Cultural Studies of Science Education 5

Julie A. Bianchini
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Angela Calabrese Barton
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Alberto J. Rodriguez *Editors*

Moving the Equity Agenda Forward

Equity Research, Practice, and Policy in Science Education

Springer

Moving the Equity Agenda Forward

Cultural Studies of Science Education

Volume 5

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Introduction to Volume

Julie A. Bianchini

Moving the Equity Agenda Forward presents current equity-related research, practice, and policy in science education and points to directions needed for future work. Its purpose is to inform critical discussion and transformative action to push us closer to the goal of a science education for all students: to help refine our methods for investigating equity; to deepen and broaden our understanding of the processes of science teaching and learning; to better address persistent inequities across science classrooms, schools, and policies; and to craft new initiatives to engage and instruct all students in science. This volume is not a review of literature.

Moving the Equity Agenda Forward is officially endorsed by NARST. Indeed, this volume grew out of the efforts of an ad hoc committee constituted by the NARST Equity and Ethics Committee in 2007. The ad hoc committee was charged with examining the strengths and weaknesses of existing equity-related scholarship in science education. Through conversations, surveys, and self-reflection, members of this committee identified five key areas of research that have defined and must continue to shape the field: science education policy; globalization; *context and culture*; discourse, language, and identity; and leadership and social networking.

In the now completed volume, scholars' work is organized into these five key areas of research identified by the NARST ad hoc committee. Cutting across these five sections, or parts, are core questions regarding race, class, language, gender, and other socializing categories, as well as issues of power and positioning. These parts are introduced below.

Science Education Policy. Authors critically examine both past and current policies in science education and discuss how they support or constrain efforts to achieve equity.

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Globalization. Authors explore how students, teachers, and researchers can use the knowledge and practices of both local and global communities to teach and learn science in K-12 schools.

Context and Culture. Authors underscore the importance of attending to and better understanding the fluidic nature of context, culture, and/or place to promote science for all in classrooms.

Discourse, Language, and Identity. Authors investigate diverse ways teachers and students' discourses, languages, and/or identities shape the teaching and learning of science.

Leadership and Social Networking. Authors discuss how science education researchers can better support teachers, colleagues, and organizations in pursuing equity and diversity goals.

Each part includes an introduction and three to four chapters written by emerging to well-established science education researchers in the USA. In the introduction, the lead editor identifies crosscutting themes and raises questions for readers to consider. To promote coherence across chapters, authors include how their work speaks to two sets of questions: (1) What do the theoretical and methodological lenses used in this scholarship enable? What do they constrain? (2) In what ways can ideas in this chapter be used to inform research, practice, and policy? More specifically, what is the "so what" for graduate students and new scholars intending to conduct research on equity and diversity? What are the implications of this research for classroom teachers and for policymakers? To strengthen the quality of the chapters presented here, editors and authors engaged in a thoughtful review of each other's work, providing suggestions and offering insights on successive drafts.

Because editors and chapter authors work in the USA, to increase the breadth of perspectives included in this volume, we invited scholars from other countries to craft responses to each of the five parts. These five international respondents represent diverse geo/political locations and kinds of spaces/places, as well as both genders and different races/ethnicities. They include those who conduct equity-based research and those who are not equity researchers per se but whose work speaks to equity in education. Each international respondent addresses the following two questions in his or her discussion of chapters: (1) In your view, how do these chapters speak to scholars and school contexts in your country, in particular, or in countries outside the USA, more generally? (2) What issues, theoretical frames, and/or methods could add to the arguments presented in these chapters? We recognize that our effort to include international voices in this volume is only partial. Our five international respondents speak to studies conducted in the USA, rather than present their own research. Further, our international respondents do not represent all areas of the globe: There is no international respondent, for example, from the continent of Africa.

The epilogue to our volume attempts to hold true to our title – to discuss ways the research presented here can indeed help move the field of science education forward. We remind readers that our purpose in creating this volume was to provide more than a forum for current scholarship on equity and diversity in science education.

We intended to encourage researchers to re/consider tensions and questions in current equity-related work and to prompt them to conduct additional, innovative research in needed areas – to suggest ways researchers might collectively build from existing good ideas about teaching, learning, and schooling and construct new theories and approaches necessary to advance the field.

We argue that this volume provides one example of the kind of purposeful and scholarly collaboration we advocate. Each of the editors of this volume has chaired the NARST Equity and Ethics Committee. Each contributed in unique and important ways to shaping the volume's purpose and substance. Through our invitations to and discussions with chapter authors and international respondents, we have produced a volume that represents a tapestry of rich insights and diverse positions. We wish to acknowledge the hard work of our chapter authors and international respondents. We also thank our copy editors, Jane Sinagub and Amanda Stansell, for their insightful questions and attention to detail.

We close by emphasizing to readers that there is still much equity-related work to be done. While this volume takes an important step in informing conversations and actions to move the equity agenda in science education forward, it does so with obvious limitations others can and must address. For example, this volume does not include all voices of US and international science education researchers that should be heard. It also does not carefully examine all equity-related topics in need of attention: Briefly touched on or entirely missing from this volume is discussion of First Nations students, children of migrant workers, and students with disabilities. In reading, responding to and pushing beyond the ideas outlined in this volume, we hope the science education community can indeed fulfill NARST's mission, reflected in its tagline, to improve science teaching and learning through research.

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Part I
Introduction: Science Education Policy

Okhee Lee (Lead Editor) and Julie A. Bianchini (Co-editor)

Education policies for science education play roles that are distinctly different from the policies for language arts and mathematics primarily because science has not traditionally been regarded as a "basic skill" unlike literacy and numeracy. Yet the profile of science education has recently been raised by the inclusion of science in the No Child Left Behind (NCLB) Act which began in 2007. The current attention on science education has been reinforced by economic realities pointing to the need for increased knowledge of science and technology. It is historically unprecedented that science is required for assessment systems in all states and is part of accountability measures in many states. Such policy change forces states, districts, and schools to allocate additional resources to science education. This presents significant challenges to under-resourced school systems as they consider how to divert a portion of already limited funding and resources to science education while maintaining funding for developing basic literacy and numeracy.

