

continuation with the earlier natural history tradition, nature study offered young women a form of science education with a positive subjective warrant. Taking up the advanced study of science in college or deciding to become a professional scientist are decisions made only at the end of a longer process, during which individuals subjectively qualify or disqualify themselves as suited to the field in question. Nature study, with its positive female role models and its connection with traditional views of women's sphere, potentially served as an effective vehicle for interesting young girls in science generally and the life sciences in particular.

During the heyday of the nature-study movement, an era that some scholars have called a "golden age" for female leaders in education generally,<sup>104</sup> women appeared poised to build on their gains in the field of science education. There remained much work to be done. Some educators expressed concern that nature study was neither consistently nor uniformly implemented in classrooms across the nation and that teachers required further training in the subject. Others cautioned that an overreliance on nature stories in some classrooms threatened to transform nature study into a literary pursuit.<sup>105</sup> Women turned their attention to these and other pressing matters in the field of elementary education. In so doing, however, they failed to notice another, far greater threat looming to the scientific interests of American girls. During the same years that nature study reached its peak at the elementary level, the numbers of girls enrolling in physical science and advanced mathematics courses at the secondary level steadily began to decline. The cause lay not within the field of science education, but also where.

## Other Paths, Other Opportunities

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By the 1890s, girls outnumbered boys in public high school science courses across the country, but at the turn of the century, this state of affairs began to change. During the same period that educational reformers began to implement nature-study programs in the first eight grades of school, female enrollments in science declined at the secondary level.<sup>106</sup> Working in different fields, a number of historians interested in understanding the decline of science as a girls' subject in the late nineteenth century have proposed two developments likely to have contributed to this phenomenon. Focusing on England, a recent study of women's scientific interests concludes that middle- and upper-class women abandoned the sciences in favor of the classics near the end of the nineteenth century. According to Patricia Phillips, as English women sought an educational program equal to that of men, "they resigned the scientific identity that had been theirs since the seventeenth century." In part, this was due to the well-meaning attempts of reformers to improve the quality of girls schools by increasing the quota of classics offered there.<sup>107</sup> Concentrating on the United States, several scholars studying American educational history have identified the late nineteenth-century vocational movement as an important factor in girls' declining enrollments in secondary-school science courses.<sup>108</sup>

This recent scholarship is suggestive of a significant relation between social class and girls' interests and opportunities in science education. To what extent did American middle- and upper-class women, like their English sisters, relinquish scientific study in favor of the classics? What effects did changes in curriculum and policy undertaken during the vocational movement have on the science studies of working-class girls and their more affluent and privileged peers? How did this movement affect the course taking of girls from various ethnic groups? In order to understand the degree to which conditions may have occurred in the United States

comparable to those in Great Britain, the following discussion begins analyzing the rise of the classics in early nineteenth-century female secondary schools and colleges.

### TAKING UP THE CLASSICS

During the seventeenth and eighteenth centuries, generations of middle and upper-class American schoolboys in Latin grammar schools studied curriculum with higher branches that included the study of Latin and Greek. Their schoolmasters and parents supported this educational program because they viewed the classics as the preferred means of providing a rigorous moral and intellectual training. It was a commonly held view that the best minds were those whose faculties had been strengthened through years of classical application. Contemporaries believed the female mind, on the other hand, to be relatively deficient in rational powers. Many seventeenth- and eighteenth-century educators viewed girls as mentally unfit in nature for the expenditure of effort required to study the classics.<sup>4</sup>

Gradually, almost imperceptibly, at the dawn of the nineteenth century some schools providing a form of secondary education for girls—female seminaries and academies, boarding schools, ladies' select schools, and so on—began to break with this traditional view by including Latin in their curricula. In contrast to other educational reforms, this particular curricular change was unaccompanied by articles published by leading educators urging the addition of a new subject to the traditional course of study. Instead, this shift occurred almost covertly; its traces enclosed within the covers of school catalogs and courses of study.

Near the turn of the century, female schools in both northern and southern states began to include Latin in their published courses of study.<sup>5</sup> In Massachusetts, one of the first schools to offer the classics to girls was Westford Academy, which included Latin and Greek in its curriculum in 1792. A coeducational institution, Westford admitted students of any age or nationality able to "read in the Bible readily without spelling."<sup>6</sup> It is difficult to know how many female students actually enrolled in Latin or Greek classes during the first decades of the nineteenth century. For females, the classics never composed part of the core curriculum during this early period, because in many cases, schools charged students extra tuition to study Latin or Greek.

Documentary sources suggest that before 1840, the numbers of females actually enrolling in Latin classes in higher schools may have been very few. A small sample of three northern coeducational schools suggests that although Latin may have been on the books as a subject for study, female enrollments in Latin classes were negligible. For example, in 1822, thirty-six percent of the males and none of the females enrolled in Latin at Monson Academy, Connecticut. Less than a decade later in Massachusetts Wesleyan Academy (1828) and the Sheldon English and Classical School (1830) revealed similar enrollment patterns. At both institutions, no more

than one percent of females studied Latin, compared with roughly one-third of the males.<sup>7</sup>

Mount Holyoke Female Seminary in Massachusetts delayed placing Latin among its required subjects for a period of ten years because of community resistance. Mary Lyon offered students the option of studying Latin when she established Mount Holyoke in 1837. Initially, the board of trustees had planned to require all students to study the subject, but community opposition made this impossible. Instead, Latin remained an elective until the 1846–47 school year, when it was required of all pupils. One former student recalled that in 1840, when Latin had an elective status, "about one-fourth of the pupils were voluntarily pursuing it."<sup>8</sup> Requiring the subject for the first time in 1846, the board explained that although the seminary had originally planned to require Latin from its inception, "it has been necessary to accommodate to the general views of the community on female education, and to the desire of many parents to finish the education of their daughters just at the age, when they have acquired strength of constitution enough to begin hard study."<sup>9</sup>

In North Carolina, newspaper advertisements placed by female schools increasingly mentioned Latin after 1810 (see Table 7.1). Like their northern counterparts, such schools initially offered Latin as an elective subject. For example, the female department of North Carolina's Raleigh Academy included Latin, French, music, painting, and needlework as electives in its course of study in 1811, as did New Bern Academy in 1823.<sup>10</sup>

It is possible that the study of Latin may have been more prevalent in some areas of the country than in others. As shown in Table 7.2, forty-two percent of a sample of female higher schools in Connecticut, Massachusetts, New York, and Maryland included Latin in their advertised courses of study from 1820 to 1842, in contrast to thirteen percent in Virginia.<sup>11</sup> At first glance, this seems to suggest that northern institutions may have offered the classics earlier than schools in the South. However, based on a small sample of North Carolina schools during the antebellum period, historian Christie Farnham concluded that Latin appeared more frequently in southern female schools than in northern institutions. The data presented here might support the speculation that female institutions may have offered Latin in North

**Table 7.1** Percentage of North Carolina Female Higher Schools Advertising Latin, 1800–1830

Year	Percentage
1800–1809 (6 schools)	0
1810–1819 (12 schools)	17
1820–1830 (24 schools)	21

Source: Kim Tolley, "Mapping the Landscape of Higher Schooling, 1727–1850," in *Chartered Schools: Two Hundred Years of Independent Academies in the United States, 1727–1925*, eds. Nancy Beadle and Kim Tolley (New York: Routledge, 2002), 33.

**Table 7.2** Percentage of Female Higher Schools Offering Latin Before 1840 in Selected States

Dates	Sample size	States	Schools offering Latin
1750-1829	36	Pennsylvania	5 (14%)
1820-1830	24	North Carolina	5 (21%)
1835-1838	31	Virginia	4 (13%)
1820-1842	24	Massachusetts; Connecticut; New York; Maryland	10 (42%)

Sources: Kim Tolley, "Mapping the Landscape of Higher Schools, 1727-1850," in *Chartered Schools: Two Hundred Years of Independent Academies in the United States, 1727-1925*, eds. Nancy Beadie and Kim Tolley (New York: Routledge, 2002), 34.

Carolina earlier than did their counterparts in some areas of New England but the discrepancy in the results for Virginia and North Carolina make it difficult to draw more general conclusions without further study.

