

Evidence from *The Mathematics Teacher* (1908-1920) on Women and Mathematics

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In September 1908, the Association of Teachers of Mathematics of the Middle States and Maryland began publishing a quarterly journal, *The Mathematics Teacher*, which eventually was adopted as the official journal of the National Council of Teachers of Mathematics upon its founding in 1920. The intervening historical period (1908-1920) was rife with political and social movements concerned with the redefinition of the role and status of women in American society. The paper examines the first twelve volumes of *The Mathematics Teacher* to determine the extent to which changes in the American society as a whole, and in education in particular, were reflected in mathematics education of the period.

My analysis of evidence from early volumes of *The Mathematics Teacher* is divided into two sections. First, I present statistics which indicate the extent of active participation by women in the profession of teaching mathematics, a sphere traditionally and continually dominated by males. These statistics were derived by tabulating the number of each of the following: articles written by women, reports of conference papers delivered by women, mathematics books reviewed which were authored by women, and women on the membership roles and lists of officers of the Association.

Secondly, I deal with evidence which reflects the attitudes of the time concerning differences between boys and girls in learning mathematics. The debate during this period of educational history over the advantages and disadvantages of coeducation not only raised social and moral considerations, but also engendered discussion concerning differences in how the sexes learn and what they should study [Krug, 1964]. Around the start of World War I, new courses of vocational study were proposed for both sexes; for girls, for example, clerical and home economics courses were established. Several questions guided by research: Did *The Mathematics Teacher* show evidence of the debate over the need for vocational courses? Were there articles concerned with the need for changes in the mathematics curriculum for girls, with different teaching methods for boys and girls, or with the debate over coeducational mathematics classes?

Participation of women in mathematics education

A typical early issue of *The Mathematics Teacher* contained 15-20 papers, many of which were identified in footnotes as reprints of papers which had been delivered either at an annual meeting of the Association or at a local meeting of

one of its affiliated subsections. In addition to conference papers and original articles, each issue included a section of Notes and News of meetings of the Association and its affiliates (including lists of officers, programs from recent meetings, and lists of new members), an annotated list of recently published books, and, occasionally, a brief editorial or a lengthy report from a regional or national educational committee.

In *The Mathematics Teacher* of 1908-1920, women mathematics teachers were under-represented in publications in proportion to their numbers in the Association. A complete list of the members of the Association is given in the third volume, and again in the ninth volume. In these lists, women made up 41% and 43% of the members, respectively. In ten of the twelve years under consideration women held at least one of the elected officer's positions (Treasurer from 1909-1913, Council Member in 1914 and 1916, and Vice President from 1917-1919). In spite of these facts, in the first eight volumes of *The Mathematics Teacher*, only 22 of a total of 222 articles (approximately 10%) were written by women (see Table 1).

Table 1
Articles in *The Mathematics Teacher*, 1908-1920

| Volume Number | Total | By Women | Percent By Women |
|---------------|-------|----------|------------------|
| I | 22 | 2 | 9 |
| II | 15 | 0 | 0 |
| III | 19 | 0 | 0 |
| IV | 21 | 0 | 0 |
| V | 14 | 0 | 0 |
| VI | 20 | 2 | 10 |
| VII | 19 | 4 | 21 |
| VIII | 19 | 2 | 10.5 |
| IX | 22 | 3 | 14 |
| X | 20 | 3 | 15 |
| XI | 20 | 5 | 25 |
| XII | 11 | 1 | 9 |
| Total | 222 | 22 | 10 |

In the early volumes, contributions by women were almost nonexistent. Two papers attributed to Bertha Broomell in Volume I were actually papers read by her at the annual meeting for the absent Professor David Eugene Smith. No papers authored by women were published in Volumes II-V, although conference reports in those volumes show that women occasionally delivered between 1/4 and 1/2 of the conference papers. (Nevertheless, the great majority of speakers were men.) Each of the volumes VI-XII contains at least one paper by a woman (the average is approximately 1/6 of the total papers).