The three chapters of the *Science Education Policy* part address policies for science education reforms as these policies relate to equity issues with nonmainstream students. The chapters collectively offer historical accounts of equity policies in science education reforms. George DeBoer describes the history of equity policies starting in the late nineteenth century until today. Then Sherry Southerland delves into recent equity policies, in other words, the test-based accountability of NCLB. Finally, Nancy Brickhouse presents the emerging policies of the Obama administration, specifically Race-to-the-Top funds and the Next Generation Science Standards.

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The authors couch equity issues from theoretical and conceptual lenses. DeBoer explains evolving conceptions of "science for all" before and after the civil rights movement of the 1960s. There was rare mention of race, class, or gender in discussions of equity policies before 1960, whereas it becomes a dominant theme thereafter. Before 1960, the discussions centered around the appropriate science for future science experts, on the one hand, and science for citizenship, on the other hand. After 1960, the discussions tended toward the rights of underrepresented and underserved groups. Southerland explains the impact of NCLB on science teaching and learning of nonmainstream students using Cuban's (1988) idea of first-order and second-order changes in education. Brickhouse explains conceptions of inequality embedded in Race-to-the-Top funds and the Next Generation Science Standards in terms of standards-based reform, market-based reform, and epistemological and cultural issues.

The authors discuss how equity policies in science education reforms evolve against the backdrop of major social events in national and international contexts. Throughout different periods of science education reforms, equity policies have been linked to national economic interest, military power, common culture, affirmative action, and/or moral imperative. These varying agendas coexist while often competing against one another. DeBoer suggests that a focus on equity as moral imperative would lead to more persistent efforts to achieve equity and more consistent and effective policies and outcomes.

The authors agree on what equity policies in science education reforms should entail. They highlight that establishing rigorous standards is the foundation that must be in place to reduce the variability in the quality of the enacted curriculum, instruction, and assessment, as stated by Brickhouse. Yet they express concerns about whether adequate resources and opportunities are provided to implement equity policies in the classroom. They also express concerns about whether student diversity in terms of language, culture, race, class, gender, and exceptionality is recognized and valued in diverse local contexts. Policies without adequate resources and opportunities are only empty words. Furthermore, resources without consideration of nonmainstream students' home language and culture could result in assimilation to the mainstream at the cost of losing students' cultural and linguistic identities.

The authors highlight both the potential and the danger in the outcomes of equity policies for science education reforms with nonmainstream students. Southerland questions why achievement gaps for nonmainstream students remain, even though NCLB is intended as equity policies. DeBoer expresses that the continued and steadfast support for an equity agenda among policymakers gives us reason to be optimistic, yet the failure to fully realize our goals demonstrates that we cannot be satisfied with talk alone. Brickhouse advocates that science education researchers should give more consideration to shaping a research agenda so that the research is read and valued by those who shape actual education policies and practices.

The authors also highlight both the promises and the trepidations of science education researchers to be engaged in research on equity policies for science education reforms. DeBoer warns that educators often tend to be "ahistorical, choosing to operate in the moment, as if every idea is new." Then he argues that "an understanding of history is an important way to broaden one's perspective in all areas of scholarship and policymaking." Southerland claims that "the next generation of researchers in science education, particularly those interested in issues of equity and diversity, should take great care to describe how the current misaligned environment of accountability 'bears down on even the best teachers' to make reform-minded practice a near impossibility and actively share these descriptions in a compelling manner in an effort to inform policy." Brickhouse points out that there are "tremendous opportunities for young scholars to build on the scholarship in this volume, yet to also design research that speaks to policymakers who are currently influenced by ideas of systemic and market-based reform."

Finally, Mei-Hung Chiu, the international respondent, provides thoughtful comments on the three chapters. After discussing major trends of the policies on equity in US science education, she offers her views on these policies from an international perspective, particularly from her vintage point of a science educator from an Asian country. She warns US science educators of the danger of standardized curriculum guidelines and high-stakes examinations that dominate the education systems in Asian countries/regions. She advises US science educators to "avoid the paradoxical situation faced by Asian countries/regions where there is a tradeoff between students' high performance and their low motivation in learning science."

The three chapters of the policy part along with the commentary remind us that science education research and practice occur in the context of education policies that, in return, reflect major social events within the USA, internationally, and from historical perspectives. Across all three chapters, there are underlying currents of hopes and concerns about how science education researchers position themselves in either shaping or reacting to emerging policies related to nonmainstream students. Readers should be grateful to these authors for allowing us opportunities to think deeply and critically about such issues in our own work.

Reference

Cuban, L. (1988). A fundamental puzzle of school reform. *Phi Delta Kappan, 69*(5), 341–344.

Chapter 1
Science for All: Historical Perspectives on Policy for Science Education Reform

George E. DeBoer

Introduction

This chapter explores the historical commitment of the USA to provide all citizens with the knowledge of science and technology needed to participate fully in society and to pursue careers that contribute to a further understanding of the physical world and to the society's economic progress. The chapter reviews the period from the late nineteenth century until today, a period of massively expanding scientific discovery and technological development, during which time social institutions made a commitment to extend opportunity to all citizens, at least in the policy documents they produced if not always in practice.

I discuss the challenges that present themselves to the educational system of a society that is ambitious in its desire to continuously improve its economic well-being through the development of exceptional talent, even as it tries to educate a public that is knowledgeable about what scientists and engineers do, sympathetic to their efforts, yet critical enough to make wise decisions regarding investments in science and technology. In addition, this is a society that values democratic principles of fairness. From its earliest days, US society has rejected hereditary privilege void of merit. But it has had difficulty finding the proper balance between the extremes of a leveling egalitarianism and the disparities that result from a highly competitive meritocracy. A meritocracy inevitably leads to differences in accomplishment. Is it enough that all persons have opportunities to succeed, or is equality of outcome expected as well? Do vastly disparate outcomes, especially when linked to gender, race, ethnicity, or social class, signal that these unequal outcomes would

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not be likely to occur by chance alone and, therefore, suggest some degree of systemic unfairness that exists in the society?

