardize if I wanted to, the development of a menu channel depends on the cable operators, although, as in other cases, consumer pressure might help.

Many other global issues lack standards and call for local, national, and multinational attention, including local gun control, worldwide weapons dissemination, health care, crime, population growth, education, and famine. to be as diverse as possible. These issues are not simple, but in all of them, at least potentially, standards might help.[1]

Although many areas of contemporary life governed by traditions, norms, and culture fall into the devoid category—namely those where more official standardization may be needed—for those discussed next, unofficial but actual standards already exist.

9.2.2 Nonsponsored

Traditions, norms, bylaws, and behaviors (including the convention of eating lunch at noon) that lack a Sponsor can be considered nonsponsored. Although traditional standards research often ignores nonsponsored standards, sociologists invest considerable time trying to understand them.

Consider this sociological example: At the suggestion of a professor at the Harvard Graduate School of Education that I "go beyond the Ed School and see other learning cultures in the Boston area," I crossed the Charles River to take a course at the Harvard Business School (the "B School"). Beyond the knowledge to be gained, I wanted to experience a different learning style and interact with different students, faculty, and administrators. Indeed, many things were different: larger classes (an average of a hundred per class at the B School, in contrast to an average of twenty at the Ed School); a system that better supports the students' need for reading materials (students can buy readings materials internally, in the B School); and a buzzing, always crowded, well-lighted cafeteria (in contrast to the Ed School's calm, often empty, dark basement cafeteria). What fascinated me most, however, was the "firm handshake" practiced by all students. Almost every personal meeting would start with the "firm handshake" and end with another "firm handshake," as if that handshake were a prerequisite to being a B School student.

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[1] *A Vision for the Future: Standards Needs for Emerging Technologies* (Geneva: ISO, 1990) summarizes the results of 2,744 respondents from forty countries representing a broad cross-section of industry, academia, and government.

The firm handshake is part of what the French sociologist Emile Durkheim called "collective conscience." It is part of the collective knowledge and the norms that define the tacit cultural infrastructure of the Harvard Business School. All cultures have a particular tacit infrastructure, which can be intricate and difficult to detect and learn. Because people usually are members of many cultures and subcultures—cultures that relate to family, workplace, friends, professional associations, ethnic origin, or religion—they need to learn.[2]

Tacit standards have neither identified originators holding a propriety interest nor any subsequent Sponsoring entity, yet they exist and are known in their respective cultures. In contrast, there are standards that have a particular entity which has developed, published, or simply taken ownership of them, and these standards are the subject of the next category.

9.2.3 Unisponsored

The introductory section (**9.1**) mentioned Microsoft's experience with its Basic programming language, which molded the way the company has dealt with standards, at least since the mid-1980s, a way that demonstrates in the extreme how one entity can develop standards, publish them, control an entire industry with them, and, as a result, make a great deal of money from them.

In the 1980s, an ANSI committee (X3J2/76-01) worked on the official ANSI Basic. Gates, then managing partner of the small software firm Microsoft, after reading a draft of ANSI's Basic, "fired off a three page letter regarding what he considered errors and omissions.... [H]e enclosed a manual of [his] basic."[3] The memo irritated committee members, especially because Microsoft felt both that it did not need ANSI to set the standards for BASIC and that through its "products [it] would soon set a standard of its own." Since then, it has continued to aspire to be the standard. In several instances, such as the Microsoft Disk Operating System (MS-DOS) or the Windows GUI, Microsoft systematically turned its products into the de facto standard.

Unisponsored standards originate from a nonpublic entity. They often are partly shared with other organizations, but a significant portion of the standard is always controlled by the Sponsor. Changes in unisponsored standards are initiated and approved solely by the Sponsor organization, and although other entities may request changes or additions, the Sponsor organization is ultimately the one to make final decisions. When stakeholders other than a

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[2]Yonathan Shapiro and Uri Ben-Eliezer, Introduction, *Yesodot ha-sotsyologyah* [Elements of Sociology] (Tel Aviv: Am Oved, 1987).

[3]Stephen Manes, *Gates: How Microsoft's Mogul Reinvented an Industry—and Made himself the Richest Man in America* (N.Y.: Doubleday, 1993), 95.

single Sponsor organization have more influence, standards are developed more democratically, with producers, customers, and others collaborating on the development.

9.2.4 Multisponsored

A standard considered to belong in the multisponsored category must be developed by several entities, usually, but not always, of different kinds. For example, a discussion about a standard for electronic antitheft devices (which help the police retrieve stolen vehicles) would include representatives of car manufacturers, installers of such antitheft devices, consumers, insurers, and various police departments, all of whom would negotiate the needed qualities, features, and other aspects for producing an antitheft-device standard. After the different dimensions of the proposed standards had been considered and debated, the parties would need to decide what exactly to standardize and what to leave to the producers and dealers of the devices. Beyond technical specifications, they would probably decide on a name for the standard, for example, UA-TD (universal antitheft device), and probably also develop a test to validate conformity to the standard. They would also decide who should publish the standards. Options include publishing it themselves or using a national organization, such as ANSI.

The essential difference between unisponsored and multisponsored standards is the application of a democratic process to setting the standard. Multisponsored standards usually stem from a formal, traditional, consensus-based process. Consensual standards are traditionally a long process—sometimes months, sometimes a year—in which all the concerned parties participate. Often parties submit bogus comments and questions to protect the status quo. Owing to the length of the process, information technology standards often are developed outside traditional public standards bodies. The Internet Engineering Task Force (IETF), for example, handles its own standards development, rather than working within the traditional bodies, and has achieved a faster development cycle than those bodies can by using a small, authoritative group to solicit ideas and comments, often electronically, while making the final decision itself.[4] Although such nontraditional methods may appear to be the wave of the future, according to at least one researcher, William Lehr, "the proliferation of new, less bureaucratic standards development organizations venues may actually worsen prospects for the development of timely industry standards."[5]

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[4]OTA, *Global Standards: Building Blocks for the Future*, 28.

[5]William Lehr, Voluntary Standards, Multiple Markets, Standards Institutions, and Industry Structure, Graduate School of Business, Columbia University, 1993 [unpublished].

9.2.5 Mandated

The difference between multisponsored and mandated standards is the addition of "enforcing power." The most obvious example of mandated standards are the many laws that govern our life, laws that carry a punishment.

Beyond basic laws—do not steal, do not kill—mandated standards regulate commerce. Thomas K. McCraw's biography of four "prophets of regulation"[6] lists several uses of mandated standards on the national Level, including (*i*) disclosure and publicity, (*ii*) protection of industries from outside pressures, (*iii*) containment of monopoly and oligopoly, and (*iv*) promotion of safety for consumers and workers. Although incomplete, this list demonstrates the diverse uses of mandated standards by state and national authorities.

Mandated standards also occur at lower Levels. Organizations often define rules, ways of conduct, methods of operation, etc. If there is a built-in punishment, these standards can be considered to fall into the mandated category, but if voluntary, into one of the previous categories.

9.3 Sponsor: Summary and Evidence

The source that originally led me to the Sponsor dimension was "The Economics of Compatibility Standards: An Introduction to Recent Research" by Stanford economists Paul David and Shane Greenstein.[7] In the introduction they distinguish between de facto standards (which include the categories nonsponsored and sponsored) and de jure standards (which include the categories agreed and mandated). Although only a small part of the paper discusses the rationale for these distinctions, David and Greenstein's description of those categories provided a basis for elaboration.

In contrast to David and Greenstein's simple division between "de facto" and "de jure," OTA's report *Global Standards: Building Blocks for the Future* offers the categorization that distinguishes three kinds of standards in what it calls the Standards Universe: de facto, regulatory, and voluntary consensus standards.[8]

Beyond the sources mentioned above, standards are usually considered only in a limited sense that does not cross the categories. For example, many discussions of multisponsored

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[6]*Prophets of Regulation: Charles Francis Adams, Louis D. Brandeis, James M. Landis, Alfred E. Kahn* (Cambridge, Mass.: Belknap Press of Harvard University Press, 1984), 301.

[7]*Economics of Innovation and New Technology* **1**, 1-2 (1990), 3-42.

[8]*Global Standards*, 106.

Table 9-2

Summary of the Sponsor Dimension

Dimension 4: Sponsor	The Sponsor of the standard is:
Devoid	missing. There is no standard, no Sponsor, no owner. An opportunity for a standard.
Nonsponsored	missing. Although the standard exists, it has no single identified Sponsor. A de facto voluntary standard.
Unisponsored	a single identified organization, usually with propriety technology. A de facto voluntary standard.
Multisponsored	a public entity, usually an organization or association. A de jure voluntary standard, but without teeth.
Mandated	a regulatory organization that makes and enforces laws. A de jure, nonvoluntary standard with teeth.

standards (i.e., pros and cons of group-based standards), unisponsored standards (i.e., those dealing with issues of monopolies and market control), and mandated standards (i.e., effects of regulations), yet, as both the OTA report and David and Greenstein's work suggest, in the knowledge age these boundaries are blurred. For example, multisponsored standards are sometimes pushed almost solely by a single company, and mandated standards sometimes incorporate multisponsored standards by reference—that is, a voluntary standard can suddenly turn into a mandated one.