Some educators in northern and southern female schools promoted the study of Latin for its presumed ability to develop the mind or to develop habits of patience and perseverance. "How much patience is needed to get one lesson in Latin," asserted educator John Todd in 1854, "or to make a single good recitation in algebra!"<sup>12</sup>

The founders of academies and their boards of trustees also viewed the classics as a vehicle for increasing their schools' status and prestige and as a means of making their institutions more comparable to male academies. For example, in 1838, the well-known educator Almira Hart Lincoln Phelps proclaimed that the object of her school at West Chester, Pennsylvania, was "to furnish females with the means of acquiring a liberal education, coinciding, as far as the varying conditions of the two sexes will admit, with a collegiate course for the other sex."<sup>13</sup> Almost by definition during this era, pursuing a so-called collegiate course involved some study of the classics.

Another important social development fueling the rise of Latin in female higher schools was the opening of new institutions for women bearing the designation of "college." Some scholars have dismissed these early attempts at postsecondary education, viewing them as colleges in name only.<sup>14</sup> Nevertheless, these institutions had an important influence on the curricula of higher schools aiming to prepare students to meet the new collegiate entrance requirements.

The first experiment in women's collegiate education in the United States took place in the South, with the chartering of Georgia Female College in 1836, an institution authorized to "confer all such honors, degrees, and licenses as are usually conferred in colleges or universities."<sup>15</sup> The college opened on 7 January 1839. As a new educational experiment, the college was the subject of some criticism, not only from those who ridiculed the notion of higher education for women, but from others who questioned the rigor and quality of its studies. Traditionally, the presence of the classics in the entrance requirements served as a marker of an institution's relative quality. Because Georgia Female College did not require a demon-

stration of classical knowledge for admission, contemporaries judged its academic standards to be relatively low. In the context of defending the college's admission policy, the college president admitted that "the standard of admission especially is reduced so low as to present an incongruity between the high character of a college . . . and the requisitions laid down in our plan, as published in the catalog." Low standards were a financial necessity, he argued, because elevating them would potentially "diminish the number of scholars, and consequently, the receipts from tuition."<sup>16</sup>

Despite fears that high admission standards might limit the number of qualified scholars, it was not long before other newly organized institutions designated as women's colleges began adding the classics to their entrance requirements. For example, in 1842, Wesleyan Female College at Cincinnati, Ohio, required Latin grammar, Latin reader, the *Commentaries* of Caesar, and Greek grammar and reader. Established in 1853, the Wesleyan Female College at Delaware, Ohio, offered students the choice of either a scientific or classical four-year course. Entrance requirements for the classical course required some knowledge of Latin and Greek: "first and second books."<sup>17</sup> The admission requirements of Mary Sharp College, which opened in 1851 at Winchester, Tennessee, specified knowledge of Greek grammar, Testament, Latin grammar, Virgil, Cicero, and Horace. When Vassar opened in 1861, its entrance requirements included Latin grammar, syntax, Latin prose, two books of the *Commentaries* of Caesar, two orations of Cicero, French, and several modern subjects. Finally, the opening of Smith College in 1875 represented a landmark of sorts. Its admission standards, heavily weighted with the classics, matched those of Amherst and Harvard.<sup>18</sup>

Reflecting the shift toward the classics in the entrance requirements of women's colleges, the percentage of girls' secondary schools offering Latin visibly increased during the rest of the century.<sup>19</sup> To a lesser extent, girls' schools began to offer Greek as well, although this subject lagged behind Latin in both male and female institutions throughout the century. For example, in Pennsylvania from 1750 to 1829, only three percent of girls' schools offered Greek, whereas fourteen percent offered Latin. In later years, from 1830 to 1889, thirty-seven percent of girls' schools offered Greek, whereas seventy-two percent offered Latin. Conceivably, girls' schools placed a greater emphasis on Latin than on Greek during this period because educators viewed Greek as a prerequisite subject for those preparing to enter the ministry, a field largely closed to women.<sup>20</sup>

Taking up the classics required female students to devote a substantial proportion of their school hours to practicing Latin grammar and reading such authors as Caesar, Virgil, Cicero, and Xenophon. Students could hardly undertake such study without reducing attention to other subjects. In some cases, girls abandoned the study of the sciences to make room for the classics. For instance, when Swedish commentator Per Stihstrom visited Connecticut's Hartford High School in the 1850s, he reported that the school had enacted a provision that girls might omit "etymology, the geography and history of the United States, natural philosophy, chemistry, and philosophy and substitute for them the study of Latin."<sup>21</sup>

The importance of classical studies in American secondary schools surprised Slijestrom, who had expected to find a curricular emphasis on the sciences and other so-called practical subjects when he visited the United States at midcentury. Instead, he discovered that Latin and sometimes Greek were among "the more substantial accomplishments which form part of the higher education of women in America." In Slijestrom's opinion, this trend was unfortunate. Believing that it was not "of the least value either for woman or for man to possess a smattering of Greek or Latin," he recommended that Americans increase their offerings of such subjects as geometry and geometrical drawing, natural history, and manual arts.<sup>22</sup>

Girls had an increased incentive to study the classics after the Civil War when growing numbers of previously all-male colleges and universities began to open their doors to women. Without knowledge of Latin, young women could not obtain entrance to the prestigious collegiate courses in liberal arts colleges. Statistical data reveal that in liberal arts universities and colleges in 1872, women more often enrolled in scientific departments than in collegiate departments. In that year, the commissioner of education published statistics on 298 universities, colleges, and collegiate departments of these institutions, fifty-nine (twenty percent) enrolled students in a scientific as well as a collegiate course. In institutions that offered both a scientific and a collegiate department, more women chose to enroll in the scientific department (Table 7.3).

Several factors may have influenced women to enroll in scientific courses, in which they studied such subjects as botany, physiology, chemistry, scientific illustration, or horticulture. One factor was the length of the course. Students not interested in a full four-year collegiate course often enrolled in the scientific course, in which they might study for shorter periods of time. A second factor was the perceived practicality of the scientific course, which, in the absence of nearby normal schools, served to prepare students to assume teaching positions in secondary schools. But most importantly, the entrance requirements of such institutions undoubtedly weighed heavily on women's enrollment decisions. In many cases, entrance to the collegiate department required knowledge of Latin, Greek, or both; subjects studied by a minority of girls in secondary schools. For example, to gain admission to the College of Letters at the Land-grant University of California in 1871, students had to pass an examination on Latin grammar, four books of Caesar, six books of Virgil, six orations of Cicero, Greek grammar, and Xenophon's *Anabasis*. On the other hand, admission to the scientific College of Arts required knowledge of subjects more famil-

**Table 7.3** Enrollments of Women in Collegiate and Scientific Departments in Fifty-nine Universities and Colleges, 1872

Collegiate departments	Scientific departments
599 (41%)	878 (59%)

Source: Data compiled from *Report of the Commissioner of Education for the Year 1872* (Washington, D.C.: Government Printing Office, 1873), 762-770.

lar to girls: higher arithmetic, algebra to quadratic equations, geometry, English grammar, geography, and the history of the United States. In 1873, women composed only ten percent of the freshmen students enrolled in the College of Letters, whereas they composed eighteen percent of freshmen enrolled in the College of Arts.<sup>24</sup>

Reformers anxious to elevate the status of female education were not pleased to discover that girls had difficulty meeting the entrance requirements of the traditional collegiate course. The scientific course, which usually substituted a modern language for Latin, was often considered terribly déclassé. Unlike their great-grandmothers, who had aspired to study the sciences as a means of attaining an acceptable form of cultural polish, late nineteenth-century women now set their sights on the culture provided by the classics and the liberal arts. The growing application of science and technology to business enterprises—and the resultant demand for mechanics, engineers, mining experts, and agricultural chemists—had noticeably shifted science's position in society. Although the middle and upper classes still flocked to hear scientific lectures and read articles about the most recent discoveries, they no longer looked so favorably on such study for their daughters. After all, young men from the lower-middle, working, and farming classes eager to train for new jobs in the new agricultural experiment stations and in industry science courses increasingly filled the new land-grant colleges and universities. Another mark of the inferiority of the scientific course was its relatively short duration, often requiring only two or three years of study, in contrast to the traditional four-year collegiate course.<sup>25</sup>

At the annual meeting of the New England Women's Club in 1873, members discussed with great interest recent efforts in certain private preparatory schools to make classical training available to girls. In its report, the club noted with approval that not only were some girls' schools beginning to offer advanced classical training, but a few all-male preparatory schools had begun to admit girls for the purpose of studying the classics: "Chauncey Hall School [has] thrown its doors open to girls as freely as to boys, offering them the opportunity of obtaining the same thorough fitting for college—the Latin School in Roxbury has, we understand, this year taken the same onward step."<sup>26</sup>