This chapter is organized in two parts: The first part discusses the concept of "science for all" prior to about 1960 and the beginning of the civil rights movement, and the second part discusses what "science for all" has meant since that time. The division into these two time periods is useful because prior to the 1960s, there was rare mention of race, class, or gender in discussions of science education equity policy, whereas after 1960 it has become a dominant theme. Before 1960, the discussions around fairness and equity centered around the appropriate science for future science experts on the one hand and science for citizenship on the other. After 1960, the discussions tended toward the rights of underrepresented and underserved groups, sometimes linked to the moral failure of the society to provide those groups with the same opportunities as others, but more often linked to economic arguments about the failure to locate exceptional talent within those underrepresented groups and the need to maximize national economic potential.

Science for All Before 1960

During the first half of the twentieth century, "science for all" meant science not only for the bright, socially elite, and college bound, but for all students regardless of their ambitions, talents, or probable life work. As early as 1892, when the Committee of Ten of the National Education Association (NEA) met to discuss the nature of the school curriculum and its relationship to college admission, the point was made that the study of science should not be treated as an elitist activity but as something that all students should be able to profit from (NEA 1894). Of course, the idea of "for all" meant something very different then than it does today, given that only 6.7% of the 14–17-year-old age group attended high school in the USA in 1890. That number soon rose sharply, though, and by 1920, 32.3% of the age group was attending high school (National Center for Education Statistics 1981, p. 49).

Unlike classical studies, which proponents of science in the curriculum said were fixed and dogmatic, science, it was argued, had a democratizing effect on those who studied it because it put the student in the position of asking questions, making observations, and reasoning about the world to draw independent conclusions unconstrained by the voice of authority. The courses that were proposed were meant to be appropriate preparation for life and for college, so there was no need to differentiate subject matter and teaching approaches for the college-bound and non-college-bound student. All who went to high school would learn about science so that they would be able to participate in a world in which scientific discovery and technological innovation were all around them. To be a fully aware and participating citizen in the late nineteenth century meant understanding science as a particular way of thinking about the world, having a basic understanding of the scientific discoveries and technological innovations that had been made, and having the skill to reason inductively from observation to conclusion.

Practical Studies and Vocational Education

By the early twentieth century, the idea that a theoretical study of science was appropriate for all students gave way to the idea that education should have practical value. The highly intellectual education that was proposed for science and other school subjects by the Committee of Ten came to be seen as inappropriate for an increasingly diverse population of individuals who expected schools to offer commercial and industrial arts courses along with the more traditional courses. Moreover, because of the rapid increase in the number of immigrants, a vocationally oriented education was seen by policymakers as a way to efficiently produce citizens who would fit well into American society. Efficiency included offering differentiated programs of study that were targeted to the students' probable life work. Thus, practical studies for non-college-bound students were used to attract more students to the public school system, for building a well-trained labor force that could contribute to the development of the society, and for teaching the youth the values of the society.

The NEA's Committee of Ten had made no mention of vocational studies in the 1890s, but by 1918 a practical and vocational focus so dominated education that the NEA's Commission on the Reorganization of Secondary Education (CRSE) recommended that the entire curriculum be reorganized along vocational lines to meet the demands of the great masses of people: "The work of the senior high school should be organized into differentiated curriculums. …The basis of differentiation should be, in the broad sense of the term, vocational" (NEA 1918, p. 22).

The CRSE did not, however, address how science would fit into a program differentiated by vocational interest. In fact, the science committees barely mentioned a differentiated science curriculum in their reports to the commission. Instead, the CRSE described how all science courses should be redesigned to make them more interesting, useful, and relevant to the everyday lives of students. If existing science courses focused primarily on future academic study, they should be modified to meet students' current needs and interests as well. The application of knowledge to the activities of life rather than as a logically organized discipline was seen as the best way to provide an education that had value for all. At least in science, if not in the other subject areas, differentiation of the curriculum for academic versus vocational studies was not a major thrust of the early twentieth century reformers. The trend was toward a practical approach to the study of science for all.

But some forces did act to separate academic and vocational education. The 1917 Vocational Education Act, also known as the Smith–Hughes Act, was specifically intended to promote vocational education in the public schools. The act separated vocational and academic study by limiting the amount of academic instruction that students in the vocational program received. In addition, the salaries of vocational teachers could be covered by the appropriation but not the salaries of academic teachers. Later versions of the act, the Carl D. Perkins Vocational and Applied Technology Act of 1984 (P.L. 98–524) and the Carl D. Perkins Act of 1998 (also known as Perkins III), eventually moved vocational education toward a greater integration of academic and vocational content.

The Comprehensive High School and Aptitude Testing as Democratizing Influences

The "comprehensive high school" was first proposed in the USA by the Commission on the Reorganization of Secondary Education in 1918 as a way to help democratize education. In contrast to the vocational education movement, which in its early form tended to separate academic study from vocational study, the comprehensive high school offered, under one roof, a broad range of academic and vocational programs for students with differing career goals. The comprehensive high school was meant to unify society by having all students, regardless of their academic or occupational goals, studying together and thereby developing mutual respect for each other. As late as 1959, James B. Conant, in his book *The American High School Today* (1959), praised the comprehensive high school that had become so popular during the first half of the twentieth century. Although criticized later for its policies of tracking and academic segregation (Angus and Mirel 1999), in Conant's time, the comprehensive high school was seen as a democratizing institution because it was thought to soften the distinctions between those planning to go to college and those entering the world of work.

Sorting students into the different tracks was often accomplished by means of standardized tests so that students most suited for each course of study could be identified on the basis of their ability. There were also efforts to use aptitude testing to place students in different levels for different subjects so that students would not be locked into a particular ability track. According to John Gardner, in such a system, "A pupil might be in the top group in one subject and not in another. Thus there is no over-all sorting out of youngsters into separate 'tracks' or programs or levels" (1961, p. 116).