The book review section of each issue of the journal included short descriptions (and occasionally reviews) of newly published books on many topics of interest to educators (not just mathematics). The following analyses are confined to those books which pertained to mathematics. The number of mathematics books listed which were authored by females remained rather small and constant throughout the twelve volumes. Of a total of 244 mathematics books listed, women authored 11 (less than 5%). Although women much more frequently specialized in elementary school teaching than in secondary mathematics, only one of these books was written for young children (*Number games for primary grades*); the remainder of the books authored by women dealt either with traditional topics in secondary mathematics (geometry or algebra), or with topics concerning new innovations in the curriculum — *Modern junior mathematics* (for junior high school), *Practical business hints* and *Household arithmetic* (to relate mathematics to vocational training). Only the *Household arithmetic* book appears to have been specifically written as a textbook for female students

Differences in curriculum for boys and girls

A major issue in education during this time period was how to adapt the curriculum to the varied needs, backgrounds, interests, and abilities of the increasing numbers of students who were attending high school [Bidwell, 1970; Coxford, 1970; Krug, 1964]. On the one hand, there were pressure to set and maintain high standards so that college-bound students would be adequately prepared. These pressure led to considerable discussion about what should be included in or deleted from the high school curriculum, and what types of examinations should be required. On the other hand, great numbers of students were attending high school with no intention of preparing for post-secondary education. Their needs dictated consideration of an entirely different kind of academic program, and led to efforts to adapt the traditional curriculum to the vocational and personal needs of such students

Arguments over the merits of academic versus vocational education in secondary schools were often further fragmented by discussions concerning differences between boys and girls. Magazines and journals of the time period were full of articles debating the pros and cons of single-sex versus coeducational learning. For the most part, however, contributors to *The Mathematics Teacher* seem to have ignored the general debate over coeducation and to have concentrated instead on matters pertaining specifically to

the mathematics curriculum in the schools (whether single-sex or coeducational). Perhaps the concerns of teachers in the middle Atlantic states (where many schools were still single-sex) were somewhat different from those of educators in other parts of the country, where coeducational colleges and secondary schools were commonplace much earlier. In general, however, there seem to have been two major trends of thought concerning the source of differences between boys and girls in learning mathematics: differences in ability and differences in interest.

Many educators of the time had doubts about whether most girls were physically strong enough to pursue studies in secondary schools. In an article in *Educational Review*, Supervisor S.D. Brooks of Boston claimed that "many a one has traded her birthright of health and strength, and happy and useful living for a mess of pottage made of sheepskin, and wrapped in blue ribbon" [1903, p. 377]. Another Massachusetts superintendent, in the journal *Education*, referred to "the sweet girl graduates who stagger through the ceremonies of diploma-giving to return to their homes condemned to invalidism for life" [Gay, 1902, p. 303]. (However, statistics of the time seem to belie these claims concerning the weakness of girls: girls made up nearly three-fifths of the pupils enrolled in secondary schools, and two-thirds of the graduates [Krug, p. 172]. With few vocational opportunities, and traditional socialization toward motherhood, adolescent women actually comprised the core of the high school student population.)

In a 1914 *School Review* article, "The Girl and Algebra," E.R. Breslich reported that mathematics in particular was alleged to have "injured the mind, destroyed the health, and wrecked the lives of thousands of children" [p. 563]. A male teacher, writing in *The Mathematics Teacher*, reflected the general belief that girls were simply not as capable of boys of learning mathematics: "woman... is organized both bodily and mentally for dealing with an entirely different set of functions, in which mathematics plays a small part" [Morrison, 1915, p. 144]. Another *Mathematics Teacher* author proposed that, because of such presumed innate differences, all teachers of mathematics above the third grade should be men. He claimed that "while women are very proficient in teaching other studies, my experience... is that a man can more successfully and more understandingly teach mathematics than a woman" [Thomas, 1913, p. 210]. Presumed male and female types of minds led some schools to water down the curriculum for girls. John Dewey, defending coeducation in the *Ladies Home Journal*, scorned the fact that " 'female botany,' 'female algebra' — and for all I know, a female multiplication table — have been conceived, adapted to the 'female mind' " [1911, p. 60].