Given the historical role of the classics in the education of gentlemen, girls met a surprising lack of resistance when they began to invade this traditionally male domain. Geraldine Jongich Clifford suggests that men may have welcomed female enrollments in classical courses at the college level during the last decades of the nineteenth century, because female students allowed institutions the opportunity to more than double their enrollments in their classical courses, areas of declining popularity among male students.<sup>27</sup> Another contributing factor was the rising popularity of science among the more literate public during this period. The historian Frank Luther Mott has documented the enormous growth of American interest in science in the 1860s and 1870s as evidenced in general magazines and newspapers. According to Mott, articles on science typically ranked ahead of fiction, travel, and history-biography in popular magazines during these decades. Statistical records kept by the Astor Library in New York reveal

Chunglin  
classics  
women

that among the Astor's readers in 1872, scientific works had attained popularity equal to that of general literature.<sup>28</sup>

Americans grew especially concerned to promote the study of science among boys. For example, *Popular Science Monthly*, first published in 1869, often included articles castigating schools for their lack of scientific courses and facilities. In 1872, the *Monthly* published an editorial critical of the narrow education available to boys, stating, "When a mother is anxious that her son shall have a liberal education, and commits him to the accredited agencies, the question is, 'What will become of him?' It is not serious that a pupil can go through a course of so-called liberal study and graduate with honor at the highest institutions, in complete ignorance of science."<sup>29</sup> The establishment of land-grant universities and agricultural experiment stations, and the increased need for engineers during the decades led many Americans to view science from a new perspective. No longer largely the domain of the interested amateur, the sciences now appeared as professional fields in which a young man might actually be able to make a decent living.<sup>30</sup>

During the same period that growing numbers of boys turned to the sciences, increasing numbers of girls began to take up the classics, motivated by the desire to gain entrance to the more socially prestigious collegiate course in universities and colleges. Many late nineteenth-century high schools offered at least two distinct courses of study: the classical or the scientific; others offered such additional courses as the modern languages and English.<sup>31</sup> During the late nineteenth century, the Office of Education collected data on the numbers of students in private and public high schools preparing for either a classical course in college or for a scientific course in a college or scientific school (Table 7.4). The data reveal a distinctly opposite shift in the curricula studied by the two sexes. In 1890, a greater number and proportion of boys than girls studied a classical curriculum, whereas in the scientific curriculum, the number of girls exceeded that of boys, although the proportion of girls was somewhat smaller. However, by 1910, the number and proportion of girls studying the classical curriculum exceeded that of boys, and the number and proportion of boys enrolled in the scientific curriculum was four times greater than that of girls.

In the last decade of the nineteenth century, science assumed a relatively minor role in the curricula of private girls' secondary schools. In 1893, Great Britain's Gilchrist Trustees sent five female teachers to America to study and report on secondary schools for girls and training colleges for women. In her report, Sara Bursall, mistress at the North London Collegiate School for Girls, noted the presence of Latin in girls' private schools: "Perhaps there is a tendency to do less science," wrote Bursall, "and more history and literature."<sup>32</sup> This trend intensified in the twentieth century. By 1914, more girls than boys enrolled in high school Latin courses across the country. A survey conducted in New York found that among seventh- and eighth-grade students, a larger percentage of girls than boys expressed a preference for Latin. Girls composed sixty-four percent of those who selected Latin.<sup>33</sup> Similarly, a 1915 survey of the interests of high school students in Iowa found that of those who stated a preference for Latin over

**Table 7.4** Number and Percentage of Public and Private High School Students by Sex in Grades 9-12 Preparing for One of Two Curricula in College or Scientific School, 1890-1910

	Classical curriculum	
	Boys	Girls
1890	8,084 (9.4%)	6,844 (5.9%)
1895	12,816 (8.9%)	13,390 (6.5%)
1900	15,120 (7.0%)	16,059 (5.3%)
1905	14,976 (5.2%)	19,941 (5.1%)
1910	11,970 (3.0%)	16,544 (3.2%)
	Scientific curriculum	
	Boys	Girls
1890	6,966 (8.1%)	7,308 (6.3%)
1895	11,520 (8.0%)	10,094 (4.9%)
1900	13,824 (6.4%)	11,211 (3.7%)
1905	17,568 (6.1%)	11,730 (3.0%)
1910	22,748 (4.4%)	5,687 (1.1%)

Source: Data compiled from John Francis Latimer, *What's Happened to Our High Schools?* (Washington, D.C.: Public Affairs Press, 1958), 155.

other school subjects, seventy-one percent were girls. In attempting to explain this phenomenon, the author hypothesized that whereas there was "something inherently attractive to boy-nature in the engineering pursuits," perhaps girls' preference for English, Latin, and German was similarly "due to the fact that the intrinsic quality of the subjects makes more of an appeal to the girl-mind than to the boy-mind."<sup>34</sup>

Women visibly dominated the teaching of Latin in public secondary schools by the second decade of the twentieth century. For example, in Wisconsin, the reports of high school inspectors written from 1915 to 1924 reveal that the great majority of Latin teachers in that state were women. During this period, inspectors visited twenty-three Latin teachers, all of whom were female.<sup>35</sup> One commentator explained that girls preferred Latin because women usually taught the subject, presenting it "in ways better suited to arouse the girls' interest than the boys."<sup>36</sup>

Unlike their British sisters, American girls never wholeheartedly embraced the classics. Although Latin appears to have become thoroughly a girls' subject in America by 1914, during the next several decades, the importance of Latin declined in the public high school curriculum. In contrast to England, where the universities of Oxford and Cambridge maintained the classics in their entrance requirements until relatively late in the twentieth century, American colleges and universities abandoned the classics requirement well before midcentury. For instance, the University of California eliminated its classics requirement by 1918.<sup>37</sup> As colleges and universities began to minimize or omit classical subjects from their entrance requirements, Latin assumed a smaller role in the studies of both sexes. In 1890,

thirty-four percent of all boys and thirty-six percent of all girls enrolled high school Latin courses. By 1928, only twenty-one percent of boys and twenty-three percent of girls took the subject, and by 1948, enrollments had fallen to fourteen percent of boys and seventeen percent of girls.<sup>38</sup>

The significance of classical study in the history of women's education lies in the fact that the turn to the classics led girls away from science. The underlying motive of educators and parents for encouraging girls to take up classical study was never solely to prepare them to become Latin teachers, although women were highly successful in assuming this role. Instead, the goal was to enable girls to gain entrance to the full four-year college course in which they might become liberally educated and, in many cases, to prepare for teaching other subjects than science. In short, the path away from science led directly to the liberal arts.

At the turn of the century, some observers of American culture reported that in addition to adolescent girls, older women of leisure were also taking up the study of the liberal arts. "Step by step," bemoaned American commentator Earl Barnes in an article published in *Atlantic Monthly* in 1912, "women are taking over the field of liberal culture. Who, fifty years ago, could have imagined that today women would be steadily monopolizing learning, teaching, literature, the fine arts, music, the church, and the theatre? And yet this is the condition at which we have arrived."<sup>39</sup> In attempting to explain this phenomenon, another writer, Josephine Conger-Kaneko, noted, "girls whose mothers had never advanced much beyond reading, writing, and arithmetic, find themselves studying Greek art and German music." Conger-Kaneko speculated that the new studies of their daughters created in many older women a desire to learn new things, to "broaden out."<sup>40</sup> Across the country, women of leisure established art and literary clubs and civic courses, organized university lectures, and enrolled in correspondence courses, even in the smallest towns. Conger-Kaneko described "one town of some five thousand inhabitants out in Kansas [which boasted] half a dozen such clubs."<sup>41</sup>

After 1910, when institutional barriers formed against the relatively few remaining women who sought to become science educators and professional scientists, the liberal arts provided college-bound girls with a well-established educational alternative. This alternative, made possible by the efforts of earlier generations of women, led to careers as educators in such subjects as English, modern languages, Latin, history, or art. In this direction, once the preserve of young men, young women encountered far less competition from men, who now looked with hope of greater personal and financial reward to careers in business, law, medicine, and science.

### TURNING TO HOME ECONOMICS AND COMMERCIAL COURSES

By the late nineteenth century, girls were turning from science not only to the classics and liberal arts, but also to the new home economics and commercial courses offered in American public and private high schools. A de-

tailed history of the vocational movement is beyond the scope of this study, but an understanding of the underlying issues giving rise to so-called vocational subjects in secondary schools is essential to understanding the eventual impact of this movement on girls' secondary school mathematics and science studies.