Aptitude testing also enabled colleges to admit students on the basis of entrance exam scores rather than on the schools they graduated from or the social standing of their parents. Conant, as president of Harvard University from 1933 to 1953, introduced aptitude testing into the college's admissions process so that students could be selected more accurately on the basis of their intellectual promise. Whether in academia, industry, or civil service job selection, aptitude tests were being viewed by the society as the fairest and most democratic way to provide individuals with opportunities best matched to their abilities.

World War II and the Search for Science Talent

For most of the first half of the twentieth century, there was little, if any, pressure to use the sorting mechanisms in place in schools to increase the number of technically trained workers in the country, to improve the quality of the technical workforce, or to find ways to attract students to study science. World War II, however, created severe shortages of technical personnel, and these shortages came to be ever more closely linked to national security. As an indication of the drain of science talent during the war, there were 375,000 science majors enrolled in college in the 1940–1941 school year; by 1944–1945, that number was just 200,000. There were 41,000 college science faculty members in 1940–1941, but only 36,000 in 1945–1946 (President's Scientific Research Board 1947, Vol. 4). In response to the need for more technically trained personnel, President Truman created the Scientific Research Board in 1946 to study and report on the country's research and development activities and science training programs.

To assist in assessing the quality of science education at all levels, the Board asked the American Association for the Advancement of Science (AAAS) to conduct a study and issue a report on the effectiveness of science education in the schools. Their report, "The Present Effectiveness of Our Schools in the Training of Scientists," provided a balanced view of the importance of science education in society by emphasizing not only the training of future scientists, but also the importance of the public's understanding of science. The report discussed the need to encourage students with talent in mathematics and science to prepare for work in science fields, early identification of science talent through standardized testing of incoming college students, provision of scholarships to ensure that all talented students had a chance to attend college, and ways to improve the general education of the nonscience student.

General education for the nonscience student also received attention because of Conant's report, *General Education in a Free Society*: *Report of the Harvard Committee* (1945), which in science emphasized the importance of "basic concepts, the nature of the scientific enterprise, the historical development of the subject, its great literature, [and] its interrelationships with other areas of interest and activity" (pp. 220–221). The AAAS Cooperative Committee on the Teaching of Science and Mathematics went one step further and recommended that this integrated and conceptual approach to science teaching was appropriate not only for the nonscientist, but should be made part of the training of the science specialist as well (President's Scientific Research Board 1947, Vol. 4, p. 143), another example of efforts to bring the education of scientist and nonscientist together.

In the postwar years (1945–1955), tensions with the Soviet Union led to even greater concerns about national security and the need to use the schools to locate and train future scientists and engineers. But, throughout the war and postwar years, the country was not yet prepared to give wholesale preferential treatment to the gifted and talented or to create special courses for them as ways to increase the number of technical personnel. Even though some in the policy community supported the idea that special efforts were needed to attract science talent (Brandwein 1955; US Office of Education 1953), there were few suggestions that actually described what science courses would look like that would be more appropriate for the talented student. Most proposals were intended to encourage talented students to study the science courses that currently existed.

The Sputnik Challenge

National attitudes toward science education and the schools changed with the launch of the earth-orbiting satellite *Sputnik* by the Soviet Union in 1957. Suddenly, the technological challenge from abroad was no longer an abstract possibility but a reality, as was the apparent technological lead the Soviet Union had on the USA. US policymakers were quick to draw a connection between technological development and education, which complicated the debate about how to meet the security needs of the country and at the same time provide equitably for the education of all citizens. The National Defense Education Act (NDEA) was signed into law on September 2, 1958, to support the "fullest development of the mental resources and technical skills of its young men and women…" (NDEA 1958, p. 3). The act was an effort to increase the number of talented students who would go into science, mathematics, and foreign language careers.

The launch of *Sputnik* also gave new impetus to those who had been arguing that the US educational system was not challenging or rigorous enough, and it boosted interest in special programs for talented students. But, as before, these proposals were not without controversy. Gardner in his 1961 book *Excellence: Can We Be Equal and Excellent Too?* noted the ambivalence of policymakers and the US public toward special treatment of gifted students, in part because, as Gardner put it: "Children who are not gifted—and parents who do not have gifted children—are in the great majority" (p. 115).

It is not that there were no new programs for gifted students. In biology education, for example, the Gifted Student Committee of BSCS (Biological Sciences Curriculum Study) was created to examine the nature of giftedness and creativity in science and the environments that would foster creative work in the secondary school, prepare summaries of promising programs for the development of able students in biology, and develop a collection of research problems in biology for gifted students (Hurd 1961, p. 150). For the most part, though, the intent of the curriculum reforms in the post-*Sputnik* era was to raise the intellectual bar for *all* students, just as practical education was seen as valuable for all students earlier in the century. The issue at hand was "science and education for national defense" (Hurd 1961, p. 108), and the best way to accomplish that was to create quality education for all students. Thus, the goal of science for all again characterized US education policy, even in the face of the obvious need to recruit and train special talent. To emphasize the idea that science was important for all students, the Committee on Educational Policies at the National Research Council said in its 1958 report: "Whether the student eventually works in agriculture, industry, government, business, commerce, education, arts or sciences, he is likely to need some part of a changing body of scientific knowledge in his own work" (as cited in Hurd 1961, p. 132).

Nevertheless, even though policymakers talked about the value of the new courses for all, in fact the courses that were created during this period of curriculum reform tended to be geared more toward the academically able student, both in terms of their conceptual difficulty and the theoretical, rather than applied, nature of the content. Subsequent analyses of the courses concluded that they were too difficult for the typical high school student because of their theoretical sophistication and abstract nature, and the courses were not motivating enough because the science was not related to the practical interests of students or the role of science in everyday life (Hurd 1970). The lesson to be learned from this period of reform is that any effort to create a common experience for all requires that attention must be paid to the nature of the experiences that will make them suitable for all.