The devoid category, although not mentioned in the sources (like the missing category of the Stage dimension, discussed in **Chapter Ten**) marks a lack of standards; the word "devoid"[9] marks the total absence of a Sponsor. It highlights the potential of, and opportunity for, new standards. Pointing to new standards is essential for the completeness of the framework. This category is valuable in using the framework to make comparisons or design standards.

The three middle categories (nonsponsored, unisponsored, and multisponsored) are similar. In each there is a standard that is not associated with any official sanction. Users may not care how a standard comes into being, whether developed by one entity (unisponsored),

[9]Other possibilities were "fuzzy," "missing" (see section 10.2.1), and "none"; ending with "d," like the other categories in this dimension, "devoid" is, in my view, esthetically pleasing.

many entities (multisponsored), or none (nonsponsored), but identifying the kind of Sponsor may shed light on inherent reasons for the standard's structure.

The design of the Sponsor dimension incorporates the de facto, the de jure, and the OTA models. The names of the categories have been modified from what they were in the original sources, and the relations between them clarified. The logic of the dimension is now based on the critical features of the categories, used in the following example.

Given a particular standard or situation to analyze, the questions in **Table 9-3** may be used to identify the most appropriate Sponsor category. When applying the Sponsor dimension to other uses—for instance, to select or design a standard—the questions may need to be modified. The main goal of the questions here is to elaborate on and clarify the logic of this dimension.

Table 9-3

Critical Questions for the Sponsor Dimension

Start by asking question 1.	If the answer is "no," then...	If the answer is "yes," then...
1. Is there a standard?	use devoid.	go to question 2.
2. Is there a Sponsor?	use nonsponsored.	go to question 3.
3. Does the standard have many Sponsors?	use unisponsored.	go to question 4.
4. Is it sanctioned?	use multisponsored.	use mandated.

9.4 Exploration: The Use of the Framework in Education

This section describes another potential use of the framework of standards, using the Sponsor dimension (with reference also to the Level, Purpose, and Effect dimensions) to analyze one reason why technology has failed to have an impact on the K-12 system.

Like other issues used in previous chapters (the K-12 system, NCTM, ETS), "technology for education" touches many parts of the educational enterprise. The example here does not present the issue in its entirety; instead, it uses the framework of standards to present analytic points about the issue.

9.4.1 Background: Technology for Education

In 1988, OTA's report *Power On! New Tools for Teaching and Learning* found that

> although new interactive technologies alone cannot solve the problems of American education, they do contribute to improvement in learning. These tools can play an even greater role in advancing the substance and process of education, both by helping children acquire basic skills and by empowering them with more sophisticated skills so they can acquire and apply knowledge over their lifetime.[10]

According to another study published a year later, "The Computer Report Card: How Teachers Grade Computers in the Classroom,"[11] a nationwide telephone survey of 1,100 precollege teachers conducted by the Whirtlin Group for IBM, teachers in formal education agree that the use of computers in the classroom is a positive development for the learning process, in the scholastic sense (e.g., college preparedness, manipulation of data) and in the social sense (e.g., student motivation and skill development).

Technology can help in the management of education, as it does in management in noneducational settings. Its greatest promise, however, lies in the positive Effect technology can have on learning and on the learner's intellectual growth. Technology can support interactivity, individualized learning, adaptation, collaboration, just-in-time training, and of course much more than can be listed here. Numerous examples in other settings (e.g., the military, industry) have proved that technology can serve education.

Despite this touted potential, beyond islands of use, technology has been used to little effect in education. The picture is depressing, especially because much of the equipment in schools was bought as a result of a "computer fashion" or "parental pressure." Although equipment exists in many schools, it is often underused or misused.

Over the years, educational technology, at least in primary and secondary education, has not fulfilled its potential. Hopes were high, but results have been few. From films in the 1920s through radio in the 1930s, television in the 1950s, programmed instruction in the 1960s, learning laboratories and the advent of instructional systems design in the 1970s, computers and videodisks in the 1980s, and multimedia in the 1990s, the steady stream of technological innovations hailed as panaceas has had relatively little affect on educational practice.[12]

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[10]Executive Summary (Washington, D.C.: OTA, 1988).

[11]*Business Week* (10 Dec. 1989; special issue, "The Technology Revolution Comes to Education"), 54ED.

[12]See: Stephen T. Kerr, "Technology: Education:: Justice: Care, or Thoughts on Reading Carol Gilligan," *Educational Technology* (November 1990), 7-12; Larry Cuban, *Teachers and Machines: The Classroom Use of Technology Since 1920* (N.Y.: Teachers College Press, Columbia University, 1986); D. K. Cohen, "Educational Technology, Policy, and Practice," *Educational Evaluation and Policy Analysis* 9, 2 (1987), 153-170; M. D.

Although most classrooms throughout the world are equipped with old, frequently used information technology (e.g., books and chalkboards), the use of newer technologies has usually been limited to innovators, that is, either "techies," who can debug, on-line, a mess of cables mixed with system bugs, or "researchers," who rarely move beyond the prototype phase.

Technology *can be* significant and helpful for education, but its usually limited effect on education has been the result of a local initiative not linked to any systematic approach, for several reasons, one being the pitfalls discussed next.

9.4.2 Discussion: The Pitfalls of Unisponsored Standards

Your son is going to celebrate his thirteenth birthday, and you decide to buy him educational software for home use—say, an electronic encyclopedia. First, you need a computer, and, if you already have one—say, an IBM PC clone—you must make sure you have the right type of screen. CGA, VGA, or SVGA? Do you have enough memory? 640 kilobytes, 2 megabytes, or 8 megs? What about system software? MS-DOS, Windows, or OS/2?

After long investigation, you purchase the software for $100. It works, and your son is happy for a few days. But by the end of the week, he is unhappy: the software does not work on his school's computer. Your child does not use the software, and the $100 software package begins to collect dust on the shelf, together with other never-to-be-used-again toys.

A year later, as you prepare for a business trip to Central America, you decide to learn something about Mayan culture. You try to run the encyclopedia software, only to receive a framed system message saying, "System Error NC-1007. Please Contact Your Dealer." Your dealer tells you, in a I'll-fix-it-for-$100 voice, that you no longer have the correct version of system. You are left with the software folder, which you could use to file other things.

The lack of standards in the PC industry can be directly attributed to both a lack of multisponsored standards and a proliferation of different unisponsored standards. Manufacturers of hardware and software develop products that do not work with each other—that is, "A Jumble of Competing, Conflicting Standards Is [often] Chilling the Market."[13] Market confusion, which causes many users headaches, is particularly harmful to

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Roblyer, *Assessing the Impact of Computer-Based Instruction: A Review of Recent Research* (N.Y.: Haworth Press, 1988).

[13]John W. Verity, "Computer Confusion: A Jumble of Competing, Conflicting Standards Is Chilling the Market," *Business Week* (10 June 1991), 72-78.

the cash-poor education field, which cannot afford the high costs of new equipment, let alone the costs of new software or training.

Even when a standard emerges as a "winner," schools may suffer in the long run. A case in point is education's romance with Apple Computers, which soured around 1987. In 1984, Apple, which then controlled the education market with the Apple II family, came up with the Macintosh—a computer not compatible with the Apple II. In 1986, however, Apple also came up with the Apple IIGS, which was compatible with the Apple II family. Many schools, convinced by Apple and its dealers to buy the IIGS computers, found themselves only two years later with obsolete technology. For reasons of its own—some say for the company's survival—Apple diverted its energies to the Macintosh line and virtually ceased to support the IIGS computer. It was technically possible to make the Macintosh compatible with the Apple II (as Apple did in 1992 with its LC model, but that was too late).

Because the Apple II standard was unisponsored (read, controlled by Apple Computers), educators were at the mercy of the company and had no real power to influence the standard. The case of Apple presents one risk associated with unisponsored standards: the single Sponsor organization simply may change the standard, ignoring the needs of users.

9.4.3 Generalization: Using the Framework to Select Standards

The preceding discussion used the Sponsor dimension to explain an inherent reason for the failure of technology to have an impact on the K-12 system, and implicit in that discussion is the recommendation to avoid unisponsored standards when selecting technology for education. Unfortunately, this recommendation is hypothetical, because education currently has no choice. The technologies now offered to schools are mostly unisponsored. In spite of the size of the educational market, educators have failed to push for standards that would better match their needs. As matters stand, educators are subject to the pressures (and propaganda) of vendors, which push new their technologies at education.

This section has demonstrated, in a partial way, the fourth use of the framework of standards, to select standards, which can be regarded as a three-step process: (*i*) use the framework to analyze the particular setting, (*ii*) use it to analyze each potential standard, and (*iii*) use it to compare and contrast potential standards for the setting.

Chapter Ten

Dimension 5: Stage

10.1 Stage: Introduction

Standards are, in many ways, like people. They are born at a certain time, and they die at a certain time. A "baby" standard typically starts with "parents." Someone has to need, or think they need, a standard. In its childhood, a standard takes on mature, final form. If all goes as planned, the mature standard will have several years of prosperity. As it ages, with exposure to changing conditions, it will starts to decline, and, after a few more years, with exposure to even more changing conditions and as new, younger, more appropriate standards emerge, the standard will "die."