Why did parents support the introduction of home economics into the high school curriculum? Earlier in the century, middle- and upper-class parents had not viewed domestic science as a particularly useful subject for their daughters. As discussed in Chapter 3, when Catharine Beecher's text on domestic economy appeared in 1840, many Americans questioned the value of a study that dealt with the common concerns of home and hearth. Critics asked, "What will be the use of this study?"<sup>42</sup> However, by the end of the nineteenth century, the perceptions of many Americans as to the value of domestic science had changed, for reasons related to changing social demographics in secondary schools, women's increased presence in the labor markets, and rhetoric focused on gender differences in the context of debates over suffrage.

As increasing numbers of states passed compulsory education laws and a greater variety and number of students enrolled in tax-supported secondary schools in the nineteenth century, some observers began to question the desirability of schooling working-class boys and girls in the traditional curriculum that had long been the domain of elites. Relatively few secondary school students ever went on to college. In recognition of this fact, even before educators began to consider offering vocational training in American secondary schools, a number of school districts had begun to modify their high school courses of study to allow students greater election of subjects.<sup>43</sup> In response to increased demands to allow greater flexibility in the secondary school course, the National Education Association's Committee of Ten advocated the use of a limited elective system in public and private high schools. In its 1894 report, the committee recommended that students be allowed to explore a variety of subject areas during the first two years of high school before choosing one of four recommended courses of study: the classical, the Latin-scientific, the modern languages, or the English.<sup>44</sup> Some educators advocated the abolition of all set courses in the high school and the creation of two flexible courses designated by the general titles of "college-preparatory" and "non-college-preparatory." For example, by 1917, educators implemented this approach in most of Michigan's secondary schools.<sup>45</sup>

In large measure, such restructuring was due to a growing belief that many subjects in the core academic programs were irrelevant to the future vocations of working-class children. In 1874, Horace Greeley, editor of the *New York Tribune*, expressed a view that a growing number of educators appeared to share: "I go into one of our public schools, and before me are boys who are to work in shops or mills or till the soil all their lives, and there are girls who are to be wives and mothers of farmers and mechanics; to cook, sew, darn, wash, starch, and make butter and cheese; and when I see them studying Algebra and Trigonometry and Logarithms, and making astronomical calculations, I ask, not whether such studies are not useful

Curricular Revolution  
Differentiation

1895  
Michigan

for some purposes and persons, but whether this does not preclude or take the place of what would be more useful, what they will urgently need to know."<sup>46</sup>

In response to a growing national interest in adapting schools to students' presumed vocational futures, the National Education Association created an Industrial Section to focus on the issue in 1876.<sup>47</sup> Many late nineteenth-century Americans recommended vocational education as a way to make schools more appealing to working-class boys. For instance Omaha's superintendent, after noting the high attrition rate of boys from the higher grades of high school, hoped that with the addition of vocational courses to the city's schools, "we shall find before long in the graduating classes nearly as many young men as young women."<sup>48</sup> In 1904, the state superintendent of Wisconsin justified the addition of vocational training in high schools as a means of increasing the self-respect of boys "who naturally have very little taste for intellectual pursuits" and who "are frequently made to feel, in our literary courses of study, that they are of inferior ability."<sup>49</sup>

The national debate over how schooling should best fit American youth occurred within the context of wide-ranging discussions over gender differences during the decades after the Civil War. Concerns about women's increased presence in the workforce, coupled with discussion of Charles Darwin's theory of evolution, sparked widespread discussion of the nature, origin, and social implications of gender differences. Magazines such as *Popular Science Monthly* and *Appleton's Journal of Literature, Science, and Art* carried articles on the subject by scientists, philosophers, and social commentators on both sides of the Atlantic. Were women inherently capable of the steady rationality required for certain forms of professional work? Academics debated the extent to which gender differences could be traced to evolutionary or social causes and whether such differences rendered certain social roles, or particular academic subjects, inherently unattainable for women. According to Luke Owen Pike, a fellow of the Anthropological Society of London, the "smallness of the brain-case" rendered women "more prone to the display of emotion than of pure reason."<sup>50</sup> Additionally, "the desire, if not the capacity, for the prolonged study of abstract subjects is less in the female than in the male."<sup>50</sup> What would be the consequences for society if women gained entry to jobs formerly reserved for men? Granting women access to jobs traditionally reserved for men would result in "a further diminution in the virile force of the nation," warned a professor of medical psychology at the University of Edinburgh in 1869.<sup>51</sup> Such opinions, expressed in the name of science, justified efforts to differentiate some areas of the curriculum along gender lines.

The rhetoric associated with the women's suffrage movement also provided impetus to national debates over gender differences. Discussion of the separation of spheres and of the inherently different qualities of men and women continued throughout the decades leading up to suffrage, the same period in which the vocational movement gained impetus. In demanding the right to vote, women appeared to attack the presumed sanctity of the male public sphere. In counterarguments, men claimed that

women were too physically or emotionally frail for the rough-and-tumble world of politics, that women were inherently illogical and emotional and lacked the steady rationality required to make informed political decisions. Some women opposed to suffrage agreed with this depiction. For example, addressing the Illinois legislature in 1897, a group of antisuffragists stated, "We believe that men are ordained to govern in all forceful and material matters, because they are men, physically and intellectually strong, virile, aggressive."<sup>52</sup> Whether particular individuals or groups rejected the notion of inherent gender differences, believed that gender differences were God-given, or accepted that distinct traits developed through evolution, the issue of difference persisted throughout debates over suffrage.<sup>53</sup> In most debates, whether they supported or opposed suffrage, women by and large supported the doctrine of difference.

Both sexes applied the doctrine of separate spheres to politics. The ideology of different realms for men and women conceived of the woman as the embodiment of self-sacrifice. According to this view, women exerted themselves for the best interests of their families, devoting themselves to their children and submitting to the will of their husbands. Because women's social identity was derived from her husband's social standing, she regarded his self-interest as her own. When women pressed for suffrage, men reacted by claiming that giving women the right to vote would destroy the very fabric of society. The right to vote would allow women—by nature pure and delicate—to enter the sordid, fractious world of politics. Worse yet, giving women the vote would upset the domestic sphere, because women could then politically represent their own interests.<sup>54</sup> To counter such arguments, leading women's organizations took steps to assure the nation that women were firmly committed to hearth and home.

Organizations like the National American Woman Suffrage Association (NAWSA), created in 1890 through a merger of the American Woman Suffrage Association and the National Woman Suffrage Association, increasingly stressed women's special qualities by giving prominence to gender differences. In pamphlets, speeches, and in publications like *the Women's Journal*, the NAWSA emphasized the unique characteristics that entitled women to vote, including benevolence; women's traditional role in the home; and an inherent female interest in issues related to children, health, and education. In contrast to older feminist arguments that the vote was essential as a recognition of an equal humanity, NAWSA's emphasis on female differences rather than equality attracted hundreds of members from such disparate women's reform groups as the Women's Trade Union League, the Women's Christian Temperance Union, and the settlement house movement. In rhetorical arguments reminiscent of eighteenth-century notions of republican motherhood, suffragists claimed that women needed to be good citizens in order to be successful mothers and homemakers.<sup>55</sup>

Modern-day historians have tended to depict this increased emphasis on gender differences as a calculated political strategy designed to advance women's interests within the context of a hostile opposition. Late nineteenth-century socialists like Charlotte Perkins Gilman rejected tradi-

tional views of women's separate sphere and argued for a full equality of the sexes.<sup>56</sup> From the perspective of writers like Gilman, appeals to women's "special differences" and "worthy home membership" as a means of advancing suffrage can be interpreted as a clever—if insincere—rhetorical tactic designed to build a broad coalition among ideologically diverse groups of women. However, the majority of women who supported suffrage at the turn of the century were not feminist socialists. Most expressed views similar to those of the feminist Antoinette Brown Blackwell, who argued that men and women were "true equivalents—equal but not identical." Blackwell believed that the sexes complemented each other in a partnership necessary to the advancement of society.<sup>57</sup> Like Blackwell, the majority of American women, to varying degrees, also believed firmly in essential differences between the sexes, even as they agitated for equal political rights. For example, the women members of the largest conservative Christian groups supporting the suffrage movement were ideologically committed to the notion of separate spheres as a matter of religious faith.