From the 1960s to the Present: The Era of Civil Rights

As was true in the first half of the twentieth century, virtually every policy document written in the past 50 years addresses the importance of science for all, not just for those preparing for science careers. This can be seen in the language used in *A Nation at Risk*, the 1983 report of the National Commission on Excellence in Education; in *Educating Americans for the 21st Century*, the 1983 report of the National Science Board of the National Science Foundation (NSF); in *Science for All Americans*, a vision of science literacy for all published in 1989 by Project 2061 of the American Association for the Advancement of Science; and in *Rising Above the Gathering Storm*, a 2007 report of the National Academy of Science; among others. But, beginning with the civil rights movement of the 1960s, "science for all" also took on another dimension. In addition to arguing that the public at large and not just future scientists should understand science, policymakers began to explicitly press the point that race, class, gender, and disability should not limit who studies science, who becomes a scientist, or the quality of education those students receive.

This emphasis on race, class, gender, and disability did not occur at once. Efforts had begun decades earlier, were codified into law during the era of civil rights legislation, and then required constant vigilance in subsequent years to move toward greater equity for all, both in terms of opportunity and outcomes. For example, school segregation on the basis of race was declared unconstitutional in *Brown v. Board of Education* in 1954, although *de facto* segregation continued throughout the country for decades. The Civil Rights Act of 1964 prohibited discrimination in voting, education, and the use of public facilities on the basis of race, color, religion, and national origin, and it provided the government with the powers to enforce desegregation by barring the use of federal funds for segregated programs and schools. The bill also included provisions outlawing sex discrimination in hiring. In 1966, the National Organization for Women (NOW) was created to fight for full equality between the sexes. In 1972, Title IX of the Education Amendments of 1972 was passed. The act says that no person in the USA shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving federal financial assistance on the basis of sex. Then, in 1973, Congress passed Section 504 of the Vocational Rehabilitation Act, which barred discrimination against people with disabilities. Regulations for implementation of the act were signed by the Secretary of Health, Education, and Welfare in 1977 (Pfeiffer 2002).

During the early years of the civil rights movement, energies were focused on legal battles and enforcement of laws involving large-scale issues such as school desegregation. Very little attention was paid to inequalities due to race, gender, or disability at the curricular level. But over time, science educators became more and more aware of the discriminatory practices that kept women, minority group students, and students with disabilities from studying science and having careers in science. For example, the *Science and Engineering Equal Opportunities Act* of 1980 made it clear that such inequities had existed and still existed. The bill, amended in 1985 and 2002 to add language regarding persons with disabilities and substituting the term "engineering" for "technology" states:

> [I]t is the policy of the United States to encourage men and women, equally, of all ethnic, racial, and economic backgrounds, including persons with disabilities … to have equal opportunity in education, training, and employment in scientific and engineering fields, and thereby to promote scientific and engineering literacy and the full use of the human resources of the Nation in science and engineering. (p. 1)

It is significant that the act is justified primarily in terms of the development of human resources ("the full use of the human resources of the Nation"), not on moral grounds of justice and fairness for all. In fact, with few exceptions, there is little mention of equity as a moral issue in policy documents.

As part of the *Science and Engineering Equal Opportunities Act of* 1980, every 2 years, NSF publishes a report titled *Women, Minorities, and Persons with Disabilities in Science and Engineering* (http://www.nsf.gov/statistics/wmpd/). The reports provide statistics on the progress being made in the participation of the various groups of students in science and engineering from elementary school through postdoctoral careers. By highlighting the obvious disparities that have persisted, the reports keep the equity agenda in front of the public.

That disparities continue to exist is evident from the data. For example, in a study conducted for the Spencer Foundation, Anne MacLachlan (2005) notes:

> In 1980, when the Science and Engineering Equal Opportunities Act was passed, under-represented minorities, African Americans, American Indians, Chicanos and Hispanics were 2% of US doctorates granted in physical science, 2.5% in engineering. In 1990 the percentages were 3.4% and 3.6% respectively. (p. 1)

Slow progress in meeting the goals identified in the *Science and Engineering Equal Opportunities Act* prompted NSF to commission Jeanne Oakes of the RAND Corporation to study educational policies that created disparities within the educational system, in particular the use of separate tracks for students in science and mathematics courses. In two reports (1990a, 1990b), Oakes concluded that the practice of tracking and ability grouping limited opportunities for many students to learn science and mathematics and pursue careers in science. In her review of these reports, Sharon Lynch (2010) says:

> Grouping practices in the elementary and middle school grades affected children who had been clustered in "low-ability classes" for years on end. By the time these students reached high school, their science education experiences were strikingly different from their peers

in high track classes, with markedly different expectations for achievement, access to resources, and chances of having competent science teachers. (p. 309)

Although ability grouping may have been seen as a way to provide both future scientists and nonscientists with courses that were appropriate to their interests and abilities during the first half of the twentieth century, by the 1980s it was clear that this practice had led to diminished opportunities for large segments of the population.

A Call for Excellence and Common Culture

In 1983, the National Commission on Excellence in Education (NCEE) issued its report, *A Nation at Risk.* Reminiscent of the recommendations of the Committee of Ten in the 1890s and of the curriculum reformers of the 1950s and 1960s for increased conceptual rigor, the NCEE recommended a return to a more academic focus and more disciplined effort on the part of all students. They said that students in the USA needed to be better educated and highly motivated if they were to compete successfully with international competitors. The new raw materials of international commerce were knowledge, learning, information, and skilled intelligence.

The NCEE also pointed to the importance of a high level of common understanding in a free and diverse democratic society. The common culture argument had been raised before, most prominently by Ernest Boyer and Arthur Levine (1981) just prior to the publication of *A Nation at Risk* in their *A Quest for Common Learning*. Boyer and Levine acknowledged that past efforts to present a "common culture" in educational programs had not addressed the *diversity* of that common culture and concluded that "this nation is not one culture but many" (p. 21), but yet "our future well-being, and perhaps even our survival, may depend on whether students understand the reality of interdependence" (p. 22). The NCEE (1983) reflected a similar inclusive approach: "The twin goals of equity and high-quality schooling have profound and practical meaning for our economy and society, and we cannot permit one to yield to the other either in principle or in practice" (p. 13).

