

NEBRASKA GIRLS AND TECHNOLOGY STATUS REPORT



NEBRASKA COMMISSION
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This report was prepared by Dr. Patricia Funk. It is based on a survey of computer course enrollments by gender for Nebraska public high schools that was administered by NCSW. The author is very appreciative of the many contributions of the NCSW staff members, Connie Snider and Heather Chilvers, in implementing this survey, and for the support of Carlene Bourn, NCSW Executive Director, in making this project possible. The author also appreciates the support of the Project Co-Director, Linda Bors, and the state board of AAUW Nebraska. The project team thanks the Nebraska Department of Education for helping us contact ESUs and high schools and extends special thanks to all the participating school districts and their staff members who gave of their time to compile and submit the survey information.

Dr. Patricia Funk is an independent public policy research consultant. She serves as the state president of AAUW Nebraska and is a Co-Director of its Nebraska Girls and Technology Project. She is completing her second term as a Commissioner on the Nebraska Commission on the Status of Women. For more information about the Nebraska Girls and Technology Project, contact her at patfunk@cox.net or at 402-571-4506.

The American Association of University Women (AAUW)--- with more than 100,000 members nationwide— promotes education and equity for all women and girls, lifelong education, and positive societal change. AAUW Nebraska has more than 400 members in branches across the state. The AAUW Educational Foundation provides funds to advance education, research, and self-development for women and to foster equity and positive societal change. For more information go to www.aauw.org and www.aauwne.homestead.com.

The Nebraska Commission on the Status of Women (NCSW) is committed to the principle that women should have the opportunity and freedom to fulfill the roles they choose to pursue without discriminatory barriers. The Commission seeks to increase public awareness and understanding of societal issues affecting all facets of women's lives—within the family, workplace, educational settings and other private and public institutions. For more information call 402-471-2039 or go to www.women.state.ne.us.

This report may be downloaded at no cost in PDF format from the NCSW website, www.women.state.ne.us. Printed copies of the report are available for a fee of \$5.00 by sending a check made payable to: Nebraska Women's Foundation, 301 Centennial Mall South, P.O. Box 94744, Lincoln, Nebraska 68509-4744.



Introduction

In the 21st century, information technology is the *new literacy*. Whatever career field, workers with good technology skills will have many more options and opportunities for advancement than those who lack such skills. At a time when women in Nebraska and across the U.S. still experience large economic disparities compared to men,¹ the national reports of a large and growing technology gender gap are deeply disturbing.² This report on the status of Nebraska girls and technology is an initiative of the Nebraska Girls and Technology Project. The mission of the project is to close the technology gender gap for Nebraska schoolgirls.

This report provides baseline data on the status of girls and technology based on a Fall 2002 survey of computer course enrollments by gender for the public high schools in the state. It also presents the national College Board Advanced Placement (AP) test-taking statistics for Nebraska by subject area and gender. Hopefully the findings of this study will be referenced in the not-too-distant future to show that we have made substantial progress in closing the technology gender gap for Nebraska girls.

Methodology

The computer course enrollment survey form was developed to capture the numbers of girls and boys enrolled in computer-related courses of different types based on the course categories used by the Nebraska Department of Education for its annual curriculum report: Introduction to Computer Applications, Computer Applications I & II, Computer Language I & II, Computer Science, Advanced Business Computing Applications, and Communication/Computer Aided Drafting (CAD).

In order to obtain enrollment data for other computer-related courses or multiple courses in the same category, the form included places to list other courses in two general categories: those that do not require a prerequisite computer course and those that have such a requirement. During analysis these courses were assigned to one of the course types listed above, and an additional category was added, Web Design and Development/HTML.

¹ Sources: "Status Report" Nebraska Commission on the Status of Women, Lincoln, NE January 2003; *The Status of Women in Nebraska*, Institute for Women's Policy Research, Washington, D.C., 1998

² Sources: *Tech-Savvy: Educating Girls in the New Computer Age*, AAUW Educational Foundation, Washington, D.C., 2000, *Balancing the Equation: Where are Women and Girls in Science, Engineering and Technology?* National Council for Research on Women, New York, 2001.