Table 10-1

Dimension 5: Five Categories of Stage

Dimension 1: Level	Dimension 2: Purpose	Dimension 3: Effect	Dimension 4: Sponsor	Dimension 5: Stage
Individual	Simplification	Constructive	Devoid	Missing
Organizational	Communication	Positive	Nonsponsored	Emerging
Associational	Harmonization	Unknown	Unisponsored	Existing
National	Protection	Negative	Multisponsored	Declining
Multinational	Valuation	Destructive	Mandated	Dying

Standards, of course, are not people, yet this analogy emphasizes that they are not fixed, that, indeed, they are dynamic designs that interact with their surroundings. In contrast to people, most standards never reach maturity but "die" at an early Stage. Yet some seem to live forever. Others, especially local standards, can emerge, prosper, and die within a short time (days, even hours, in the case of short-term projects); or they can live for years and then, suddenly, die.

The Stage dimension, and its five categories, was designed to capture the different Stages of the life of a standard. The logic and the selection of the wording of the categories (except for the third one, "existing") are relatively simple. The relations between the categories are what is critical, and in the following example, using an illustrative, fictive

metropolitan saga about seven car dealers, these relations are highlighted across descriptions of the five categories.

10.2 Stage: Categories

10.2.1 Missing

Seven car dealers in Newton, Massachusetts, joined forces to bring more customers to their town. The motive for this somewhat unusual coalition was competition from another coalition of car dealers in nearby Needham, which was decreasing the revenues of the seven Newton dealers. The Needham coalition used slick, animated television commercials to invite customers to see their "diversity of dealers." The Newton dealers set a first meeting to consider their options.

In the language of the Stage dimension, at this point this narrative is in the missing Stage. There is no standard yet, but there is a Sponsor for a future standard—actually seven Sponsors, which, in the language of the dimension, makes this a multisponsored effort.

Thinking about situations that lack standards is as interesting as—and potentially more profitable than—thinking about situations for which there are standards. For example, in 1965, Ralph Nader, in *Unsafe at Any Speed*,[1] was, according to OTA, the first to criticize the U.S. government for not stepping into the arena of automobile standards.[2] The following question can be extracted from Nader's criticism: Why, if there are mandated speed limits, does the government allow car manufacturers to make cars that can go beyond them? There is no simple answer. Perhaps limiting the speed of a car is too difficult technically (though today's technology makes it appear doable; perhaps it is a civil rights issue (a right to "go fast," like the right to bear arms); or perhaps people need to drive fast during emergencies. As that example and the extrapolated question indciate, identifying a missing standard is often more difficult than developing the standard itself, although more challenges will appear as a standard begins to emerge.

10.2.2 Emerging

Returning to the story of the car dealers in Newton: all seven send representatives to a meeting, which opens with a discussion of local gossip—Have you heard about the milkman and Pat? about the new air bags? about the customer who purchased three cars, one himself and two for his twin sons? This informal exchange lasts about thirty minutes, and then they

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[1] *Unsafe at Any Speed: The Designed-In Dangers of the American Automobile* (N.Y.: Grossman, 1965).

[2] *Global Standards: Building Blocks for the Future*, 54.

start to discuss the annoying problem of the competing Needham coalition. After they have appointed a chair and a note taker, they begin the real discussion with brainstorming. Many ideas emerge—ideas about what actions to take and how to pay for them. After several meetings, the group decides on a three-point plan that includes a toll-free-800 number, a television commercial, and a joint "basic price and features" booklet. This plan constitutes a local standard that originated in an associational accord aimed at fulfilling the purpose of dealing with the Needham coalition.

This fictional anecdote typifies the chronology of a classic voluntary standard-making process. A group holds meetings, appoints a chair and note taker, and decides on a strategy that can be considered a standard for beating the competition. As with most multisponsored standards-making processes, the informal portion of the meetings is important. "Shmoozing" provides an opportunity for the participants to exchange ideas and learn about the state of the art of their field.

In general, the Stage of emerging can take different shapes, depending upon the Level, Purpose, and Sponsor dimensions. On the individual Level, for example, a person may take a minute or more before the standard has moved to the next Stage. At the organizational Level, the emerging phase may take longer. Verman, who collected data for 1959–63, found that most national standards take three years to develop.[3] Since 1963, because of complexity and international factors, costs and efforts have grown. For example, "the development of a major international telecommunication standard may require in the range of 1,000 person years of experience, 20 person years of actual effort, and three million dollars."[4]

In the Stage of emerging, vague ideas, concepts, and structures are turned into coherent, logical, and viable standards. In all but extreme cases, dialogue is the basis for the Stage, dialogue among producers of the standards, those with a direct stake in the process (such as potential customers and suppliers), and those with an indirect stake (such as developers of competing or related standards). The most important factor for an emerging standard and the key to its potential success is internal dialogue among developers. Beyond listening to and accounting for the different stakeholders, the process of making a standard involves meticulous, even, some say, pedantic, and, most important, reflective thinking, which can lead a standard to the existing Stage.

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[3]Verman, 145.

[4]OTA, *Global Standards*, 12.

10.2.3 Existing

The toll-free 1-800-2NEWTON line is working, the television commercial is on the air, and the "basic price and features" booklet is being handed out to customers by all seven Newton dealers. As more customers come to shop, sales seem to be increasing—and, indeed, when the actual sales figures arrive, they indicate that the increase is real. The Newton dealers still meet every month, but the meetings are now mainly social. There is nothing substantive to discuss, because the process seems to be working to the benefit of all.

In contrast to the hectic emerging Stage, the existing Stage is calmer. The standard is out there, doing its work. The shift from emerging to existing may take a day (for mandated standards that are turned into law), months, even years (for unisponsored or multisponsored standards). In more recent cases, especially in industries that involve information technologies, Sponsors may already be at work on the next version of a standard even before the first version has reached the market.

In some circumstances, mature standards may stay in the existing Stage forever. Basic standards—the meter, second, and kilogram—probably will last, as they have so far, for centuries.[5] Others, such as the QWERTY keyboard or the British system of inches and pounds (also used in the United States), refuse to decline, despite their flaws and the availability of alternative standards; their omnipresence reinforces them.

10.2.4 Declining

Although the dealers' toll-free 1-800-2NEWTON standard is working very well, its real Effect is causing some concern. Among themselves, some of the small dealers claim they are paying too much for the group effort; they want the bigger dealers to pay more. The bigger dealers claim that the small dealers change their prices rapidly and then conveniently "forget" to update the joint "basic price and features" booklet. There are murmurs about the overall value of the partnership, especially since the competitive Needham coalition dropped its television campaign.

Standards, as said above, are mortal or immortal. Most multisponsored standards are structured to be mortal. For example, according to the ISO, because standards "determine not only the basis for the present but also for future development,"[6] they should be reexamined periodically. The ISO certainly practices what it preaches. Each of its standards has an expiration date, usually every five years, when the future of the standard is determined:

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[5]*The United States and the Metric System: A Capsule History* (Gaithersburg, Md: NIST, NIST LC 1136, 1992).

[6]Verman, 20.

renewal, revision, or rejection. The maintenance activity is as important as ongoing creation of new standards.

Although there are no clear signs to use to identify a declining standard, there are symptoms: complaints from different directions about the standard; a Sponsor that no longer supports it; the emergence of one or more competing standards; the overriding by negative Effects of positive ones; support from organizations that initially supported the standard and advertised doing so now continued only as a side feature; and the standard's relative agedness in its industry.

These may be only symptoms, but they point to the potential for decline. Yet similar signs can be seen in old standards that seem immortal, as well as in young, emerging standards, especially when a young standard is competing with other standards to gain marketshare. When the symptoms grow and accumulate, however, the standard may approach the end of its useful life, a Stage bluntly called "dying."

10.2.5 Dying

The story of the Newton car dealers incorporated symptoms of "death." As the symptoms intensified, calls to dismantle the group standards intensified. First, one small dealer stopped payments for the group television campaign, sending a letter to the group to say "We feel that this coalition is no longer useful to us, therefore we unilaterally exit the arrangement." Attendance at monthly meetings lessened, meetings were short and lacked the old "what's-new-in-the-area" ambiance. The chair of the committee, an ex-salesperson from a big dealer, did her best, yet even she could not revitalize the group or find a good rationale for its continued existence. Twelve months after the initial meeting, she canceled the toll-free number and sent a letter to the member dealers that said, "It was fun, but it appears there is no real reason to continue."

Standards do die. Again, depending on the Level and Sponsor, they die in different ways. Some die quickly and painlessly when they are replaced by a new, compatible standard that allows a smooth transition. Some are stubborn; for example, the British system of measurement, although replaced everywhere else by the metric system, is alive and well in the United States (and Burma and Liberia).[7]

The symptoms of a dying standard are similar to those of the declining Stage, but more severe: *major* complaints come in from different directions about the standard; its Sponsor no

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[7]Malcom W. Browne, "Yardsticks Almost Vanish as Science Seeks Precision; Scientists Redefine Standards of Measurement," *New York Times*, 23 Aug. 1993, A1.

longer actively supports it and may even support a competing standard; negative Effects override positive Effects; and fewer organizations support the standard.