This same spirit of a quality education for all is echoed in *Educating Americans for the 21st Century* (National Science Board 1983). Because US national security and economic health depended on its human resource development, a commitment to academic excellence would place the USA on a firm economic footing in its competition with other countries. The NCEE addressed the excellence–equity distinction in the context of human resource development by saying: "While increasing our concern for the most talented, we must now also attend to the need for early and sustained stimulation and preparation for all students so that we do not unwittingly exclude potential talent…" (p. x).

"Science for all" was also a prominent theme of *Science for All Americans,* the 1989 publication of Project 2061 of the American Association for the Advancement of Science, which describes what all citizens should know in science to be considered science literate. The authors of *Science for All Americans* also focused on the "common core" argument, making it clear that a recommended core applied to all students:

> The set of recommendations constitutes a common core of learning in science, mathematics, and technology for all young people, regardless of their social circumstances and career aspirations. In particular, the recommendations pertain to those who in the past have largely been bypassed in science and mathematics education: ethnic and language minorities and girls. (p. xviii)

The Economic Argument

It was the economic argument for raising academic standards for all students, however, not the common culture argument, that soon became the major justification for ensuring access to science education for all students regardless of race, gender, or disability. For example, on April 18, 1991, President George H. W. Bush released *AMERICA 2000: An Education Strategy* (US Department of Education 1991), which described a plan for moving the nation toward a set of national goals and linked American economic competitiveness to "educating everyone among us, regardless of background or disability" (p. 2).

Then, on March 31, 1994, President Clinton signed the *Goals* 2000*: Educate America Act*. The act featured eight goals centered on educating workers for productive employment, with special reference to competition in international trade. The purpose of the act was to support new initiatives to ensure educational opportunity for all students so that they would be prepared to succeed in the world of work and in civic participation.

Also in 1994, President Clinton signed the *Improving America's Schools Act* (IASA), which was a reauthorization of the original *Elementary and Secondary Education Act* of 1965 (ESEA), first enacted as part of President Johnson's War on Poverty and intended to improve education for disadvantaged children in poor areas. IASA laid the foundation for what was later to become the *No Child Left Behind Act* of 2001 (NCLB). Under IASA, each state had to: (1) develop challenging content standards for what students should know in mathematics and language arts; (2) develop performance standards representing three levels of proficiency for each of those content standards—partially proficient, proficient, and advanced; (3) develop and implement assessments aligned with the content and performance standards in at least mathematics and language arts at the third through fifth, sixth through ninth, and tenth through twelfth grade spans; (4) use the same standards and assessment system to measure Title I students as the state uses to measure the performance of all other students; and (5) use performance standards to establish a benchmark for improvement referred to as "adequate yearly progress" (AYP). All schools were to show continuous progress or face possible consequences, such as having to offer supplemental services and school choice options to students or replacing the existing staff.

In one of the few references to equity as a moral issue in any of the policy documents that appeared during this time period, the act's statement of policy says: "The Congress declares it to be the policy of the United States that a high-quality education for all individuals and a fair and equal opportunity to obtain that education are a societal good, are a *moral imperative* (italics added), and improve the life of every individual, because the quality of our individual lives ultimately depends on the quality of the lives of others" (*Improving America's Schools Act* 1994). The act also acknowledges the persistent achievement gap among various groups in society and calls for improvements in Title I and other federally funded programs aimed at closing that gap.

At the signing of the landmark *Americans with Disabilities Act* (ADA) on July 26, 1990, President George H. W. Bush also acknowledged the moral responsibility we have to enable Americans with disabilities to contribute their efforts and their talents to the nation:

> The ADA is a dramatic renewal not only for those with disabilities but for all of us, because along with the precious privilege of being an American comes a sacred duty to ensure that every other American's rights are also guaranteed. (Bush 1990, p. 1)

But more often than not, rather than arguing on the basis of common culture or moral imperative, policymakers have used the nation's technical personnel needs and economic competitiveness as the primary argument in support of improved educational opportunity for underrepresented groups. For example, in *Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future,* the National Academies' Committee on Prospering in the Global Economy of the 21st Century, says:

> …in the long run, the United States might not have enough scientists and engineers to meet its national goals if the number of domestic students from all demographic groups, including women and students from underrepresented groups, does not increase in proportion to our nation's need for them. (National Academy of Sciences 2007, p. 166)

No Child Left Behind (NCLB)

Perhaps, the most aggressive legislation to date for ensuring opportunity for all students was NCLB. NCLB requires states to build assessment systems to track the achievement of students in their state against a common set of state-defined standards. By 2005–2006, states were required to test individual students annually in reading and mathematics between grades 3 and 8 using statewide tests, and to test students at least once during grades 10 through 12. By 2007–2008, students had to be tested in science at three grade bands. States were also required to administer the mathematics and reading tests of the National Assessment of Educational Progress (NAEP) every 2 years to a sample of students in grades 4 and 8. NCLB mandates that the data reported to the public must be disaggregated by the following subgroups: economically disadvantaged students, students from major racial and ethnic groups, students with disabilities, and limited English proficiency students (US Department of Education 2008, p. 24). The goal of NCLB was to have all students be proficient in reading and mathematics by 2014. Failure to make adequate progress toward meeting these goals results in various actions intended to help a school improve. In addition to technical assistance, staff changes, and the possibility of private or state takeover of the failing school, students in schools that do not meet their target goals are able to transfer to another school or use their Title I funds to pay for tutoring or other supplemental services.

Although well intentioned as a vehicle for focusing national attention on the performance of all students and for motivating school districts to direct resources toward those students most in need of assistance, there have also been unintended negative consequences of the NCLB legislation, which Sherry Southerland so convincingly argues in the next chapter of this volume. Similarly, Nancy Brickhouse notes in her chapter the limitations of standards-setting as a way to improve science education for all, even though this has been the dominant policy approach over the past two decades.

By early 2012, separate bills to overhaul ESEA had been passed by the House Committee on Education and the Workforce and by the Senate Committee on Health, Education, Labor and Pensions. As of May 2012, none of these bills had been considered by the full House or Senate, nor is it likely that any reauthorizing legislation will pass before the 2012 presidential election. Nevertheless, it is hoped that when modifications to ESEA are finally made they will reflect a spirit of bipatisanship, address the concerns that have been raised about the limitations of NCLB, and support the ongoing efforts to achieve educational equity and excellence for all.