Many of the rhetorical debates women used to advance suffrage reproduced and reinforced not only traditional views of women's separate sphere, but also deeply held beliefs about ethnic and racial inequality. Feminist scholars have documented the ways that northern suffragists often drew on anti-immigrant feelings to argue that one way to avoid "the ignorant foreign vote" would be to "give it to women." For their part, many southern suffragists claimed that giving the vote to women would swell the numbers of white voters in states where the blacks outnumbered whites.<sup>58</sup>

The concerns and attitudes reinforced through debates over competition in the workforce, gender differences, and women's political activism underlay reforms implemented in the nation's secondary schools. Conservative women argued that because women's place was in the home, the most practical life training available to girls was domestic science, a curriculum based on the applications of scientific principles to the routines and chores of the home. So-called pure science, once viewed as highly appropriate for young ladies, now conveyed a masculine aura. Some commentators characterized the rejection of scientific study for women as the expression of a societal fear that girls would lose their feminine traits. "It is my object to urge against the prejudice which still largely prevails in reference to scientific study for women," wrote Mary W. Whitney of Vassar College in 1883. "We are afraid it will make our girls rude and ungentele; in a word, will make them masculine."<sup>59</sup>

In response to social concerns, several large school districts began to experiment with ways to differentiate life science offered the two sexes in coeducational public schools. In a highly publicized experiment in limited segregation in Englewood High School in Chicago in 1906, principal J. E. Armstrong tracked boys into science courses that emphasized experimentation and logical reasoning, and girls into courses that focused on the application of scientific principles to the activities of the household. Armstrong reported the experiment to be a success; grouped together and sheltered from academic competition with girls, boys' enrollment increased from thirty-four to thirty-eight percent.<sup>60</sup> Reporting on a similar ex-

periment several years later, Earl Barnes remarked approvingly that in the Girls' Evening High School in Philadelphia, "the only science courses given . . . are those in domestic science."<sup>61</sup>

Not everyone embraced such reforms. Liberals, interested in correcting gender inequalities in the workplace, argued that girls should have equal rights to the trade and vocational education afforded boys. The National Women's Trade Union League expressed the view that "young women should have access to the same training and educational opportunities as young men." The league strongly objected to the growing practice in some high schools of offering domestic science to girls and limiting trade training to boys. In a speech at the league's 1913 biennial meeting, Margaret Dreier Robins described a case at one school in which boys learned elementary physics, mechanics, and electricity in the science course of an industrial education program, whereas in a differentiated science course, girls studied the removal of stains from clothing and the action of alkalies.<sup>62</sup>

In spite of scattered protests against offering domestic science to working-class girls and industrial science to boys, some school districts experimented with sex-segregated science courses in an effort to adapt science content to the presumed life goals of the two sexes. For example, in 1915, a physics teacher in Seattle authored an article advocating the new method of segregating and differentiating science courses, noting that it was now possible to omit "much of the most difficult part for the girls" and present more challenging material to the boys.<sup>63</sup> In the same year, a high school in San Jose, California, offered a physics course for girls, in which students learned about vacuum cleaners, sewing machines, "the illuminating power of wall surfaces, the efficiency of lamps, and a comparison of colors."<sup>64</sup> In 1919, chemistry teacher Will Couson described a course he had designed specifically for girls, claiming, "Eminent educators have practically agreed that the highest training that can be given girls is that which pertains to home life." Reflecting these views, Couson's chemistry course included such topics as "How to make good bread."<sup>65</sup>

Despite the glowing reports as to the ostensible success of such experiments, the practice of providing segregated instruction in science classes never became widespread, largely for reasons of financial and institutional constraint. Offering separate courses to boys and girls was costly, requiring additional faculty and a large student body from which to create multiple courses. Few high schools had sufficiently large enrollments to allow the kind of sex segregation undertaken in Chicago and Seattle. In 1904, more than sixty-six percent of students attended relatively small high schools, with faculty of only one to ten teachers.<sup>66</sup> Instead, high schools began to differentiate their curricula by introducing sex-typed vocational courses, usually offered as electives. For example, in 1904, Wisconsin required its public high schools "to gradually introduce [for the benefit of boys] work in wood, mechanical drawing, forge work, and work with the lathe in metals, together with work for girls in sewing and cooking."<sup>67</sup> By 1920, most public and private secondary schools in the nation offered their students some form of vocational training along these lines, together with commercial or business courses.

The impetus for the home economics movement came largely from women themselves. The General Federation of Women's Clubs (GFWC) took the position that young women's studies should be consistent with their future roles as wives and homemakers. Rather than study algebra, Greek art, and Latin verbs, GFWC members argued that girls should learn about cooking, mending, hygiene, and health. Some leading women magazines promoted and popularized this view as well.<sup>68</sup> The educator Earl Barnes noted in 1912 that "one of these journals, which boasts a fabulous circulation . . . opposes the larger interests of women in education, industry, and political life." Although a conservative himself, Barnes found it ludicrous that American women would pay "one dollar and a half a year to read monthly articles telling them 'to go back to their kitchens, churches, and children.'<sup>69</sup>

Nellie Kedzie Jones, pioneer founder of the first home economics department at Kansas State Agricultural College, recalled that when the subject first appeared in colleges and universities during the 1880s, many male college authorities opposed it on the grounds that "My wife knows how to keep house," and "there is no need to teach girls to cook."<sup>70</sup> Similarly, in 1882, the city superintendent of Omaha questioned the value of introducing a domestic economy course in the city's high schools, noting that girls already "learn every kind of home industry" within the family circle.<sup>71</sup>

At the college and university level, the growing field of home economics offered college-educated women increased employment opportunities as members of university faculties. According to Jones, after the home economics department at Kansas State Agricultural College staged a successful, highly publicized exhibition at the Chicago World's Fair, "it was not long before young women were called on to go to other Land Grant colleges to organize departments for teaching homemaking."<sup>72</sup> Often the first full professorships awarded to women went to faculty members in departments of domestic science. For example, Cornell University elected Martha Van Rensselaer of the College of Home Economics its first female professor in 1911.<sup>73</sup> Nellie Jones was the first woman granted an emeritus professorship at the University of Wisconsin at Madison.<sup>74</sup>

Home economics appealed to members of the middle and upper classes who promoted the subject as a means of solving a growing servant problem. According to historian Jane Barnard Powers, between 1910 and 1920 the number of domestic servants nationwide fell by approximately twenty-five percent as working women sought higher-paying jobs in manufacturing and other growing sectors of the labor market. Federation Club women noted with anxiety the increasing scarcity of servants and the low skills of the few workers available. "It is perplexing," commented one club woman, "because working women are generally unwilling to accept domestic service as a means of gaining a living, and . . . the woman heads of families are doing little to improve the situation."<sup>75</sup>

In contrast to earlier generations of educators who had sought, without much success, to introduce domestic science to middle- and upper-class girls in private secondary schools, middle-class women now targeted

lower- and working-class girls, often of immigrant parentage, as the audience most in need of domestic training. "I hail with delight," wrote Wisconsin's state superintendent in 1904, "[and trust it is not a mere passing fad, that many of the wealthiest women and leaders in society are, within the last few years, beginning to give time, money, and the weight of their influence in the direction of training girls in the supervision and care of the home."<sup>76</sup>

Another factor in the increased support for home economics was the desire of many parents and educators to offer girls courses comparable to the new vocational programs available to boys. At the college level, Nellie Jones reported that in spite of initial resistance, "as women began to see how their daughters enjoyed the work, pressure was brought to bear, and many a college . . . [added] Home Economics . . . just to please the women."<sup>77</sup> As the home economics movement gained ground, well-meaning male educators also began to pressure local school authorities to add home economics courses. For example, during a visit to the high school in Bloomer, Wisconsin, inspector R. A. Walker noticed in 1928 that the school "offers no instruction in home economics," although it provided "instruction in agriculture for the boys." Walker wrote to the principal to suggest that, in all fairness, "girls are entitled to as much consideration with respect to home economics . . . you have plenty of room in the building which might be fitted up for domestic science."<sup>78</sup> Marching boys' vocational courses with similar offerings for girls also solved administrative scheduling problems. Historian Geraldine Jongich Clifford notes that the introduction of home economics and other sex-segregated courses for girls effectively balanced boys' and girls' courses so as to preserve the basic educational mix in the remaining areas of the curriculum.<sup>79</sup> Finally, home economics courses, like other sex-typed courses, undoubtedly appealed to female students who enjoyed participating with other girls in activities related to girl culture. According to Jones, shortly after she joined Kansas State Agricultural School to establish its new department of home economics, "a group of girls graduating next commencement came and asked for a sewing class." In response, Jones suggested that each sew her own graduation dress, with the result that at commencement, "the newspapers made great stories of the beautiful dresses, and thereafter sewing was a permanent course for every girl in college."<sup>80</sup>

Although sometimes billed as a form of science—and described under such various names as "home science," "domestic economy," "household science," "science and art," or "home management"—Jones gave her opinion that "what ever name was used, the teaching was homemaking."<sup>81</sup> George Counts of Teachers College, Columbia, corroborated this view in a secondary school survey conducted in the mid-1920s, concluding that the field consisted primarily of cooking and sewing classes rather than science.<sup>82</sup> Contemporary photographs of high school girls in so-called domestic science classes support these characterizations (Plate 7.1).