Most multisponsored organizations, such as the ISO, that routinely write standards by policy reexamine all those they have written. Mandated standards also can decline and die. For example, in the United States, the eighteenth amendment (which prohibits making or selling alcohol) was canceled by the twenty-first (enacted after a surge in illegal trading).

10.3 Stage: Summary and Evidence

Early versions of the framework, which excluded considerations about the making of standards, did not include the Stage dimension. Two arguments persuaded me to seek a dimension that would capture the life span of standards.

The first argument for a Stage dimension arose from several discussions about standards. After initial questions, such as "What do you mean by standards?" or statements such as "Gee, I didn't know there were so many," often the question arose, "What about innovation? Are standards too rigid, formal, and overall limiting?" This question originates in the prevailing misconception that standards do not change, that they are fixed, rigid. But, as said earlier, nothing could be further from the truth. Standards, particularly good standards, are frequently reexamined and modified. The misconception about their rigidity called for a dimension to highlight the life span of standards, especially the expected and often planned decline of most of them.

The second argument for a Stage dimension came from what Carl F. Cargill, in *Information Technology Standardization*, called the shift from reactionary standards to anticipatory standards. Cargill characterized industrial age standardization as a "reactive activity" that produced standards for a product, process, or method established as the de facto standard. Old industrial standardization turned de facto standards into de jure ones. In contrast, in the knowledge age, with its fast-changing, new technologies, standardization has become a "proactive activity," in which producers of standards try to anticipate future products, processes, or methods. As a result, new standards often precede products, by years. The shift to anticipatory standards called for a way to describe the life span of a standard.[8]

The central logic of the Stage dimension, relating human life to standards, is derived from the work of Stephen Jay Gould, the biologist and historian of science. In the article "The Panda's Thumb of Technology," Gould traces a Darwinian history of the QWERTY keyboard, suggesting that the evolution of its suboptimal design can be explained in terms of

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[8]Cargill, 45.

Darwinian evolution (i.e., it is like the Panda's false thumb, which is "clumsy, suboptimal, but working").[9]

Others besides Cargill and Gould have reflected on the process of making standards.[10] The most expanded definition of Stages can be found in the ISO's official ten Stages of international standardization, which include forty potential substages in the life span of a standard.[11]

There were many options for the names of the Stage categories, and, as for the other dimensions, an esthetic principle was needed that could be shared by the categories. The suffix "-ing" suited the active, dynamic nature of the Stage dimension, but as an esthetic principle, it limited the selection; for example, "maturing" looked awkward. As with the other dimensions, but more so here, further feedback may improve the names of the categories. In its present form, the Stage dimension tackles the misconception of rigidity by highlighting the full life span of standards, which, in turn, makes this dimension as generative analytically as the other four.

10.4 Exploration: The Use of the Framework in Education

Previous exploratory sections demonstrated uses of the framework as a tool that allows users of standards to respond to their environment. In contrast, the fifth use, to design a standard, serves those who develop standards.

Designing standards, like any other project of design, is more complex and time-consuming than the analysis of settings, standards, and views or the selection of standards. Designing standards is also riskier, because it involves potential negative and even destructive results (see **Chapter Eight**). Thus, exploring the use of the framework for designing standards requires special treatment.

The challenge is to present an example that is sufficiently concrete to demonstrate the ways the framework can be used in the process of designing standards. A good example that

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[9]Stephen Jay Gould, "The Panda's Thumb of Technology," *Natural History* 87, 1 (1987), 15.

[10]Others whose works influenced the design of the Stage dimension include: Odo Struger, "Impact of International and Foreign Standards on a Company's Operation," a speech given at the Standards Engineering Society Conference, Washington, D.C., 20 Aug. 1991, and subsequently quoted by Diedo Betancourt in *Strategic Standardization Management*, an internal report of the Company Member Council, Executive Committee, ANSI; Verman, 36, 144; and Maureen A. Breitenberg, *The ABC's of Standards-Related Activities in the United States* (Gaithersburg, Md.: NIST, NBSIR 87-3576, 1987), 7.

[11]The complete list of stages according to the ISO, which includes forty substages (and sixty potential future substages), can be found in the annual catalogues of *Technical Committee Drafts and International Standards*. The data used here were taken from the January 1992 edition, ii-iii.

Table 10-2

Summary of the Stage Dimension

Dimension 5: Stage	The Sponsor of the standard is:
Missing	not there. An opportunity for a new standard, although there may be no need for one.
Emerging	in discussion now, initially being proposed or discussed. It is not common and usually not implemented.
Existing	already out there and common. It is being used by people, and its effects are known.
Declining	in its final useful days. There are calls to replace it, and even some existing competing standards.
Dying	no longer useful, it is obsolete. Usually a new standard replaces it.

arose in a Harvard-based research project is presented below in the form of a fictional memo from a "standards expert" to the project's directors. The memo was designed to concretize the discussion. Instead of addressing "how a standard should or could be designed," the example presents real considerations that stem from applying the framework to a real project.

This particular research project offered a useful example, because it is related to the K-12 setting, the NCTM math standards, ETS, and the use of technology, and thus builds, in part, on exploratory sections in previous chapters.

10.4.1 Background: The Balanced Assessment Project

The goals of the Balanced Assessment (BA) project for the mathematics curriculum are to produce assessment "materials for mathematics education that have broad national applicability—and that serve not only as a means of measuring student attainment, but also as a positive force for curriculum change." The project is supported by the National Science Foundation (NSF), which provided the Harvard-based project roughly $3 million over three years (1992–95).[12] The intent of the project was to produce alternative tests for K-12 math education that would build on the NCTM math standards (see **Chapter Seven**). To develop

[12]From an internal, unpublished NSF memo.

the tests, the project brought together developers, designers, and researchers from four teams based at different universities.[13]

Within the entire BA project, the terms "packages" and "tasks" are used for what are traditionally called "tests" and "questions." A package consists of a balanced collection of about twenty tasks, and each package is expected to contain a balance of the following elements:

- *Length of time students are expected to work on tasks*. Each package includes a combination of (*i*) short tasks, which occupy from a few seconds to about ten minutes; (*ii*) long tasks, which occupy from about thirty minutes to an hour; and (*iii*) extended tasks, which may take many hours and are often spread over several weeks.

- *The context of the tasks*. Each package includes a combination of (*i*) pure mathematical tasks, which focus on the inherent nature of mathematics, and (*ii*) applied tasks, which apply mathematical concepts to some realistic situation.

- *The mathematical content of the tasks*. Each package includes several branches of mathematics, for example, it may demand knowledge of algebra, geometry, and statistics.

- *The mode of presenting the tasks*. Each package includes a combination of modes of presenting the tasks. Although most tasks are presented using paper, other modes are possible, such as a teacher asking the questions orally or a student using a video.

- *Tools used to arrive at and submit answers to the tasks*. Tools other than paper and pencils—such as computers, calculators, rulers, and other teaching objects—may be used to arrive at solutions.

- *Method of working on the tasks*. Each package includes tasks for which students can work on either individually or as a group.

Aside from the balanced packages, the project plans to develop classroom materials and professional development resources. These support materials are to smooth the transition to the new kinds of assessment advocated by the project. Although the actual transition lies beyond the scope of the initial three years, the assessment packages and the support materials are to be delivered by way of publishers, professional associations, states, districts, and even individual schools. Even though primarily a research project aimed at understanding how to develop national assessment, the ultimate real-world implementation of the new assessment methods was always kept in view.

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[13]Principal investigators include Alan Schoenfeld and Phil Daro (University of California at Berkeley), Judah Schwartz (Harvard University), Sandra Wilcox (Michigan State University), and Hugh Burkhardt (the British Shell Center).

The "standards expert," whose role was to coordinate technical support for the Harvard team, was charged with developing the BA database, an all-in-one tool to assist project leaders in managing the tasks, scoring, testing, and with overall work flow.[14]

10.4.2 Discussion: Memo on Trying to Become a Standard

The memo from the standards expert to the BA project directors, although fictional, synthesizes actual written reports and conversations with team members over the course of a year. It does not constitute a complete analysis of the BA project nor in any way represent the official position of the project. It was constructed to demonstrate the use of the framework to design a standard in the emerging Stage.

The memo opens:

> **To**: Project Directors, BA Project
> **From**: The Resident Standards Guru
> **Subject**: On becoming the standard for K-12 math assessment
> **Date**: January 1, 1995
>
> Your memo of last week asked me to contemplate the prospect of the BA packages becoming the standard for mathematics assessment. After several hours spent thinking about this, I respectfully raise the following four points for further discussion.

Next, the need to build consensus is emphasized:

> (1) On early linking with other interested parties:
>
> As with other emerging standards, a wide coalition, support, and feedback are needed. Even at this early stage, when the packages are not fully tested, BA leaders should seek similar research projects, publishers, testing sites (i.e., states, districts, etc.), and other potential partners. Beyond the concrete value of getting feedback

[14]As an insider, in the role of the expert, I had a first-hand opportunity to reflect on and contemplate ways in which the framework of standards might be applicable to this emerging national, perhaps international, standard for K-12 math assessment.

about what in the packages works well versus what needs improvement, early "linking" will position the BA project as a national player in the assessment arena.