Other educators attributed the differences between boys and girls in mathematics classes not to differences in innate abilities, but to differences in interest and in potential future utility of the subject. For example, in Volume II of *The Mathematics Teacher*, a teacher recommended motivating the study of mathematical curves by discussing the paths taken by a ball in baseball. He anticipated that this would certainly interest the boy students and that "even the girls would enthuse over a goodly mixture of colored

crayon or the study of families of curves" [Dean, 1909, p. 45]. Notice that the interest of girls was assumed to be based on the "prettiness" of the graphs or on their relationships to one another in "families."

A female *Mathematics Teacher* author, Jean F. Robertson, while admitting that the interests of boys and girls might differ, argued that girls should nevertheless have access to the same mathematics courses as boys. She suggested that any differentiation between a mathematics course in a girls' high school and a boys' high school should not be in the mathematics, but in the applications that were made of it. She pointed out that boys were hungry for problems relating to their interests of "carpentry, engineering, wireless, and constructions of various forms. . . . But many of these same problems are to a girl 'words, words, words.' . . . However, if that same girl plays tennis. . . let her lay out a tennis court and there is at once as much enthusiasm as any boy could evince" [Robertson, 1914, p. 16].

Robertson would probably have agreed with J.E. Armstrong, who, writing in *School Review*, defended limited segregation in the high school, pointing out that "in the textbook in mathematics for the mixed class all matters that appeal exclusively to the life of our girls or to womanhood have been omitted because mathematics plays so important a part in the occupations of men. No wonder so large a number of girls find mathematics uninteresting" [Armstrong, 1910, p. 342]. Armstrong claimed that "if the textbooks for algebra and geometry were rewritten with reference to the needs of the two sexes it would be a great improvement" [p. 341].

On the other hand, many authors saw inherent dangers in differentiating the mathematics curriculum for special groups. James Russell, Dean of Teachers College, Columbia University saw "no reason. . . to modify a college preparatory course to suit the needs of girls or boys; their needs are identical as far as they go" [1913, p. 495]. In girls' high schools, since few students studied higher mathematics, modification of course offerings to cater to the needs of the majority might mean that advanced mathematics was not available for those who desired it. Thus, the public high school, in attempting to broaden opportunities for all, might be forced to restrict opportunities for a few. A male author in *The Mathematics Teacher* argued, "we cannot teach mathematics in such manner as will enable the one girl out of ten millions to use it if she will become a surveyor or an engineer. All our teaching must be done with the single view to what is good for the majority" [Schwatt, 1910, p. 100].

However, Mary Adelle Evans, in a *Mathematics Teacher* paper that sounds amazingly contemporary, argued for the availability of elective courses in higher mathematics for girls who desired them: "now that women compete with men on their own ground, none will deny to the woman engineer, architect, physicist or astronomer as thorough a mathematical equipment as that demanded of the man. . . . The high school should provide for the girl the same mathematics as that given to the boy who elects such a course" [Evans, 1914, p. 19].

Even more widespread than disagreements over the college preparatory curriculum were discussions recommend-

ing changes in the mathematics curriculum to accommodate the new vocationally oriented education. Numerous articles in *The Mathematics Teacher* reflect the debate over what constituted appropriate mathematical content in technical or manual training. In Volume VI, Frederick Gentleman reported the responses he received to a questionnaire sent to one hundred of the largest public high schools which either specialized in manual or technical training or had a manual training department. Among the questions he asked was whether the school was coeducational, and if so, whether the same mathematics course was required of both boys and girls. He found that "in all schools that are coeducational, practically the same mathematics is offered for the girls as for the boys, excepting that in most cases less is required of the girls" [Gentlemen, 1913, p. 24].