The survey was piloted in September and October 2002 by emailing it to 30 randomly selected high schools. The final version was emailed to all public high school principals in November 2002 and by mail in January 2003. Schools had the option of completing the survey online at the NCSW website. Responses were received from 170 high schools, representing 56 percent of all public high schools in the state and 68 percent of all grade 9 to 12 students. More detailed descriptions of the methodology and response rates are given in Appendix A.



Computer Course Survey Results

The participating schools reported a total of 23,274 enrollments in computer-related courses for the fall of 2002. The total membership in grades 9 to 12 for the participating schools was 58,961 for the 2001-02 school year. That means there were approximately 40 computer course enrollments per 100 students in grades 9 to 12. However, since some students may be enrolled simultaneously in more than one computer course, the proportion of high school students taking one or more computer courses is somewhat lower than 40 percent. It is impossible to estimate from this survey the percent of Nebraska high school students who take at least one computer course before graduating, but the results suggest it is a very high percentage.

There were 9,761 computer enrollments for girls, representing 42 percent of the total. That shows a moderate under representation of girls, since they comprise 49 percent of all grade 9 to 12 students in public schools for the 2002-03 school year. Although the results seem to indicate that the overall technology gender gap is not that wide in Nebraska, analyses of enrollments by type of course and patterns within courses show that there is indeed a very large gender gap.

The results presented in Table 1 and Figure 1 show that although girls and boys enroll in computer introduction and application courses in equal numbers, boys outnumber girls by more than 3 to 1 in most of the more technology-oriented courses: computer languages, computer science and computer-aided drafting. Girls are even outnumbered by more than 2 to 1 in web design and development courses.

Table 1. Nebraska High School Computer Course Enrollments by Gender and Type of Course, Fall 2002

Course Type	Girls	Boys	Total	% Girls
Introduction to Computers	1,892	1,984	3,876	49%
Applications I	4,451	4,344	8,795	51%
Applications II	1,362	1,319	2,681	51%
Advanced Business Applications	967	925	1,892	51%
Computer Language I	168	581	749	22%
Computer Language II	14	219	233	6%
Web Design & Development, HTML	183	424	607	30%
Computer Science & Technology	280	891	1,171	24%
CAD, Drafting & Engineering	444	2,826	3,270	14%
Total Enrollments	9,761	13,513	23,274	42%

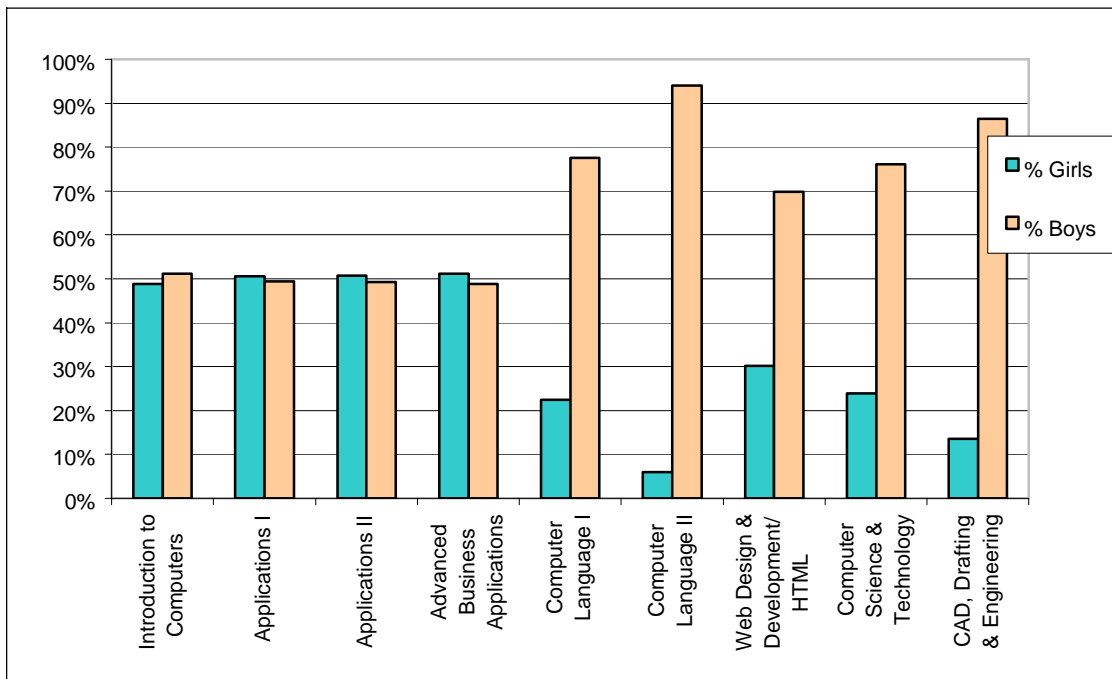


Figure 1. Nebraska high school computer course enrollment distribution by gender, Fall 2002