If that is done correctly, the project will gradually position itself as the major developer of new math assessment methods. Yet a word of caution is needed: as with all emerging standards, someone may grab our ideas and steal them. Thus, just the right amount of "linking" should be sought. Although this may sound like a far-fetched danger, it is not. Our ideas are quite "stealable," especially if you, as I, believe they are sound and potentially profitable.

Here, a similar organization is identified:

(2) On learning from our archrival:

In thinking about the different entities related to our effort, I was struck by how much we can learn from our "archrival," ETS, and its SATs. Like the SAT, which has become the standard for university admissions, we want the BA packages to become the standard for every K-12 math assessment. But in other ways, the BA project is attempting to avoid ETS style. For example, we encourage tasks that have more than one correct answer, and, in contrast to ETS, the project develops tasks that engage test-takers for longer periods of time (hours, even days). Despite these differences, the BA project can learn valuable lessons from ETS's method of operation, such as how to maintain objectivity, how to build a cost-effective structure, how to consider the international market, and how to automate scoring, which will contribute to the project's long-term success.

In terms of a concrete vision, instead of trying to write one test for everyone (as ETS does with the SAT), we should strive to allow different customers (states, districts, etc.) to compose tests according to their own educational agendas. Of course, what will help us is a computer-based system, which leads to my next point.

In the first paragraphs the Level dimension (organizational, national) was used to identify a similar standardization effort. Then, the Effect dimension was used to list positive and negative effects that can provide lessons for the BA project. The second paragraph can be seen to link with the Purpose of simplification.

Next, the dynamic nature of standards is highlighted:

> (3) On building future options into present tools:
>
> The above vision of a BA consultant developing different tests for different clients calls for modern information tools. Beyond printing on-demand, we need a system that will allow our consultants to tailor packages for our clients. In this vision, each task will be coded in various ways (e.g., difficulty, length of time, mathematical content, age group, accessories needed, etc.), and the BA consultant will translate the clients' requests into concrete database queries. If, for example, a client asks for tasks that use computers, the BA consultant will enter this condition as "accessories = computer." If a client asks for a maximum time on a package of ten hours, the consultant will enter this condition "maximum time = 10 hours." At this point, we do not know the exact composition of the coding method or the form of interaction between the BA consultant and our system, but we do know that they will be essential for the long-term prosperity of the project.
>
> This means that we should keep the future in mind when we design our current technological tools. Flexibility is the order of the day. Our current tools should allow us to incorporate as many new ways of coding as necessary to allow future BA consultants to cater to the needs of various clients. But, beyond that, because our vision may not be implemented for five to ten years, we should not lock ourselves into current technologies. To be constructive, we should choose systems and tools that allow for expansion and modification.

In making this point, I used the Stage dimension to emphasize the need for flexibility. Notice the way the BA consultant is protecting the client from the complexities of the system (Purpose: simplification, protection).

And here the valuation category is dealt with:

(4) On becoming neutral standards:

In the original proposal, we used the rhetoric of change and newness. Although this is indeed our direction, it could hamper our acceptance by the old guard. It is possible and, I think, desirable to present our standards as the answer for all clients. For example, assume that our client is a private school pushing for drill and practice. Even though this philosophy goes against NCTM standards, we—in striving to be the answer for all—should be able to produce packages that support drill and practice. Our data bank should have some drill and practice tasks to satisfy such "traditional" clients.

By catering to the "traditional" clients, we allow ourselves a foot in the door. In theory, an experienced BA consultant should be able to demonstrate some of the nontraditional tasks. The consultant may even convince an old-timer to try some new tasks "just to see how students and teachers react." Like the Trojan horse (which looked like one thing but was quite another), being neutral and inclusive will open many doors for us—doors that might have otherwise stay closed.

Last, the project leaders are urged to take a neutral, nonvalue approach, based on the Purpose dimension (mainly valuation). The letter concludes in the usual manner:

In conclusion, as a project that strives to create the standards for K-12 math assessment, we should consider our long-term plans. Even at this early stage, we should at least engage in (1) linking with other parties; (2) learning from other similar efforts (i.e., ETS); (3) building our future into our current systems and structures; and, most important, (4) adopting the policy of neutral standards. Of course, this should be the basis for further discussion among other project members.

10.4.3 Generalization: Designing Standards with the Framework

In the process of generating this fictional memo, the five dimensions were used as analytic checklists, which yielded several points, minor and major. Four points were selected for full development and presentation, because they have immediate implications for the project.

The realities of the BA project were a bit more complex. While engaging in the day-to-day activities of the project, it is difficult to find time for long-term analysis. An actual memo would be delivered in person, so questions and concerns could be addressed.

Only a few terms of the framework are used in the memo. Experience suggests that for those unfamiliar with standards in general and with this framework in particular, presenting the points in the local vocabulary (in this case, the BA vocabulary) is preferable to using the vocabulary of the framework. The fictional memo presented ideas from the framework, but not the framework itself. Where they seemed integral, terms of the framework were incorporated.[15]

As said earlier in this chapter, this discussion demonstrated the fifth use of the framework—to design a standard, in this case a national assessment standard. Designing a standard relies on the other four uses: first, an analysis of the setting; next, analysis of current and potential standards for the setting; then, analysis of potential views of the proposed standard; and, finally, asking what would make the users select the proposed standards. Consequently, because of the number of interrelating facets of designing standards, the framework, and the systematic approach it encourages, are especially beneficial for this use.

[15]The need for initial training must be recognized. Asking people to adopt a new framework immediately is unreasonable, especially for the complex and heated topic of standards.

Part Three

General Reflections

Chapter Eleven

On Designing the Framework

Building on the dimensions discussed in previous chapters, this chapter presents reflections on the process of developing the framework, thus addressing the third goal of this work. This chapter attempts to answer several questions: What dimensions did not make it into the framework? Why were certain names chosen for the categories? And what is difficult about the current framework?

Along with the other two chapters in this part, this one is not intended as a full-fledged evaluation of the framework but, rather, the starting point toward one. My intention here is to cover a lot of ground in relatively little space, so that future work can use this as a foundation.

11.1 Which Dimensions Did Not Make It into the Framework?

Selecting the five dimensions, Level, Purpose, Effect, Sponsor, and Stage, was not easy, because the literature suggested many other possible dimensions to standards. This section offers a kind of obituary for those not included, that is, short, simplified descriptions aimed at encouraging further research.

The dimension that almost made it, called "Form," concerned the embodiment of standards. Form included, as usual, five categories—definitions, specifications, processes, certifications, and meta-standards—in near final format (using the suffix "-s"). Beyond the format, preliminary definitions were developed for the categories, yet, as the logic, arguments, and examples for the Form dimension were being outlined, distinctions between the categories faded. Further, the different Forms of standards that were distinct in the industrial age seemed to lose distinctiveness in the knowledge age, when a single standard often takes multiple Forms. After the Form dimension died, one of its categories (meta-standards) was incorporated into the Purpose dimension (under harmonization).

Another dimension that did not make it into the framework was "Domain,"[1] which included the categories of business, knowledge, and technology. This dimension, which captured the three cultures presented in the discussion of the research background (**Chapter Two**), was intended to push toward a focused analysis of the cultures that motivate the producers and users of standards. Yet as work progressed, those cultures seemed more the background for the whole framework, rather than a separate dimension. Using Domain as an

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[1]See Yesha Y. Sivan, "The Pandora's Box of Standards for Education," *Technos* 2, 2 (Summer 1993), 21.

analytic dimension produced interesting results, although these were related more to the emerging nature of the knowledge age than to standards.

Beyond "Form" and "Domain," several other candidate dimensions appeared in the literature. Apart from one in Verman's work, all of them found their way into the framework either as actual dimensions or as parts of dimensions.

Verman's "Subject" dimension[2] includes the categories of engineering, transport, housing/building, food, agriculture, forestry, textile, chemicals, commerce, science, and education. Verman considered this a partial list and said that further disciplines would need to be incorporated over time. The Subject dimension did not make it into my framework, because it seemed too specific to the working of NSBs, which are the focus of Verman's book. Further, because in the knowledge age the interdisciplinary links are as important as the disciplines themselves, there is no particular point in highlighting the disciplines the Subject dimension does.

Other than these three dimensions, several concepts did not find their way into the framework, such as quality, market, competition, monopoly, consensus, control, and voluntary. They might have provided the basis for a dimension tentatively called "Principles" (because all could be considered principles of standards), but, on reflection, most of these concepts could be included as parts of dimensions already in place (e.g., quality under the valuation category of Purpose, or monopoly under the unisponsored category of Sponsor). Without a potentially explicit logic for these tentative categories, the Principles dimension was not pursued.

11.2 Why These Names for the Categories?

After all sources were read and all considerations made, after the dimensions were settled came the final process of naming the categories. The process of name-smithing was really one of fine tuning, in which alternative considerations, arguments, and competing agendas were hammered into the specific names. To arrive at the names, several guidelines (presented below) were used, ranging from assuring the substantive soundness of a name to enhancing its esthetic appeal in relation to the rest of the framework.

The guidelines were used in naming the categories of all five dimensions. By design, they blur the difference between substantive and esthetic.