In spite of fairly widespread support among educators and community members, home economics was never as popular among high school girls



Plate 7.1 Young Girls' Class in Domestic Science, 1909, WHI-3216. (Courtesy of the Wisconsin Historical Society.)

as were the newer commercial courses (Table 7.5). College-bound girls, often from wealthier middle- and upper-class families, preferred instead to concentrate on courses that were required for entrance to colleges and universities. Those seeking employment directly after high school sought to learn clerical skills in the hopes of landing office jobs that paid higher wages.

Commercial education afforded girls a greater degree of respectability and status than did home economics. Clerical work was a white-collar oc-

Table 7.5 Percentage of Public High School Students Enrolled in Typewriting, Industrial, and Home Economics Courses, 1910-1949

	1910	1915	1922	1928	1934	1949
Typewriting	—	—	13.1	15.2	16.7	22.5
Industrial	—	11.2	13.7	13.5	21.0	26.6
Home economics	3.8	12.9	14.3	16.5	16.7	24.2

Source: "Offerings and Enrollments in High-School Subjects," *Biennial Survey of Education in the United States, 1948-1950* (Washington, D.C.: U.S. Government Printing Office, 1951), 107-08.

cupation that offered some degree of economic and social mobility. Some women climbed a ladder of advancement that led, within the restricted sphere of female office work, to the desirable position of private secretary.<sup>83</sup> It was also a respectable way for young women to earn a living before marriage and meet promising young men "on the job," becoming for the first time a significant alternative to teaching. In a study published in 1922, George Counts reported that in Bridgeport, Connecticut, eighty-eight percent of working-class high school girls enrolled in commercial courses. And in New York, whereas first-generation Italian-American families had encouraged their daughters to leave school early to go to work, by the second generation girls stayed longer in school, in part to obtain the training necessary for white-collar jobs in the city's growing clerical labor force.<sup>84</sup>

The first three decades of the twentieth century witnessed a fourfold increase in the percentage of girls enrolled in commercial courses in the last four years of public high school.<sup>85</sup> The growth in commercial course enrollments paralleled the enormous growth in office and sales work during this period. Historian Maurine Weiner Greenwald demonstrates that during the decade from 1900 to 1910, growth in industrial production created an expanding market for support services, telephone communications systems, insurance firms, advertising companies, and mail-order houses. At the same time, the spread of high school commercial training created a growing supply of young women available and qualified for office employment. Greenwald shows that "the shift toward specialization was accompanied by a feminization of the clerical field," as the number of women employed in clerical work more or less doubled each decade from 1870 to 1910 (Table 7.6).<sup>86</sup>

The events of the First World War created an increased number of openings in clerical work, which women quickly filled. For example, tens of thousands of women gained entry to clerical positions in the railroad industry during the national emergency produced by the war. After the war ended, some employers continued to hire women in preference to men for such work, because, in the words of a Women's Service Section inspector, "They are not so damned anxious to get out and rustle around. Women are

Table 7.6 The Ascendancy of Women Office Workers, 1870-1910

Year	Total number of office workers	Number of women office workers	Women as percent of all office workers
1870	68,819	1,823	2.6
1880	139,819	6,610	4.7
1890	380,141	73,603	19.4
1900	614,509	179,345	29.2
1910	1,525,757	575,792	37.7

Source: Maurine Weiner Greenwald, *Women, War, and Work: The Impact of World War I on Women Workers in the United States* (Westport, Conn.: Greenwood Press, 1980), 9.

more content with the detailed monotonous work because they are filling in between school and marriage."<sup>87</sup>

In spite of the rhetoric of their supporters, home economics and commercial courses never succeeded in truly vocationalizing American high schools.<sup>88</sup> The majority of girls continued to enroll in the basic academic courses, in part because such courses already equipped women to be teachers, office workers, or sales clerks. In the basic courses, girls learned to speak, write, calculate simple sums, and take directions. In the twentieth century, it was increasingly the high school diploma itself, rather than a list of completed commercial courses, that helped a young woman land her first job. For example, the telephone companies preferred girls with high school experience; a survey conducted in 1912 found that eighty-seven percent of Boston's telephone operators had been to high school.<sup>89</sup>

Nevertheless, not every student was able to avoid home economics, in spite of its elective status at most secondary schools. One of the first educational institutions of higher learning open to African-Americans offered a vocational education curriculum designed to cultivate students' industry. The Hampton Normal and Agricultural Institute, established in 1868 for the education of freed slaves living near Hampton Roads, Virginia, opened its doors to American Indian students ten years later. Besides taking the required elementary subjects, female students were expected to master the household arts. In 1898 the institute opened a domestic science department, in which female scholars prepared for careers as home economics teachers, seamstresses, cooks, and laundresses.<sup>90</sup> The Hampton Institute served as a model for schools across the state. For instance, in 1910, the supervisor of colored rural elementary schools reported, "Hampton Institute has been our leader in negro education, and has amply demonstrated the wisdom of this policy by training many hundreds of negroes to lives of social and industrial efficiency in the various communities into which they have gone and become leaders of their race. The problem it seems to me is to extend and project this ideal and this practical training from Hampton as a center to all the rural schools of the state."<sup>91</sup>

Educators at Tuskegee Institute further elaborated and defined the model of vocational education developed at Hampton Institute. Established in 1880 in Macon County, Alabama, Tuskegee Institute became best known as the site for Booker T. Washington's philosophy of industrial education for African-Americans.<sup>92</sup> The curriculum at Tuskegee emphasized the importance of domestic science for girls. As noted by one advocate, "[T]he girl in the laundry does not make soap by rote but by principle; and the girl in the dressmaking shop does not cut out her pattern by luck or guess or instinct or rule of thumb, but by geometry."<sup>93</sup> The trend toward vocational education for African-Americans appears to have spread during the subsequent three decades. For instance, in 1922, a news article in the *Wilmington Star* in North Carolina provided an enthusiastic description of the town's new high school for African-Americans: "[In 1914] the colored people also came in for their part of the improvements—the board of education erected a handsome school for the higher grades on the land given to the city by the government in 1910. This building, erected at a cost of \$20,000, contains

nine large recitation rooms above the basement, with two recitation rooms and other rooms in the basement. This is the beginning of a real industrial school in New Hanover county; as classes are taught there in domestic science, including sewing and cooking and in agriculture."<sup>94</sup>

In spite of the apparently widespread approval for vocational education and home economics training on the part of some educational and community leaders, there is documentary evidence to suggest that in some locations, African-American teachers resisted this curricular trend. For example, the supervisor of colored rural elementary schools in Virginia noted in 1910, "The average negro teacher is untrained, and is ambitious to use many books, and to teach the so-called 'higher branches.' The supervising teacher will prevent this mistake by showing the teachers how to connect the school with the child's every day life through simple forms of industrial work, and by planning a course of study and work that will fit them for a useful and happy life in their own community."<sup>95</sup>

Although evidence is sketchy because of the lack of data on special home economics programs, it appears that school authorities in so-called colored schools more frequently required African-American girls to take the subject than did school authorities in institutions serving white students. For example, the subject was required for female African-American high school students in Winston-Salem, North Carolina.<sup>96</sup> Such differential treatment, coupled with discrimination in the workplace, may explain why few African-American women gained access to clerical work, even in large northern cities; in 1920, only one percent of their nonagricultural employment was in clerical and sales jobs. In that year, three-fourths of employed African-American women worked as farm laborers, servants, and laundresses.<sup>97</sup>

Whether by choice or by school mandate, female enrollments in home economics and commercial courses came at a cost to other subjects. Consistent with their greater persistence in high school, in 1890, a preponderance of girls had filled high school science and mathematics courses (Table 7.7).<sup>98</sup> However, the years from 1910 to 1922, witnessed a precipitous drop in girls' mathematics enrollments, accompanied by a commensurate rise in total commercial enrollments. Similarly, the percentage of girls enrolled in chemistry and physics declined by two-thirds (Table 7.8).