Conclusion

There is no question that the equity theme has been prominent in science education policy for more than a hundred years. Prior to the civil rights era, “science for all” referred to science for both citizenship and technical career preparation. Following the era of civil rights legislation, there was a much greater recognition of the significant disparities in both opportunity and outcome for various subgroups of students within the population. The arguments for reducing those disparities due to race, ethnicity, gender, and disability as well as arguments for raising standards for all were often economic in nature. The argument was that talent had to be found wherever it could, not just among students who traditionally pursued high-level technical careers. Along with a concern for equity, there has also been an unwavering commitment to excellence, and in most policy statements, it is clear that high standards are meant for all students.

Today, the policy goal in science education is clearly one of excellence for all. But there are challenges in meeting that goal. In reality, the society does not expect everyone to achieve the same outcomes. In a meritocracy, vast differences in accomplishment are inevitable. There is no way to create identical outcomes in a meritocracy because someone will always be more naturally gifted in a specific area or work harder than others. We have come to believe that the best way to achieve an equitable system for all is to provide all students with the opportunity to succeed to their fullest potential in whatever area they wish to pursue their talent, along with high expectations for all and incentives and resources for all to achieve their full potentials. Although there are limits to what can be accomplished simply by establishing standards, many policymakers believe that enforceable high standards for all students are important so that students are not short-changed by themselves or by others.

But as Gardner said in 1961 and is still true today: "One of the obstacles to the full development of talent in our society is that we still have not achieved full equality of opportunity" (p. 38). There are many examples of that lack of fairness, and many of them involve educational resources that are not provided equitably to students. Lynch (2010) identifies a number of key areas in which resources are still unequal, including access to quality teachers, availability of specialized facilities and materials, and instructional technology, especially out of school. Also, *America's Lab Report*, the National Academies' study of science laboratories in schools, notes that less adequate laboratory facilities are more likely to be found in schools with higher concentrations of minority students and in schools with higher concentrations of students eligible for reduced-price meals (National Research Council 2005).

For the nation to achieve the goal of science for all, it is important that resource allocation be made more equitable, particularly in the quality of teachers that students have. Two things might make that more likely. The first is to keep data on the participation and performance of various subgroups of students in front of the public. If the public sees the wide disparities that continue to exist for different groups of students, they may be more likely to see the injustices in our present system. For this reason, it is important that the reauthorization of ESEA require that performance data continue to be disaggregated by subgroups as it currently is under NCLB. This does not mean that the same kinds of tests that were used under NCLB have to be used in the future. Those tests were often too narrow in their focus and led, especially in low-performing schools, to uninspired teaching. But whatever metrics are used, we need to know how subgroups of the population are doing.

The second is that it may be time that we begin to discuss equity not just as an economic necessity but as a moral imperative as well. As John Rawls (1971) said in his *Theory of Justice*: "Justice is the first virtue of social institutions, as truth is to systems of thought. …Each person possesses an inviolability founded on justice that even the welfare of society as a whole cannot override" (p. 3). To Rawls, this meant both the freedom to pursue personal goals and the opportunities to succeed. There is no question that most individuals within this society do see equity as an issue of basic fairness. But in public policy, policymakers seem more comfortable talking about the economic benefits of a broadened work force than about basic justice. It is certainly not uncomplicated how the twin goals of excellence and equity are best achieved in a democratic society, but it is important to realize that the commitment to equity must be based on something more permanent than simply the search for talent to support the nation's economic competitiveness. Perhaps, a focus on equity as a moral issue would lead to more persistent efforts to achieve equity and, therefore, to more consistent and more effective policies and outcomes.

What insights and understandings do the theoretical and methodological lenses used in this scholarship enable and constrain? By examining the evolution of relevant policy over time, the historical approach taken in this chapter allows the reader to place equity in science education within the larger social, economic, and national security contexts of the nation during major historical events and eras (e.g., World War II, the Cold War, the civil rights movement). This enables the reader to appreciate the full range of factors that can influence science education policy at any given time and the tensions and challenges that can result when principles collide with practical needs. In addition, by focusing on policy at various levels—federal, state, local, professional, disciplinary—the reader can begin to understand the complex nature of policymaking in science education.

But, with the focus strictly on policy, what this account does not provide (and cannot provide given the limits of space) is insight into how policies have actually played out in the classroom for specific groups of students. A critically important question to ask is how effective these policies have been and what impact they have had on the wide diversity of students in schools. It is one thing to espouse an equity agenda, but implementation efforts supported by adequate funding are also essential. This chapter does not examine efforts at implementation, the support or resistance by various stakeholders, the adequacy of legislative appropriations to support equity policy, or policy analyses that have examined the effectiveness of these efforts.

How can the ideas in this chapter be used to inform research, practice, and policy? Educators often tend to be ahistorical, choosing to operate in the moment, as if every idea is new, but an understanding of history is an important way to broaden one's perspective in all areas of scholarship and policymaking. This chapter distills important lessons about education policy from key periods in the nation's history when science was in the foreground. It also documents the continuing struggle to provide equitable opportunities to all students, and highlights factors that make the education of all students in science particularly challenging. The continued and steadfast support for an equity agenda among policymakers gives us reason to be optimistic, yet the failure to fully realize our goals demonstrates that we cannot be satisfied with talk alone. Practical steps are needed to give all students an opportunity to succeed to their fullest.

References

American Association for the Advancement of Science. (1989). *Science for all Americans*. New York: Oxford University Press.

Angus, D., & Mirel, J. (1999). *The failed promise of the American high school, 1890–1995*. New York: Teachers College Press.

Boyer, E., & Levine, A. (1981). *A quest for common learning: The aims of general education*. Washington, DC: The Carnegie Foundation for the Advancement of Teaching.

Brandwein, P. (1955). *The gifted student as future scientist*. New York: Harcourt Brace.

Brown v. Board of Education, 347 US 483 (1954).