There are explanations for the balanced enrollment in the computer introduction and applications courses: schools may require all students to take one or more of these courses and studies have found that girls are more interested in the application of technology than in the technology itself. However, an examination of the gender distribution for individual courses presented in Table 2 below shows there still is reason to be concerned about gender differences even for computer application courses.

Unlike the analysis presented in Table 1 which uses aggregated data that is weighted in favor of schools with large enrollments, the analysis for Table 2 gives equal weight to each course surveyed, regardless of the number of students. For most schools, different sections of one course were entered as a single course. For some, but not all schools, different courses of the same type were combined as a single entry. In spite of these inconsistencies, the course-level data provide a useful view of gender patterns that can't be arrived at with the aggregate data.³

More than 40 percent of the surveyed Computer Application II and Advanced Business Application courses are gender-dominated (at least two-thirds of students of the same sex), with a fairly equal division between girl-dominated and boy-dominated courses. This pattern doesn't appear for the Introduction to Computers and the Computer Application I courses, which are more likely than the advanced application courses to be required for all students.

Table 2. Nebraska High School Computer Course Gender Patterns, Fall 2002

Course Type	Number of Courses Surveyed ¹	Median % Girls	-----Percent of Courses-----		
			Girl-dominated ²	Boy-dominated ²	Either gender-dominated ²
Introduction to Computers	83	49%	5%	14%	19%
Applications I	181	51%	16%	12%	28%
Applications II	111	50%	23%	23%	46%
Advanced Business Applications	66	52%	24%	17%	41%
Computer Language I	52	19%	12%	83%	95%
Computer Language II	20	0%	10%	90%	100%
Web Design & Dev., HTML	31	33%	13%	61%	74%
Computer Science & Technology	72	14%	3%	79%	82%
CAD, Drafting & Engineering	125	9%	1%	93%	94%

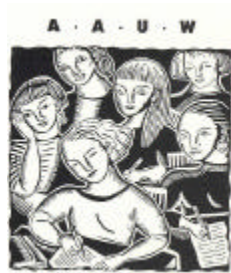
Note 1: Different sections of the same course were generally combined as one course entry, and for some of the schools different courses in the same category were combined as one course entry.

Note 2: A course is considered dominated by either girls or boys if at least 67 percent of the students enrolled are of the same sex.

³ The gender patterns of computer course enrollments for small schools need to be viewed with caution because it is not unusual for a particular class (e.g., grade level) to be dominated by one sex or the other (e.g., 10 girls, 20 boys). In larger schools, those natural variations in gender distribution are much less likely given the number of students involved. When data are aggregated across all schools, the small school variations should offset each other in the computation of averages as shown in Table 1. However, when looking at an individual course data, the gender distribution of the available pool of students should be considered when assessing the course enrollment. It was not feasible to collect such data for this survey.

Although there might be a rational basis for segregating courses by sex when one sex is underrepresented, there is little evidence that the gender dominance in the intermediate and advanced application courses is a result of an effort to encourage girls' interest in technology. Rather, there is much more reason to be concerned that girl-dominated application courses are of a clerical type, whereas boy-dominated ones have a greater technology focus. The names entered for many of the courses are too general to indicate the contents (e.g., computer applications II, business applications). However, where there was more specificity, terms like *office*, *word processing*, *keyboarding*, and *publishing* show up in girl-dominated courses, but rarely in boy-dominated ones. Nebraska schools need to look closely at the design of application courses and the enrollment patterns to see if girls and boys are being informally placed in separate computer technology tracts.