Table 7.7 High School Students Enrolled in Selected Subjects in the Last Four Years of Public High Schools, 1890

	Males	Females
Physics	19,125	26,912
Chemistry	8,415	12,064
Algebra	38,505	53,360
Geometry	18,445	24,708
Trigonometry	5,184	4,545

Source: John Francis Latimer, *What's Happened in Our High Schools?* (Washington, D.C.: Public Affairs Press, 1958), 149.

**Table 7.8** Percentage of Girls Enrolled in Selected Subjects in the Last Four Years of Public High Schools, 1890-1948

	1890	1900	1910	1922	1928	1948
Chemistry and physics	33.6	26.1	18.5	12.8	10.2	10.2
Algebra and geometry	67.3	83.5	84.2	56.7	49.4	42.6
Commercial	—	11.8	11.1	44.4	47.0	48.5
Home economics	—	—	—	26.4	29.8	30.1

Source: John Francis Latimer, *What's Happened to Our High Schools?* (Washington, D.C.: Public Affairs Press, 1958), 149-150.

In order to enroll in commercial and home economics courses, students had to give up a number of other subjects not required for graduation or for entrance to college. In 1894, the Committee of Ten recommended that two units of mathematics and one of science be required for entrance to college.<sup>99</sup> By 1910, most high schools offered biology in the tenth grade chemistry in the eleventh grade, and physics in the twelfth. Students desiring to prepare for entrance to college could fulfill the usual requirements by taking biology. Because of the nature of graduation and college entrance requirements, and because of their placement in the higher grades, chemistry and physics assumed the status of elective subjects, a phenomenon resulting in declining enrollments, not just among girls, but among boys as well. "At the present rate of decline," warned an anxious science educator in 1909, "physics will disappear from the high school curriculum about the year 1930."<sup>100</sup> The intellectual challenges of physics and chemistry were simply not worth the effort for young women who did not require the subjects for high school graduation or for entrance to college. As high school student Florence Peck explained in her diary in 1901, "Tried chemistry. And flunked. It is the horridist of hateful things to flunk. I will, I shall drop it . . . I won't need it for the university of Rochester! and that is where I shall go on account of the 'lonesome dollars' in the E. C. Peck family."<sup>101</sup>

Bucking the trend, biology enrollments actually rose during this period (Table 7.9). Biology served as a preparatory course for the further study of medicine. During the 1880s and 1890s, increasing numbers of medical

**Table 7.9** Percentage of Boys and Girls Enrolled in Biology in the Last Four Years of Public High School, 1910-1948

	1910	1922	1928	1948
Males	1.0	8.9	13.2	19.5
Females	1.2	8.7	14.0	19.5

Source: John Francis Latimer, *What's Happened to Our High Schools?* (Washington, D.C.: Public Affairs Press, 1958), 149.

schools began to accept female students training to become doctors. Middle-class parents did not consider nursing a suitable occupation for their daughters until relatively late in the nineteenth century, but between 1900 and 1910, the numbers of trained nurses increased sevenfold; by 1920, nursing had become a respected profession among women.<sup>102</sup> In part, the increase in biology enrollments may also have been due to the subject's grade placement, coupled with a concomitant drop in girls' mathematics enrollments. The lack of a secure foundation of mathematics left many girls ill-prepared to undertake the study of chemistry and physics. Students of both sexes possibly preferred to fulfill their single science requirement by taking biology in the ninth or tenth grade before turning to other subjects in grades eleven and twelve. Finally, the social and cultural construction of the life sciences as particularly suitable for women, an ideology reinforced through the nature-study movement, may have continued to make this subject attractive to girls.

As part of the wider effort to adjust schooling to students' presumed life goals, a growing number of school districts began to reduce or eliminate the high school mathematics course requirement for girls. By the turn of the century, educators from both ends of the ideological spectrum increasingly questioned the value of requiring girls to study advanced mathematics. For example, in 1900, the *Report of the Commissioner of Education* quoted writer Rebecca Harding Davis, who asserted that girls would be far better prepared "for a full, happy life by a course in dressmaking or cookery and arithmetic," than through the study of "trigonometry and art."<sup>103</sup> In a similar vein, Joseph Van Denburg noted the apparent irrelevance of algebra to everyday life when he studied New York City high school students around 1910. Denburg concluded that high school seemed "hard, uninviting, and entirely out of keeping with what appear to be the realities of life. The contrast between the abstractions of algebra and the life of the neighborhood is too great to be bridged, save by an arch of faith which few indeed can construct."<sup>104</sup>

In 1904, Wisconsin's state superintendent noted that many public high schools had adopted a proposal to make Latin and advanced algebra elective subjects.<sup>105</sup> In 1910, the independent high schools of Wisconsin arranged, with the approval of the state university, courses "which do not require algebra in the first year, and which do make physics an elective study for girls."<sup>106</sup> By 1917, some of the public high schools in the state had followed suit, cutting algebra as a required subject to half a year, or even making it "an elective altogether for students in vocational courses, such as agriculture and domestic science."<sup>107</sup>

In 1914, E. R. Breslich of the University of Chicago High School noted a recurring nationwide demand that girls be allowed to graduate from high school without any algebra. According to Breslich, the question had been "discussed throughout the country by parents and teachers, by administrative officers, and professors of education." Breslich felt that the main question was not whether algebra was more difficult for girls than for boys; in his own experience, he had found that girls often excelled boys in algebra.

Rather, the opponents of algebra denied that its study was of value to young women. Dr. J. H. Francis, superintendent of the Los Angeles schools, caused a stir during the National Education Association meeting that year when he reportedly exclaimed, "God bless the girl who refuses to study algebra. It is a study that has caused many a girl to lose her soul." Dr. Francis reportedly recommended replacing algebra with courses in costume designing for girls.<sup>108</sup> According to Breslich, as increasing numbers of American high schools lowered or eliminated their mathematics requirements for high school graduation, "many pupils did not take any mathematics."<sup>109</sup>

The movement to reduce or eliminate the mathematics requirements in high schools stemmed both from efforts to make schooling more "socially useful" and from new developments in the field of psychology. Throughout most of the nineteenth century, educators believed that any form of mental discipline improved the minds of school students in a general way. Since the eighteenth century, this rationale had served as a popular defense for the study of the classics and advanced mathematics. As discussed in Chapter 1, it also served to justify the introduction of the sciences in girls' courses of study before midcentury. At the dawn of the twentieth century, however, the theory of mental discipline came under attack from such scholars as Edward L. Thorndike and Charles Judd, who reported numerous unsuccessful attempts to demonstrate any transfer of learning from one setting to another.<sup>110</sup>

The effort to provide girls with a more "practical" education, one more suited to their supposed future goals, received added impetus from the creation of a new professional field: vocational guidance. The first National Conference on Vocational Guidance took place in Boston in 1910. Three years later, leaders of this new movement founded the National Vocational Guidance Association.<sup>111</sup> In 1910, a National Education Association Committee, asked to make recommendations concerning the vocational education of girls, expressed a common view among professional guidance counselors: "The girls in our schools will be the wives and mothers of the next generation and the courses of study should be so laid out that these girls will lead happier and richer lives and will be more successful as the future homemakers of our cities."<sup>112</sup> Guidance professionals aimed to match the talents of the individual to the job. They believed that based on a scientific study of education and the workplace, appropriate vocational training and guidance could assist pupils to fill their proper roles in society. In 1913, Thorndike wrote optimistically that once trained in the principles of vocational guidance, "the average graduate of Teachers College in 1950 ought to be able to give better advice to a high school boy about the choice of an occupation than Solomon, Socrates, and Benjamin Franklin all together could give."<sup>113</sup>

What sort of counsel did guidance professionals offer girls? In the literature published for an audience of parents and educators, guidance professionals described a far more limited range of career choices for girls than for boys. Most expressed the belief that girls were destined to become

homemakers. "In answer to the question, 'What ought women to be?'" wrote Marguerite Stockman Dickson, a leader in the vocational guidance field, "we say boldly, 'A homemaker.'" According to Dickson, one obstacle to women's successful pursuit of her "ultimate vocation" as homemaker was "the instruction of the times [which] has imbued her with too little respect for her calling."<sup>114</sup> For those girls who sought to enter the workforce, Dickson and other authors followed the recommendations of the National Education Association's Committee on the Vocational Education of Females, which had suggested that girls "train for work in distinctly feminine occupations."<sup>115</sup> Thus, guidance books recommended for girls a narrow range of such sex-typed occupations as factory work, dressmaking, food production, salesmanship, teaching, nursing, and social work.<sup>116</sup>

Such recommendations represented a distinct departure from earlier views. During the 1870s and 1880s, middle-class women had expressed confidence in the opportunities available to them in science, particularly as educators. Those women who needed to work for a living, stated a speaker at the New England Women's Association in 1884, could find "an ample field" in "scientific observation . . . as teacher, curator, lecturer in chemical, physical and biological laboratories, principal and superintendent of schools or professor of pedagogy."<sup>117</sup> However, within the span of a single generation, women began to express doubts that more than a talented few would ever earn a decent living through scientific study and research.<sup>118</sup> More importantly, the field of science generally, once perceived as a source of enjoyment and opportunity for women, increasingly appeared inappropriately unfeminine as the twentieth century began to unfold.