- As much as possible, prefer names from the sources, especially names cited repeatedly; a case in point is Verman's Levels (individual, organizational, associational,

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[2]Verman, 48-58.

national, and multinational), which, with only slight differences, appear in more than ten sources.

• Prefer general over specific names (i.e., organizational rather than industrial), to support use of the framework in diverse settings.

• Prefer names in their common meaning and do not invent new meanings for words; prefer to extend common meanings, rather than select esoteric meanings found only in the dictionary. (The word "harmonization," which is used to mean harmonization of national standards, was chosen to describe harmonization of any standards, in contrast to another possibility, the word "reconcilement," which has almost the same meaning.)

• When necessary, create new names; when there is a reason, use a lesser known word (e.g., harmonization) or invent a word (e.g., unisponsored).

• Prefer simple names. Give a high priority to the usefulness of the framework; thus, as a rule of thumb, the category names should be known words that any lay person can readily understand.

• Do not use the same name for two different categories, to prevent confusion; for example, the same word could have been used for the unknown Effect, the devoid Sponsor, and the missing Stage, all of which are in some senses similar.

• Do not use nonstandard categories; all categories should look the same. This led to selecting one word, rather than two words or a hyphenated expression (e.g., multinational rather than multi-national).

• Prefer names with different initial letters for categories in the same dimension. Although this guideline could not be satisfied for all dimensions, it helped produce interesting names.

• Strive for structural similarities (e.g., using the same prefix or suffix) in each dimension; similar categories contribute to the usefulness of the framework. For all dimensions suitable suffixes were found; thus, Level ends with "-al," Purpose with "-tion," Effect with "-tive" (except unknown), Sponsor with "-d," and Stage with "-ing."

In selecting the final names, substantive soundness of the category names preceded esthetic attributes. If a choice had to be made between two substantively sound words, the more esthetic one could be selected. All but one name satisfied both substantive and esthetic considerations (the exception being the less pleasing "unknown," as opposed to the more pleasing "none," which, however, terminates with an "e" and did not satisfy the logic criterion).

11.3 What Is Difficult About the Current Framework?

Although the most appropriate category names were selected to support the use of the framework, the names of some categories will undoubtedly cause problems, raise questions, or, worse, be misunderstood. This forecast is extrapolated from responses both to previous versions and to the current framework.

The Level dimension will probably present only minor difficulties, because it has a powerful intuitive and lucid logic. The individual and the associational categories may give rise to questions, which can be answered quickly by revisiting the definitions and examples.

The Purpose dimension and its categories are a different story. Of the five dimensions, this one may prove to be the most difficult. It lacks an ordinal logic. It includes unrelated categories, at least to the eyes of a typical novice observer. It uses a relatively new word (harmonization). And it includes the emotion-laden "valuation" category. These problems are likely to subside after several uses of the framework.

The Effect dimension is the least problematic one. Its symmetric structure provides a clear logic. There are only two potential problems: the distinction between the two mild and stronger categories (positive and constructive, negative and destructive) and the meaning of the unknown category. Both can be resolved by reading the definitions and examples.

The Sponsor dimension is expected to present a challenge. After Purpose, it seems the most problematic. The categories have no intuitive meaning: the use of "devoid" and "mandated" may not be clear in the context of standards, yet, paradoxically, may help users, who may find assigning new meanings to new words easier than assigning new meanings to previously known words. The three different prefixes ("non-," "uni-," and "multi-") to the same word ("-sponsored") may also be helpful.

Last, the Stage dimension should present only minimal problems, because its logic is obvious. The category names, particularly "existing" and "dying," may prompt questions, even objections, but novice users should otherwise have no difficulty relating to this dimension.

One potential problem for all the dimensions is the boundaries between categories. This is especially true when several categories may be applicable. For the sake of generating insights, clear distinctions between categories are not needed; indeed, some fuzziness may encourage creative use of the framework.

Despite these potential problems, the logic and esthetics of the dimensions should make them easy to understand and, therefore, easy to use.

Chapter Twelve

On the Framework in General

In the spirit of the previous chapter, this chapter expands on judging the value of the framework, improving the framework, and related insights gained during this work.

12.1 Judging the Value of the Framework

The rationale for the framework for standards was developed in terms of logic, precedents in the literature, and the ability to generate general as well as educational insights. Put another way, how can one tell whether a framework is "right?" What would validate it? A framework is not a theory. It does not directly advance claims that can be tested, such as "smoking causes cancer" or "gravitational fields deflect light." Instead, a framework is a classification system, its soundness not a matter of truth (because it makes no claims) but of organizational usefulness—how completely and clearly does it classify? The Periodic Table of Elements, for instance, is neither true nor false (although individual atomic weights of particular elements may be true or false) but, rather, complete, clear, and illuminating.

Chapter by chapter, I have tried to make the case for this rationale. Here, standing back from the enterprise, I want to argue that the long-term soundness of the framework depends on a demonstrably good track record delivering insights. Whether the framework "delivers" in this sense can be found through an experiment that addresses not truth (because, again, the framework does not claim truth) but the usefulness of the framework. Although such research is beyond the scope of this work, imagining such a study is a useful mental experiment.

A conceptual experiment—a skeleton structure here, not a fully designed experiment—if conducted properly, might reveal how the framework should be judged.

12.1.1 Conceptual Three-Phase Experiment for Proving the Value of the Framework

Phase 1: In this phase of the experiment, two groups of ten people (the "subjects") watch a thirty-minute video called "Introduction to Standards." The first, or "framework," group, is also exposed to a five-minute video that presents the framework. The second, or "control," group, is not exposed to this video.

Phase 2: In this phase, the subjects in both groups are asked to "use what they have learned about standards" to deal with several tasks (e.g., analyzing settings, analyzing

standards, analyzing views, selecting standards, designing standards). They are also told they will be asked to report on "where, how, and how well they used the concept of standards."

Phase 3: In the last phase, after dealing with the tasks for a few hours, the subjects' responses are collected and analyzed by "blind" evaluators (who do not know the original grouping of the subjects). The evaluators are asked to assess the quality and effect of the video, on the basis of the subjects' reports about their use of the concept of standards.

12.1.2 Potential Results

If the "framework" group does better than the "control" group (as assessed by the blind evaluators who would examine the quality and effect of the video for each subject), then yes, the framework helped people to apply the concept of standards. This result would not mean that this is the ultimate framework; it would mean simply that the current version had positive effects.

But if both the "framework" and "control" groups were to have the same result (again, as assessed by blind evaluators), then no, the framework did not help them to apply the concepts of standards. On the assumption that there were no flaws in the experiment, the particular framework did not work, but this result would not mean that other frameworks would not work.

To turn this conceptual experiment into a real one would require careful consideration of the different parameters (e.g., number of subjects per group, length of video, number and kinds of tasks, length of time spent performing the tasks, and the training method of the blind evaluators). If conducted correctly, the experiment would gauge the value of the framework.

In conclusion, the mere fact that an experiment to test the framework can be suggested means that this is indeed a "scientific" framework, that, in theory, the value of the framework can be gauged *empirically*. The experiment is a reminder that the value of the framework is its real-world ability to generate insights about issues.

Last, the three phases of the conceptual experiment can be carried out by those who wish to try the framework themselves. They can study the framework, apply it to several tasks, then reflect on its usefulness and value.

Can the framework be used in its current form? Probably yes. Although it may call for some experimentation, it is possible to use the framework in various ways for various settings. The interested reader may reexamine how, in the exploration sections in each chapter, the framework has been used: (*i*) to analyze a setting that involves standards, (*ii*) to

analyze a particular standard, (*iii*) to analyze a view, (*iv*) to select a standard, and (*v*) to design a standard. These uses may hint at the general generative power of the framework.

The framework can be used by both novice and expert thinkers about standards. Novice thinkers can use the dimensions as an analytic checklist, in which the categories of each dimension prompt analytic questions about the particular issue. Expert thinkers, more familiar with standards and, thus, with the spirit of the dimensions, will probably use the analytic matrices, where two or three dimensions are highlight an issue.

12.2 Improving the Framework

Unfortunately, the current framework has one major flaw, a flaw so big it may hamper the long-term usefulness of the framework. As it currently stands, the framework, which I alone developed, lacks an established Sponsor, one that could worry about its long-term survival and prosperity, update it as needed, and maintain its integrity. Such a Sponsor would probably test the framework more extensively than a single person can and build on it in various ways for the benefit of all users and producers of standards.

As with any other standard, before people can use the framework, they need to trust it. They need to count on the Sponsor of the standard to be reliable a few years down the road. A Unisponsored standard is inherently weaker than a Multisponsored one, because users do not trust it. Lack of trust discourages adoption, which, in turn, could bring the standard into the Stages of decline and, ultimately, dying. Seeking reliable institutional sponsorship is far beyond the scope of the initial development of the framework. Potential sponsors may include national bodies, such as ANSI, or, preferably, international bodies, such as the ISO. For long-term survival and prosperity, *the framework needs an institutional Sponsor*.

Beyond the need for a Sponsor, is this the best framework? Absolutely not. Although it represents the results of a fair, even exhaustive, effort, there is always room for improvement. The framework must be improved to support the evolving uses and circumstances of the knowledge age.

