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ABSTRACT

Researchers have claimed both that female students are discouraged from taking higher level math and science courses and that they actually take more of these courses than males do. On the surface, data from the Florida community colleges would appear to confirm that females take more science and math courses than males, with 63% of the fall 1995 biological science enrollments, 55% of the mathematics, and 52% of the physical science enrollments being female. However, this unit of analysis is too broad to provide a good indicator of gender course patterns since the biological science discipline contains courses that are geared toward nursing and dental hygiene students and mathematics contains courses that are required by anyone seeking an associate degree. An analysis of Florida community college enrollment patterns at the course level reveals that as math and science content level increases, the percentage of women enrolled decreases. Although women clearly dominate enrollments in biological science, there is a higher concentration of women in courses that lead to the more traditional associate degrees of nursing and dental hygiene. Finally, in the physical sciences, as well, women were more likely than men to be enrolled in courses related to associate degrees in allied health rather than those required of chemistry majors. (BCY)

GENDER BIAS

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GENDER BIAS

Introduction

The January, 1997 issue of *Reader's Digest* contains a synopsis of an article by Diane Ravitch that originally appeared in *Forbes*. In the original article, Ms. Ravitch appears to be questioning the results of the American Association of University Women's 1992 report, "How Schools Shortchange Girls." The AAUW results indicated that girls are discouraged from taking higher level science and mathematics courses and that they suffer from low self-esteem. Ms. Ravitch counters those results with the following statements:

> Here's what the AAUW downplays:
>
> Girls take more academic courses than boys. Women are now a majority of all college students, and they receive a majority of both undergraduate and master's degrees.
>
> What about gender bias in the traditionally male-dominated fields of math and science? According to the National Center for Education Statistics of the U.S. Department of Education, more girls than boys study advanced algebra and geometry; about equal numbers of boys and girls study trigonometry and calculus. More girls than boys take biology and chemistry. Only in physics are there decisively more boys than girls.
>
> The AAUW's charge that girls are "discouraged" from taking math and science courses by schools is flatly contradicted by the facts. (p 133-134)

Community College Status

On the surface, Ms. Ravitch's comments appear to be correct, not only at the high school level, as represented by the NCES statistics, but also at the community college level. The Florida State Board of Community Colleges collects course enrollment information on a term-by-term basis. A comparison of fall 1995 male and female enrollments for the discipline of biological science indicated that sixty-three percent were female and only thirty-seven percent male. Although not as dramatic, women were also the majority enrollees in the disciplines of mathematics, fifty-five versus forty-five percent, and physical science, fifty-two versus forty-eight percent.

Contradictory Results

Since girls/women are enrolling in math and science courses more, why is there still concern that they are not as successful as boys/men in these areas? The 1994 National Assessment of Educational Progress (NAEP) report (Campbell, et,.al., 1996) indicates girls at age 17 scored an average of eleven points below boys in science and five points below in mathematics based upon average scale scores. While these gaps are smaller than those of the first assessment years of 1969 and 1973 respectively for the areas, the gaps consistently widen as one considers the results for students age 9, age 13 and age 17.

The Florida State University System's 1994-95 Fact Book indicates that more women than men are enrolled in courses and receive baccalaureate degrees. The figures also show that the genders are almost even in receiving biological science/life science degrees, but that men are ahead for both mathematics and physical science. The gaps increase dramatically as the level of the degree moves up to master's and doctorate. In those professional areas that require science, women received one-third of the dental and medical doctor degrees, while comprising two-thirds of the pharmacy and veterinary medicine graduates.

Unit of Analysis

What is happening in these apparent contradictory results is that the unit of analysis quoted by Ms. Ravitch is too large. The discipline area of biological science contains courses that are geared toward both nursing and dental hygiene students as well as biologists. The area of mathematics contains those courses that are required for anyone seeking an AA degree as well as those specifically designed for future mathematicians. An examination of enrollment patterns at the course level provides a better indication of what is actually happening.

