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“Integration does not simply place people side by side...rather, it remakes America, creating a new community founded on a new form of respect and tolerance” (p. 299). Are we there yet?

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The Science Education of American Girls: A Historical Perspective

Kim Tolley
Routledge/Falmer, 2003
\$39.95, 256 pages

Reviewed by William Watson

In *The Science Education of American Girls: A Historical Perspective*, Tolley challenges culturally developed and accepted notions of American girls' lower aptitude, participation, and success in pre-college science and mathematics courses. Tolley's research uncovers the politics, competition, and power relationships encompassed by the struggle to establish and maintain equal rights for women in science education. The author thoughtfully and thoroughly investigates primary sources to explore how events in American history helped to shape perceptions of women and the ways in which those perceptions have influenced schools, curriculum, and science education.

Tolley begins after the American Revolution, when geography—including elements of biology, physics, geology, and astronomy—was the school science of the day. Geography education was considered a boys' subject because it was perceived that exploration and scientific investigation were the domain of men. Nevertheless, some girls were taught in the private schools that served boys on the rationale that the girls would eventually become mothers, and as mothers, they would be responsible for their sons' first exposure to science.

At the dawn of the 19th century, attitudes shifted, and the classics eclipsed science in academic importance. Classics were taught almost exclusively to boys, usually to the exclusion of science. Education of girls in private academies became more accepted, with science perceived as a source of academic rigor for girls. The growing acceptance of the tenet of natural theology, which

suggested that a study of nature could help all children to have a greater understanding of God, aided the cause to teach science to girls.

The introduction of science to girls was embraced by the scientific community because a population of young, willing students of science provided an audience for their lectures and a cheap labor source for data collection and laboratory work. Despite the fact that women were beginning to find employment as assistants to scientists, and later as science teachers, some important educational leaders of the time led a movement to offer “domestic science” to girls. This term was used to refer to a course of study that focused on the applications of science in the home, such as mixtures and reactions in cooking or the best ways to clean clothing. The argument for domestic science for girls lost to the counterargument to continue to advance “pure” science education for girls. Pure science was considered more rigorous than the alternative and increased the prestige associated with girls’ schools.

Closely associated with pure science was mathematics, which provided girls with the tools they needed to study the math-intensive physical sciences, chemistry and physics. By the end of the 19th century, girls were more likely to stay in school long enough to study the advanced sciences than boys, who often left school to seek employment. In fact, by that time, girls were taking as many chemistry and physics classes as boys in both private and public schools, and in many cases, they were outperforming boys on public examinations.

Despite the evidence that girls were thriving in math and the physical sciences, there was never widespread acceptance of these subjects as “girls’ subjects.” As the Industrial Revolution took hold in the United States, popular women’s magazines portrayed industrial jobs related to chemistry and physics as cold and institutional in an effort to reinforce the culturally accepted notion that these jobs were not appropriate for women, whose proper realm was thought to be “domestic duties” and “in the home” (p. 99).

The industrial revolution did provide women with an entrée into careers in the biological sciences, which, unlike physical sciences, were regarded to be in the sphere of women. Women were willing and able to continue to enter the labor force as field assistants for natural historians collecting data in natural environments and as teachers. However, while nature study was providing job opportunities for women who had studied science, several developments were actually contributing to a decline in enrollment in science at girls’ higher schools, or schools “that provided instruction beyond the common school level” (p.19). Colleges had begun to open their doors to women, so the focus of private girls’ higher schools shifted to the classics, which were a prerequisite for admission to most colleges. At the same time, vocational studies

for daughters of working- and lower-class families, immigrants, and African American girls were advocated. Vocational studies, analogous to home economics courses, were the realization of the call for domestic science half a century earlier.

World War I shifted the nation's priorities so that by its end the nature study movement was all but dead, and science in the United States took on a serious tone, as emphasis was put on discoveries geared toward national defense and security. Because of a lack of boys studying subjects in which they were now supposedly needed, programs were instituted specifically designed to increase the participation of young boys in science and to decrease the feminizing effect of women teachers (p. 177). These developments continued as part of a larger backlash against women in the workforce that was intensified by the Great Depression and, later, the return of soldiers from World War II. Science careers for women reached all-time lows, aided by an increased focus on domestic science, repackaged as "life adjustment education," for girls.

Tolley does not leave the reader with this grim picture as an enduring image of science education for American girls. In the conclusion, the author describes a significant increase in enrollment in science classes and in science careers for women since the early 1960s and attributes it to the signing of affirmative action legislation in 1968. Tolley leaves little doubt that girls are every bit the equal of boys in their aptitude for science, and the author's primary explanations for girls' historical exclusion from science are cultural norms, expectations, and biases—so much so that it is puzzling that the sources of the cultural norms are not pursued in more detail. Richer explorations of these biases would paint a clearer picture of what steps might be taken today to provide high school educational opportunities for girls that would continue to shift cultural beliefs and help to combat the under representation of women in science careers.

Ultimately, *The Science Education of American Girls: A Historical Perspective* is a book not only about the science education of American girls, but also about the science education of all American children and the factors that influenced it. It is about the role that American culture—as well as the roles of men and women who shape and are shaped by that culture—plays in defining science education for boys and girls. Although arguing that science classes were once the domain of girls, Tolley is clear that the establishment of women in science careers has been an uphill battle from the dawn of the nation. It is promising that we have made gains since that time, but it is equally clear that we have a long way to go.