Bush, G. (1990). Remarks on the signing of the Americans with Disabilities Act, July 26, 1990. Charlottesville: Miller Center of Public Affairs, University of Virginia. Retrieved December 6, 2010, from http://millercenter.org/scripps/archive/speeches/detail/3424

Carl D. Perkins Vocational and Applied Technology Act of 1984. Pub. L. No. 98–524, § 20, 98 Stat 2435. Retrieved December 6, 2010, from http://eric.ed.gov/PDFS/ED256926.pdf

Carl D. Perkins Vocational and Technical Education Act of 1998, 20 U. S. C. § 2301 *et seq*. Retrieved December 6, 2010, from http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=105_cong_public_laws&docid=f:publ332.105

Committee on Educational Policies, Division of Biology and Agriculture. (1958). *Suggestions for a comprehensive program for improving the content of biology programs for elementary school to college*. Washington, DC: National Academy of Sciences-National Research Council.

Conant, J. (1945). *General education in a free society: Report of the Harvard Committee*. Cambridge: Harvard University Press.

Conant, J. (1959). *The American high school: A first report to interested citizens*. New York: McGraw-Hill.

Elementary and Secondary Education Act of 1965, Pub. L. No. 89–10, 79 Stat 27. Retrieved December 6, 2010, from http://www.eric.ed.gov/PDFS/ED017539.pdf

Gardner, J. (1961). *Excellence: Can we be equal and excellent too?* New York: Harper and Row.

Goals 2000: Educate America Act of 1994, 20 U.S.C. § 5801 *et. seq.* (1994). Retrieved December 6, 2010, from http://www2.ed.gov/legislation/GOALS2000/TheAct/index.html

Hurd, P. (1961). *Biological education in American secondary schools 1890–1960: Biological sciences curriculum study bulletin no. 1*. Washington, DC: American Institute of Biological Sciences.

Hurd, P. (1970). *New directions in teaching secondary school science*. Chicago: Rand McNally.

Improving America's Schools Act of 1994, Pub. L. No.103–382, 20 U.S.C. § 8001 *et. seq.* (1994). Retrieved December 6, 2010, from http://ed.gov/legislation/ESEA/toc.html

Lynch, S. (2010). Equity and US science education policy from the GI Bill to NCLB: From opportunity denied to mandated outcomes. In G. DeBoer (Ed.), *Research in science education: Vol. 5, The role of public policy in K-12 science education*. Greenwich: Information Age Publishing.

MacLachlan, A. (2005). *A longitudinal study of minority Ph.D.s from 1980–1990: Progress and outcomes in science and engineering at the University of California during graduate school and professional life* (Final Report to the Spencer Foundation). Berkeley: Center for Studies in Higher Education, UC Berkeley. Retrieved December 6, 2010, from http://cshe.berkeley.edu/research/minorityphd/

National Academy of Sciences. (2007). *Rising above the gathering storm: Energizing and employing America for a brighter economic future* (Report of the Committee on Prospering in the Global Economy of the 21st Century). Washington, DC: National Academies Press.

National Center for Education Statistics. (1981). *Digest of education statistics*. Washington, DC: US Government Printing Office.

National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform*. Washington, DC: US Department of Education.

National Defense Education Act of 1958, Pub. L. No. 85–864, 1 U.S.C. § 101, 72 Stat. 1581 (1958).

National Education Association. (1894). *Report of the committee on secondary school studies*. Washington, DC: US Government Printing Office.

National Education Association. (1918). *Cardinal principles of secondary education: A report of the commission on the reorganization of secondary education* (US Bureau of Education Bulletin No. 35). Washington, DC: US Government Printing Office.

National Organization for Women. (1966). *Statement of purpose.* Retrieved December 6, 2010, from http://www.now.org/history/purpos66.html

National Research Council. (2005). *America's lab report: A report of the committee on high school science laboratories: Role and vision*. Washington, DC: National Academies Press.

National Science Board Commission on Precollege Education in Mathematics, Science and Technology. (1983). *Educating Americans for the 21st century: A report to the American people and the National Science Board*. Washington, DC: National Science Foundation.
National Science Foundation. (various dates). *Women, minorities, and persons with disabilities in science and engineering*. Arlington, VA: Author. Retrieved December 6, 2010, from http://www.nsf.gov/statistics/wmpd/
National Vocational Education (Smith-Hughes) Act of 1917, 20 U.S.C. § 11 *et seq.* (1917).
No Child Left Behind Act of 2001, 20 U.S.C. § 6301 *et seq.* (2002).
Oakes, J. (1990a). *Lost talent: The underparticipation of women, minorities, and disabled persons in science*. Santa Monica: The RAND Corporation.
Oakes, J. (1990b). *Multiplying inequalities: The effects of race, social class and tracking on opportunities to learn mathematics and science*. Santa Monica: The RAND Corporation.
Pfeiffer, D. (2002). Signing the Section 504 rules: More to the story. *Ragged Edge Online, Issue 1*. Retrieved December 6, 2010, from http://www.ragged-edge-mag.com/0102/0102ft6.html
President's Scientific Research Board. (1947). *Science and public policy* (Vol. 4). Washington, DC: US Government Printing Office.
Rawls, J. (1971). *A theory of justice*. Cambridge: Belknap.
Science and Engineering Equal Opportunities Act of 1980. Pub. L. 96–516, Sec. 32, Dec. 12, 1980, 94 Stat. 3010, 42 U.S.C. § 1885 *et seq.* Retrieved December 6, 2010, from http://law.justia.com/us/codes/title42/42usc1885.html
Title IX of the Education Amendments of 1972. 20 U. S. C. §§ 1681–1688 *et seq*.
US Department of Education. (1991). *America 2000: An education strategy sourcebook*. Washington, DC: Author.
US Department of Education. (2008). *No child left behind*. High school graduation rate: Non-regulatory guidance, December 22, 2008. Retrieved December 6, 2010, from http://www2.ed.gov/policy/elsec/guid/hsgrguidance.pdf
US Department of Education. (2010). *A blueprint for reform: The reauthorization for the elementary and secondary education act*. Washington, DC: Author.
US Office of Education. (1953). *Education for the talented in mathematics and science*. Washington, DC: US Government Printing Office.