The state of Florida has what is known as a common course numbering system. The

major purpose of this system is to facilitate the transfer of courses between the participating institutions. All public institutions in the state participate in this system. This ensures that MAC1102 taught at one public community colleges has the same content as MAC1102 taught at another. This allows for state level examinations of enrollment patterns which can be based upon thousands of students and not just a few who may take courses in a unique manner.

Under this system, each course designation contains a three letter prefix. The prefix represents a major division of an academic discipline, subject matter area or sub-category of knowledge. The vast majority of enrollments in mathematics are in courses that begin with the letters MAC, MAT, MGF and STA. The MAT designation is for pre-college level courses and includes college preparatory or remedial courses. MGF is for general mathematics; STA is for statistics; and MAC contains college algebra and the sequentially higher level mathematics courses. Table 1 shows the percent of enrollments by gender in these areas.

This table illustrates the successive decline in the percentage of women as the content level increases. This is especially dramatic in the calculus sequence. While the overall number of students also declines dramatically throughout the sequence with only about fifty percent of students continuing from one level to the next, it is clear women are adversely effected more than men.

The top enrollment areas for biological science are BSC, MCB and ZOO. BSC is the prefix for biological science, MCB for microbiology and ZOO for zoology. Microbiology courses are required for either the nursing or dental hygiene AS degrees. The information in Table 2 for the discipline of biological science mirrors that of Table 1 for mathematics.

Women clearly dominate the enrollments in biological science. However, even in this area, there is a higher concentration of women in the courses that lead to the more traditional AS

degrees of nursing and dental hygiene than in the courses designed for biology majors.

The final area investigated is that of physical science. The major course areas are CHM, PSC, PHY and GLY. The CHM prefix designates chemistry courses; PSC is for physical science; PHY is for physics; and finally GLY is for geology courses. Table 3 provides the same information for this area as Tables 1 and 2 do for the other areas. As with biological science, the actual course enrollments appear to be more related to the AS degrees in allied health rather than the courses required of chemistry majors.

Conclusions

While this is merely a snapshot based upon one term's course enrollments, there appears to be enough information to question the general statements quoted at the beginning of this article. It is true that girls/women have made great strides in enrollments in math and science courses, but that is not translating into mathematicians and scientists in the traditional meaning of those terms. Clearly, there is still a need to provide support to girls/women so that they can complete the course sequences necessary to earn degrees in these fields.

Table 1
Enrollments by Gender
(Percent)

Area/Course	Female	Male
MAC	49.40	50.60
MAC1102 (algebra)	56.35	43.65
MAC1104 (algebra)	52.47	44.15
MAC1144 (trig)	42.70	57.33
MAC1140 (precalculus)	45.58	54.42
MAC2233 (calculus for management)	44.16	55.84
MAC2311 (calculus with analytical geometry I)	34.86	65.12
MAC2312 (calculus with analytical geometry II)	27.31	72.69
MAC2313 (calculus with analytical geometry III)	20.43	79.57
MAT	59.27	40.72
MGF	63.93	36.07
STA	59.95	40.05

Table 2
Biological Science
(Percent)

Area/Course	Female	Male
BSC	62.99	37.01
BSC1005 (introduction)	61.30	38.70
BSC1010 (biology for science majors I)	61.70	38.30
BSC1011 (biology for science major II)	58.64	41.36
BSC 2085 (anatomy and physiology I - designed for AS degrees, not intended for biology majors)	78.15	21.85
BSC 2086 (anatomy and physiology II)	76.49	23.51
MCB	78.90	21.10
ZOO	58.38	41.62

Table 3
Physical Science
(Percent)

Area/Course	Female	Male
CHM	52.09	47.91
CHM1020 (general ed)	54.98	45.02
CHM 1032 (allied health)	76.33	23.67
CHM 1045 (general I)	44.79	55.21
CHM 1046 (general II)	44.49	55.51
CHM 2210 (organic)	50.05	49.95
PSC	57.85	42.15
PHY	37.36	62.64
GLY	57.15	42.85

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