In an article in Volume V of *The Mathematics Teacher*, the famous mathematics educator, David Eugene Smith, took issue with those who claimed that, for the non-college-bound, "no mathematics whatever, beyond mere computation, is to be required, except, perhaps, of the boy." However, in defending the need of girls to study mathematics too, Smith simultaneously relegated women to their traditional domestic role. He argued that since, in the urban society, "the father no longer has control of the education of the children. . . the mother must have a general knowledge of the subjects that children study if she is sympathetically to direct their intellectual activities." [Smith, 1912, p. 169].

Smith's argument was that a mother needed to be well educated to be able to teach her children. Other educators maintained that training for girls should include preparation not only for child rearing, but also for household management. James Russell (Dean of Teachers College) commented, "the fact that eighty per cent. (sic) of the girls in any high school will marry within a few years and be settled in homes, and that the only specific training they will ever get for their life work must be had in the high school, suggests the desirability of giving girls something more than the boys want. . . . Co-education, if it means identical education, seems to me an absurdity" [Russell, 1913, p. 493].

Many writers proposed modifying the traditional mathematics curriculum to include training for girls in "the household arts." I. McGlaufflin, in a 1911 article in *Education*, asked "why not include household expense account in a girl's mathematical training? That she may know something of the purchasing value of money let her go to the market and ascertain the cost of eggs, butter, flour, etc. and keep her books with record of supposed money received and expended, balancing her books at the end of each month" [p. 525]. Katherine Ball, writing in volume IX of *The Mathematics Teacher* on "Mathematics Applied to Domestic Arts," pointed out that "a diligent search in mathematics textbooks. . . reveals how little attempt has been made to discover the part that mathematics plays in what has come to be considered peculiarly 'woman's sphere' " [p. 58]. She described a course in household mathematics which emphasized the economic aspects of household problems (budgeting, investments, insurance,

energy usage, sewing, and cooking) In volume X, Louise Northwood outlined the three-track junior high school mathematics curriculum in Trenton, New Jersey. Although topics were not sex-differentiated in either the academic or the commercial courses, work for boys and girls in the practical arts course was radically different. Girls worked with problems which might arise in the home (cooking, sewing, budgeting), while boys used mathematics in problems related to shop work and to house building.

The onset of World War I produced another very interesting example of the trend toward differentiating the mathematics curriculum for boys and girls. In volumes X-XII of *The Mathematics Teacher* there are a number of articles which describe applications of mathematics to warfare. (Interestingly, these volumes also contain war-related editorials, news, and poetry.) High school boys, who anticipated becoming soldier soon after graduation, eagerly studied graph reading, trigonometry, and rudiments of calculus in order to be able to understand problems such as "Locating the German Super-Gun," or "Visibility of a Periscope of a Submarine" [Breckenridge, 1918]. For the most part these problems "were of scarcely any interest to girls, who seemed to be sadly neglected so far as adaptations of mathematics were concerned because of the war" [English, 1920, p. 163]

Conclusion

World War I seems to have had more of an impact on *The Mathematics Teacher* of 1908-1920 than did most other national concerns of the times, and its effect on the mathematics curriculum was to provide applications which were, for the most part, of interest to boys but not to girls. Despite the fact that this was a period during which women were involved in ardent campaigning for the right to vote, there is no mention of the woman's suffrage movement in any of the volumes examined. During this era, women were not equally accepted in many professional fields [medicine is a prime example: see Walsh, 1977]. Although women were certainly welcomed as members in the Association of Teachers of Mathematics of the Middle States and Maryland — they made up nearly half the membership — they were seriously under-represented in published articles, conference papers, and positions of authority within the Association. In the field of mathematics education — as in

society at large — women still had a long way to go before they would be fully accepted as professional colleagues and leaders.

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In the title of Paulus Gerdes' article in the last issue (volume 5, number 1) the word "undeveloped" was printed in place of "underdeveloped", as written by the author. We are sorry the error occurred and express our very sincere regret to Dr. Gerdes. We understand the considerable difference between the two words and the embarrassment our mistake may have caused him and our other readers.