Several places have already been identified where fine tuning of the names of categories might contribute to the use of the framework. Fine tuning might also involve changing the order of the categories and expanding their definitions. A more substantive improvement may be needed when new dimensions become more salient (e.g., the Domain dimension, which did not make it into the current framework, might become important with further entry into the knowledge age).

Further models of use could be developed that might examine uses of the framework in different fields and different languages. A typical model use can follow the exploratory

sections presented in the preceding chapters. Single dimensions can be used as analytic checklists, and two or three dimensions can be used as analytic matrices to analyze settings, standards, views, and select or even design standards.

Another potential aid that could enhance the usefulness of the framework would be a model, called "the dimensions and other concepts," that might even take the form of a poster on which the five dimensions would be linked to other concepts related to the field of standards (e.g., monopoly, competition, consensus, voluntary, anticipatory, among others). This model might be especially useful to the standards community.

In summary, the framework should evolve to accommodate changing needs, diverse settings and users, and related concepts. Thus, in more general terms, *the framework needs to be updated constantly*. But a caveat about updates:

- All updates must maintain the flexibility of the framework in order to accommodate future changes; a particular virtue of the current framework, which stems from the independence of the dimensions, is its ability accommodate change. Because the dimensions are not directly related to one another, dimensions can be added, modified, even deleted without endangering the integrity of the entire framework. This "independence that allows flexibility" should be guarded.

- Even more important, updates should be grouped and not cause frequent changes. Because users need time to assimilate the changes, constant and frequent changes might harm the framework's most important role, which is to facilitate dialogue about standards by creating a common vocabulary. If the language is not stable, people will not be able to use it. Thus, *the framework needs to be both flexible and stable.*

12.3 Complementary Insights Beyond the Framework

In the course of mapping the general land of standards, beyond the general framework of standards, other insights were gained, some mentioned earlier in passing. Five insights are worth noting here:

(i) There is a lack of general frameworks for standards.

Reexamining the use of the sources, the lack of any that attempt to talk about standards in general was striking. Aside from Verman's book, *Standardization: A New Discipline*, and the OTA report, *Global Standards*, all other sources took a more focused and limited look at standards. Most analyzed and compared a few cases, and some analyzed what may be called one or two dimensions. This finding largely confirms what was described in **Chapter One** as "omnipresence."

(ii) In the knowledge age, as opposed to the industrial age, standards will play a greater role.

Understanding standards requires understanding their roles in the industrial age as well as their potential roles in the knowledge age. This understanding can come from examining the culture and sphere images presented in sections **2.2** and **2.3**. Although simplistic, the shift from the industrial age cultures of business and technology which operate in a sphere of standards to the knowledge age cultures of business, technology, and knowledge which operate in a bigger sphere of standards serves as a reminder of the growing roles of standards in the knowledge age.

(iii) The framework's lack of exclusiveness may look like a bug but is a feature.

An examination of the framework reveals that the five dimensions can be related to other concepts besides standards. For example, the dimensions of the framework could be dimensions of "cultures," of "forces," of "computers," of almost any other sufficiently large concept. Only small, concrete objects cannot use the dimensions (e.g., lamps, pens). I tried to apply the dimensions as dimensions of forces and of cultures and so on, and the results of this limited application revealed that while the dimensions seemed to work well when the concept was close to standards (i.e., force, quality), they did not work as well when the concept was further from standards (i.e., computers, markets). Thus, in spite of appearing to be a bug, the lack of exclusiveness of the framework is really a feature that reflects the framework's generality. The framework was, after all, designed to be used across many settings. Still, this potential flaw may require additional, more specific standards-based terminology.

(iv) Aside from standards themselves, producing them has important benefits.

On two occasions here—the meetings to discuss standards for children's toys (**Chapter Eight**, note 3) and the informal meetings of the seven car dealers in Newton, Massachusetts (see section **10.2.1**)—I alluded to the added value of the process of producing standards. Arriving at standards creates informal opportunities to discuss, understand, and partner with interested parties. The need to arrive at specific ways to phrase, measure, and define the standards forces those with different mindsets to communicate and bridge their differences. These side benefits, which were not explicitly part of the framework, may be incorporated into future versions.

(v) Producing standards demands skilled producers.

Good standards may serve as critical leverage points for solving greater problems, but arriving at the right standards at the right time and at the right place is far from trivial. To produce a standard in a particular field requires, beyond extensive knowledge of the field, the

ability to lead and follow, negotiate internal and external competing agendas, balance present and future needs, and, perhaps the most challenging aspect of standards production, the ability to juggle the skills of abstraction as well as simplification.

Chapter Thirteen

The Framework in Education

This work has shown how general standards (*i*) can be produced and used by entities from different Levels, (*ii*) can have one or more Purposes, (*iii*) can cause diverse Effects, (*iv*) can be developed by different Sponsors, and (*v*) can be in different Stages. This final chapter returns to the original quest—to understand the concept of standards in education. It attempts to show how the general framework with its dimensions can assist in dealing with some of the challenges to education.

Table 13-1

Summary of the Five Dimensions

Dimension 1: Level	Dimension 2: Purpose	Dimension 3: Effect	Dimension 4: Sponsor	Dimension 5: Stage
Individual	Simplification	Constructive	Devoid	Missing
Organizational	Communication	Positive	Nonsponsored	Emerging
Associational	Harmonization	Unknown	Unisponsored	Existing
National	Protection	Negative	Multisponsored	Declining
Multinational	Valuation	Destructive	Mandated	Dying

13.1 The General Framework Applied to Education

Can the framework be used in education? This question has already been partly answered in the five exploration sections, where parts of the framework were used to explore various educational issues—the K-12 setting, the NCTM mathematics standard, Owen's view of ETS, the context of technology for education, and the design of standards for the Balanced Assessment in mathematics research project—demonstrate the variety of areas in which such a framework of standards could be used.

The exploration sections demonstrated at least five kinds of uses of the framework—to analyze a setting, to analyze a standard, to analyze a view, to select a standard, and to design a standard—that are relevant to many educational endeavors.

The framework can explain the educational barriers presented in the introduction ("standards in education are loved and hated at the same time and used in a limited sense"). It seems that in education, standards are over-used and under-used at the same time: over-used when valuation standards are advocated as a remedy for every educational problem (e.g., more standardized tests, more standards for teachers, more standards for districts) and under-used when the other Purposes (simplification, communication, harmonization, and protection) are ignored. The language of "over-used and under-used" is a different representation from what is here called the "squeaky wheel that gets the grease." Certain kinds of standards (valuation) that evoke intense emotions get all the attention and leave no room for other kinds of standards (the other four Purposes).

13.2 The Five Dimensions in Education

In more general terms, the framework presents the concept of standards in a much broader perspective. Different interested parties, practitioners, and researchers can now communicate more clearly about the use and production of standards. The following are some of what the framework of standards may do for education:

- The framework may highlight the range of *Levels* at which standards can operate and the interaction among standards at different Levels, for example, the interaction among a districtwide twelfth-grade English competency standard, a state curricular standard, and a national test.

- The framework may highlight the diverse *Purposes* of standards, for example, compare the Purpose "to ensure the highest level of achievements in math in the world" with a potentially complementary Purpose "to ensure certain levels of achievements in math for all." In more general terms, the framework can allow the proponents of one Purpose to recognize the Purposes advocated by others.

- The framework may highlight the range of positive and negative *Effects* standards have, in both the short and long term. For example, demanding certain educational outputs in one subject matter may raise the results in one year but deplete the system's resources for dealing with other subject matters in later years.

- The framework may highlight the different *Sponsors* of standards and their respective strong and weak attributes. For example, the consensus method used for multisponsored standards, which is the preferred method in many sectors, is seldom used in education. Possible reasons for this situation might be a lack of resources for dealing with the long and difficult task of using the consensus method or reliance on mandated standards.

• Perhaps most important, the framework may highlight the different *Stages* in the life of standards. The perception that all standards begin somewhere may encourage educators to participate early on in the making of standards, when they can still mold and influence their design. Even more critical, a framework of standards may expose stubborn standards, relics from the past that refuse to go away and can prevent needed innovation.

13.3 Taming the Forces of Educational Standards

Ultimately, the value of this work lies in exposing the potential impact of standards. Further research is necessary to examine the applicability of the framework to education, but, beyond research, once educators fully appreciate the current roles of standards and, even more, their potential roles in the knowledge age, they will start to act in coordinated ways to use standards better and even to produce them.

That in many situations standards play a critical role, both positive and negative, is not in question. What is in question is how, when, and where education can use this general concept of standards. According to Alvin Toffler, those who invest in standards will "win immense, high-quality power in the fast-arriving world of tomorrow."[1] In contrast, those who ignore the forces of standards will ultimately reach their own demise, as others impose standards on them.

The challenge of this work is to offer a practical framework for clarifying the fuzzy, emotion-laden forces of standards and thus address the concept's multiple, often contradictory, meanings and nuances of meanings. If I am right, taming the forces of standards will assist educators in their efforts to improve our future.

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[1] *Powershift*, 140.

Appendix

Grouping the Sources

1. General Standards

These sources usually were written by practitioners or researchers in the disciplines of economics or engineering. Many newer sources (from 1990 on) discuss the changing nature of standards, especially in relation to information technology.