## CONCLUSION

Declining female enrollments in advanced science and mathematics courses accompanied increasing enrollments in subjects that contemporaries viewed as more useful, worthwhile, or appropriate for girls. When colleges and universities opened their doors to women, many college-bound girls, like their British sisters, abandoned the sciences to take up the study of Latin, an entrance requirement at some institutions just after midcentury. As American institutions of higher learning generally abandoned the classics requirement for admission near the end of the century, young women continued to enroll in liberal arts courses; a territory they had already staked out as their own.

Latin, a subject that underwent a dramatic shift from a traditionally male domain to one that contemporaries viewed as more suitable for girls, represents an interesting case in the gender stereotyping of the curriculum. From the perspective of the eighteenth century, it is difficult to identify a subject more strongly associated with men than Latin, largely because of its historic association with the traditionally male clergy. Nevertheless, young women predominated in Latin classes at the end of the nineteenth

century, a move that apparently was not motivated by any attempts to differentiate the curriculum specifically for a female audience. Instead, the transformation occurred because leading female educators strongly supported its inclusion into the curriculum, because knowledge of Latin helped women gain access to higher education, and because there existed virtually no resistance to the presence of females in Latin classes during an era when the subject faced declining male enrollments. In other words, Latin became "feminized" in secondary schools simply because girls came to dominate the subject.

The efforts of progressive educators to make schooling more "practical" for boys and girls also inevitably drew additional enrollments from science and mathematics classes. Young women enrolled in commercial courses in high school to prepare for work in the expanding clerical market. Students interested in working in the home, or those believed destined to become domestic servants, enrolled in domestic science, or home economics courses. High school guidance counselors undoubtedly contributed to changing enrollment patterns by steering young women away from advanced science and mathematics courses into classes deemed more vocationally appropriate, a trend that appears to have been strongest among African-American girls and those from families recently immigrated to the United States.

The introduction of home economics at the secondary level had a long range. Negative influence on the enrollment of girls in higher mathematics, chemistry, and physics classes. Some scholars have argued that the nineteenth-century Victorian domesticity championed by Catharine Beecher that ultimately evolved into the twentieth-century home economics movement focused more on professional careers for women than on keeping women in the home. Recent research supports this viewpoint by documenting the ways that women scientists, unable to find academic employment in chemistry or physiology departments, found a niche for their work in home economics in many institutions of higher education.<sup>119</sup> Nevertheless, although home economics departments may have created faculty positions for women scientists in chemistry, nutrition, and health, the documentary sources analyzed for this study indicate that the introduction of home economics at the secondary level contributed to a reduction in the numbers of young women entering institutions of higher education with the necessary background to major in a scientific field. At the high school level, home economics—also known as domestic science—offered little or no scientific content. Instead, classes for adolescents generally focused on cooking, sewing, and life in the home.

Considerations of social class played a large role in the selection of subjects that women viewed as appropriate for study. Secondary course-taking patterns suggest that near the end of the century, middle- and upper-class native-born white girls continued to enroll in the basic liberal arts classes in preparation for college. Noncollege-bound white girls appear to have predominated in the commercial courses. When they recommended home economics as an addition to the high school course of

study, many middle- and upper-class white women targeted girls from the working classes and minority ethnic groups, particularly African-Americans and those recently immigrated to the United States. At the high school level, where home economics courses experienced disproportional enrollments of immigrant and African-American girls, the movement served as a mechanism for tracking certain ethnic and racial groups into training focused on domestic service, a trend that reinforced the relative dominance of white middle-class women in higher-paid clerical and professional work.

Although some scholars have speculated that a decline in feminist activity after the suffrage victory contributed to a decline in women's participation in science, at the secondary level it is not clear that late nineteenth- and early twentieth-century feminism served to promote female interest and participation in science. Rhetoric that stressed women's separate sphere and commitment to the home provided support to the creation of home economics classes and science courses that attempted to differentiate content along gender lines. From the standpoint of its contemporary supporters, home economics offered the opportunity to elevate the status of women's work, create employment opportunities in institutions of higher education, and provide training to young women interested in becoming homemakers or poised to enter domestic service. If women had concerns about the impact of such vocational courses on girls' secondary science enrollments, they rarely—if ever—voiced them.

Discriminatory practices in secondary schooling reflected widely held beliefs about class, race, and ethnicity. Throughout contemporary debates over gender and science, educators rarely questioned the underlying assumption that a student's social class, ethnicity, or gender largely determined what he or she should study. Whereas on the one hand, efforts to track students of particular class or ethnic groups into vocational courses in secondary institutions can be attributed to the contemporary belief that such training constituted the fairest, most equitable form of schooling possible for a child unlikely to have the financial resources to pursue a college degree, institutional policies that discriminated among girls according to class and ethnicity persisted in high schools for decades, serving as an important barrier to the continued study of science and mathematics. Similarly, although the broad acceptance of gender differences that supported the creation of separate arenas of study and professional employment for women created higher-status professional positions in institutions of higher education, middle-class white women predominated in these positions. At the turn of the century, few middle-class white women appear to have questioned the desirability of creating expanded opportunities in institutions of higher education for their social equals while supporting educational programs at the secondary level to track their presumed social inferiors into lower-paying careers such as domestic service.

Although little reliable data exist on the number and distribution of women scientists during these decades, we know that some women persisted in taking up scientific research. Data compiled by Margaret Rossiter

suggest that in 1921 women attained twelve percent of the total doctorates awarded in botany, eleven percent in zoology, four percent in medical sciences, three percent in chemistry, and two percent in physics. These proportions appear extremely low by today's standards, but they would decline over subsequent decades. Within the context of a growing backlash against women's entry into the workforce and a national atmosphere supporting the development of segregated, distinct spheres of professional activity for women, women scientists would encounter great difficulty obtaining positions in male-dominated academic departments. The arguments advanced by women to support women's distinct sphere of professional activity would also have the unforeseen negative consequence of strengthening efforts to differentiate the secondary science curriculum offered the two sexes in the core academic program, a development that is explored in the following chapter.

## Physics for Boys

### 8

During the years following the First World War, two related shifts occurred in the direction and leadership of science education. First, the coalition that had bound together the nature-study movement unraveled. As meteoric as was the rise of nature study near the close of the nineteenth century, its decline occurred with even greater rapidity. In the words of one scholar, the movement was "all but dead" by the early 1930s.<sup>1</sup> Second, although women had come to dominate the leadership of the nature-study movement, the new national associations and organizations in science education that came to power after the war were almost entirely composed of men concerned to increase male enrollments in science.

The new leaders in science education urged a greater emphasis on the physical sciences and recommended the use of textbooks at the elementary level. The schoolbooks that came to market as a result of this policy shift tended to depict physics as a masculine field of endeavor. Such representations stood in stark contrast to the physics textbooks females had encountered more than a century earlier, in which refined ladies discoursed on the concepts underlying various experiments in physics and chemistry.

How can we explain the gender stereotyping of science—particularly physics—as a male school subject in the twentieth century? As discussed in the previous chapter, the nineteenth-century movement to improve female access to colleges and universities led to a decreased emphasis on science in favor of an increased focus on the classics and the liberal arts. Coupled with the vocational movement in secondary education, these educational reforms played a significant role in diverting female enrollments away from science and mathematics courses in secondary schools. Nevertheless, these developments alone do not explain the decline of nature study and the gender stereotyping of physics.

Scholars interested in gender and science have given little attention to factors influencing student science enrollments in high schools during the early and midtwentieth century. This era has significance, because the number of women receiving advanced degrees in science declined steadily from 1920 onward, reaching a low in 1960. Although women's representa-

ASTRONOMY



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