Group 1.1 Edited Collections of Chapter-long Essays on a Single Theme

Steven M. Spivak and Keith A. Winsell, eds., *A Sourcebook of Standards Information: Education, Access and Development* (Boston: G.K. Hall, 1991). (Includes an annotated bibliography for general standards in North America).

T. R. B. Sanders, ed., *The Aims and Principles of Standardization* (Geneva: ISO, 1972).

Robert B. Toth, ed., *Standards Management: A Handbook for Profits* (N.Y.: ANSI, 1990).

Group 1.2 Policy Reports That Look at Standards and Advocate Particular Conclusions

International Standards Organization, *A Vision for the Future: Standards Needs for Emerging Technologies* (Geneva, Switzerland: ISO, 1990).

U.S. Congress, Office of Technology Assessment, *Global Standards: Building Blocks for the Future* (Washington, D.C.: OTA, 1992).

Robert Galloway Dixon, *Standards Development in the Private Sector: Thoughts on Interest Representation and Procedural Fairness: A Report to the National Fire Protection Association* (Boston: NFPA, 1978).

Group 1.3 Reflective Sources Offering a Long-Term Approach to the Field

Lal Chand Verman, *Standardization: A New Discipline* (Hamden, Conn.: Archon, 1973).

Albert L. Batik, *The Engineering Standards: A Most Useful Tool* (Ashland, Ohio: Book Master/El Rancho, 1992).

Ross E. Cheit, *Setting Safety Standards: Regulation in the Public and Private Sectors* (Berkeley: University of California Press, 1990).

Carl F. Cargill, *Information Technology Standardization Theory, Process, and Organizations* (Bedford, Mass.: Digital Press, 1989).

David Hemenway, *Industrywide Voluntary Product Standards* (Cambridge, Mass.: Ballinger Publishing, 1975).

Group 1.4 Case Studies Describing Various Aspects of Standardization in Particular Settings

Martin C. Libicki, *Information Technology Standards: Quest for the Common Byte* (Newton, Mass.: Butterworth-Heinemann, 1995).

H. Landis Gabel, *Competitive Strategies for Produce Standards: The Strategic Use of Compatibility Standards for Competitive Advantage* (Maidenhead, Berk., Eng., U.K.: McGraw-Hill, 1991).

William Lehr, Voluntary Standards, Multiple Markets, Standards Institutions, and Industry Structure (N.Y.: Columbia University School of Business, 1993 [unpublished]). By permission of the author.

H. W. Singer, *Standardized Accountancy in Germany* (1943) (N.Y.: Garland, 1982 [reprinted]).

Anthony Rutkowski and Richard J. Solomon, Standards Making for IT: Old vs. New Models, a paper presented at the Conference on Economic Dimension of Standards Users and Government in IT Standardization, Tokyo, 18 Nov. 1992. Reprinted from an electronic copy received from R. J. Solomon, 18 Nov. 1992.

2. Educational Sources

Sources in the first five groups were used mainly as background against which to explore the use of the framework in education. Those in the sixth group influenced the development of the framework much more directly.

Group 2.1 Vision Standards

"Brief and general" aspirations, vision standards are related to broad mission statements and emphasize long-term, overarching direction. The *America 2000* education standards offer the best known example.

George Bush, *America 2000: An Education Strategy* (Washington, D.C.: U.S. Department of Education, 1991).

Group 2.2 Content Standards

Content standards, which "set out the knowledge, skills," are related to such efforts as the widely known National Council of Teachers of Mathematics standards and many other curriculum standardization efforts, including standards for science and for jobs of the future:

National Council of Teachers of Mathematics, Commission on Standards for School Mathematics, *Curriculum and Evaluation Standards for School Mathematics* (Reston, Va.: NCTM, 1989).

National Research Council, U.S. National Committee on Science Education Standards and Assessment, *National Science Education Standards: An Enhanced Sampler.* (Washington, D.C.: NRC, 1993).

U.S. Dept. of Labor, Secretary's Commission on Achieving Necessary Skills (SCANS) *Skills and Tasks for Jobs: A SCANS Report for America 2000* (Washington, D.C.: U.S. Dept. of Labor, 1992).

Group 2.3 Student Performance Standards

Student performance standards "establish the degree or quality of student performance" are related to student testing and evaluation.

Fred M. Newman and Gary G. Wehlage, "Five Standards of Authentic Instruction," *Educational Leadership* (April 1993), 10-12.

Group 2.4 School Delivery Standards

School delivery standards "enable educators [and others] to assess schools." These standards list the input, process, and output parameters of schools, including standards for the teaching profession and delivery standards for schools.

James A. Kelly, National Board for Professional Teaching Standards, *Toward High and Rigorous Standards for the Teaching Profession: Initial Policies and Perspectives of the National Board for Professional Teaching Standards* (Detroit: NBPTS, 1989).

Mary Hatwood Futrell, "Standards for the Teaching Profession: A Call for Collaborative Action," *Peabody Journal of Education* **65**, 3 (1988), 4-11.

Robert Rothman, "'Delivery' Standards for Schools at Heart of New Policy Debate," *Education Week* (7 April 1993), 21-22.

Group 2.5 System Delivery Standards

The same as school delivery standards, but for local, state, or national systems:

Harold Howe and Margaret Vickers, "Standards and Diversity Down Under," [Australia] *Education Week* (14 July 1993), 36.

William E. Schmidt, "Britain Flunks a Test of Its National Curriculum," *New York Times* (1 Aug. 1993), 17-18.

Group 2.6 Reflective and Miscellaneous Sources

Special attention was given to sources about nontraditional educational uses of standards, as well as reflective works about the topic, in particular, educational evaluation standards:

Ridings (Nowakowski), Jeri, Standard Setting in Accounting and Auditing: Considerations for Educational Evaluation (Kalamazoo: Western Michigan University, 1980). [Unpublished dissertation].

Joint Committee on Standards for Educational Evaluation, *Standards for Evaluations of Educational Programs, Projects, and Materials* (N.Y.: McGraw-Hill, 1981).

3. Terminology

A monumental effort, although with no apparent long-term impact, was published as a lengthy handbook of standard terminology; part of a multivolume effort to define a taxonomy for education, this work defines hundreds of terms related to educational technology.

Ivan N. Seibert, *A Handbook of Standard Terminology and a Guide for Recording and Reporting Information About Educational Technology* (Washington, D.C.: National Center for Education Statistics, 1975).

4. Professionalism

The International Society for Technology in Education (ISTE) developed a set of guidelines for colleges of educational computing and technology that were seeking certification from the National Council for Accreditation of Teacher Education (NCATE). These standards had a positive impact on such diverse issues as teacher preparation and funding opportunities.

Lajeane G. Thomas, Harriet G. Taylor, and Donald G. Knezek, "National Accreditation Standards Impact Teacher Preparation," *T.H.E. Journal* **20**, 11 (1993), 62-64.

5. Educational Technology

Several authors wrote about the potential roles of standards:

Dexter J. Fletcher, *Courseware Portability* (Alexandria, Va.: Institute for Defense Analysis (IDA) Paper P-2647, 1992).

Richard Brandt, "Video Games: Is All That Gore Really Child's Play? Violent Games Spark Debate over Ratings," *Business Week* (14 June 1993), 38.

Raines Cohen, "Apple Sets Standard for Education Events, Apple's Education Apple Event Communications Specification," *MacWeeK*, 6, 8 (24 Feb. 1992), 5 [brief article].

Last, LeRoy Walser has documented the similarities and differences between developing standards in the education and in the private sector. Walser's seminal work and Walser himself had a strong influence on the early stages of the present work.

Leroy F. Walser, Similarities and Differences in Procedures for Developing and Approving Voluntary Standards in Selected Organizations in Education and the Private Sector (Dissertation [unpublished], Dept. of Educational Leadership, Brigham Young University, Provo, Utah, 1989).

Acronyms

ANSI	American National Standards Institute
ASCII	American National Standard of Code for Information Interchange
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BA	balanced assessment
CD	compact disk
CEN	Comité Européen de Normalization
CNN	Cable News Network
CPSC	Consumer Product Safety Commission
DIN	Deutches Institut für Normung
EPA	Environmental Protection Agency
ETS	Educational Testing Service
EU	European Union
GMAT	Graduate Management Admission Test
GRE	Graduate Record Examination
GUI	graphical user interface
HOLLIS	Harvard [University] On-Line Library Information System
IEC	International Electrotechnical Commission
IETF	Internet Engineering Task Force
ISO	International Standards Organization
ISTE	International Society for Technology in Education
ITU	International Telecommunication Union
LSAT	Law School Admission Test
MS-DOS	Microsoft Disk Operating System
NCATE	National Council for Accreditation of Teacher Education
NCEST	National Council on Education Standards and Testing
NCTM	National Council of Teachers of Mathematics
NEA	National Education Association
NIST	National Institute for Standards and Technology
NSBs	national standards bodies
NSF	National Science Foundation
OSHA	Occupational Safety and Health Administration
OSI	Open Systems Interconnection
OTA	Office of Technology Assessment

PC	personal computer
PIN	personal identification number
SAT	Scholastic Aptitude Test
SCSI	Small Computer Systems Interface
TQM	Total Quality Management
UA-TD	universal antitheft device

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