The high level of boy-dominance for the technology-oriented courses – from 74 to 100 percent – reflects the low percentage of girls enrolled as reported in Table 1.⁴ These statistics drive home the serious extent of the technology gender gap in Nebraska high school computer courses. Although the percent of students taking any of the more technology-oriented courses is relatively low compared to the application courses, these are courses that help steer many students into technology-oriented careers. We need to close the gender gap for these courses if we are going to succeed in substantially increasing the number of women in technology.



Advanced Placement Testing Rates

National documentation of the technology gender gap has been accompanied by reports that substantial progress has been made at the high school level in closing the long-standing math and science gaps for girls, although substantial disparities remain at the college level. In order to put the results of the computer course enrollment survey in the context of gender patterns for other subjects in which girls have traditionally been underrepresented, the project obtained Advanced Placement testing rates for Nebraska by gender and subject area for 2002 from the College Board.

⁴ The few technology-oriented courses that are girl-dominated (between 1 and 13 percent) are most likely an incidental result of very low course enrollments (e.g., 2 girls, 1 boy), or a disproportionate number of girls in a small class, and/or lack of other options. For example, one computer aided drafting course with 67 percent girls is offered in a small school to a single class that is 58 percent girls: all of the girls and all but two of the boys take the course, in part because there is nothing else offered in that time slot.

The results, presented in Table 3, confirm the technology gender gap and reveal disappointing disparities for Nebraska girls in most of the math and science subject areas, including some that are worse than at the national level: biology, economics and statistics. Only 17 Nebraska high school students took either of the AP Computer Science exams, and of those, only two were female. This statistic is of concern not only because of the gender disparity, but because so few students took the exam, accounting for just one percent of all Nebraska AP tests. This is true nationally as well, with computer science representing three percent of AP tests.

Table 3. Nebraska Advanced Placement Test Takers by Gender and Subject, 2002

Subject	Number of		
	Nebraska Test Takers	Nebraska % girls	National % girls
Biology	155	41%	59%
Chemistry	103	43%	45%
Computer Science A	7	29%	16%
Computer Science AB	10	0%	10%
Calculus AB	331	47%	48%
Calculus BC	125	34%	39%
Physics B	52	33%	35%
Physics C: Mechanics	23	26%	26%
Physics C: Elec. & Magnet.	15	20%	22%
Economics Micro	58	33%	43%
Economics Macro	68	29%	44%
Statistics	65	20%	50%
English Language & Composition	245	60%	63%
English Literature & Composition	601	61%	64%
European History	173	53%	53%
French: Language	18	67%	70%
US History	620	43%	54%
Government & Politics: US	38	47%	52%
Psychology	95	67%	66%
Spanish Language	35	83%	65%
Total (non duplicating)	1,922	51%	56%

Source: The College Board



Discussion

This study clearly documents the computer technology gender gap in Nebraska public schools – a disparity that is totally unacceptable under the principles of educational equity. It is critically important that Nebraska educators, policy makers, parents and community leaders recognize the technology gender gap as a serious problem and expand current efforts to close that gap.

Title IX of the Education Amendments (1972) prohibits sex discrimination in *all aspects of education* (not just in sports). While gender disparities in course enrollments are not necessarily Title IX violations in and of themselves, schools are required to closely examine those disparities, eliminate any discriminatory practices, and make a good faith effort to reduce other barriers that contribute to the disparity. It's not likely in this day and age that girls are excluded from enrolling in the more technology-oriented computer courses, but it is likely that many girls are not actively encouraged to enroll and that these courses themselves are designed to meet the interests and learning styles of boys more than of girls. These practices can and should be changed.

This report is intended primarily to generate more dialog and action toward the goal of closing the technology gender gap in Nebraska schools, and it is beyond the scope of the study to lay out a detailed strategic plan of action. However, there are a number of general approaches that various experts have identified that are worth noting here:⁵

- Debunk the myth that girls can't do as well as boys in computer technology courses –girls are more likely to lack interest and/or confidence, but they are just as capable as boys.
- School administrators and teachers should make a firm commitment to closing the technology gender gap in their schools— changes in girls' interest is unlikely without a number of concerted, pro-active steps.

⁵ Sources of recommendations include among others: *Tech-Savvy: Educating Girls in the New Computer Age*, AAUW Educational Foundation, Washington, D.C., 2000, *Balancing the Equation: Where are Women and Girls in Science, Engineering and Technology?* National Council for Research on Women, New York, 2001; *The Girl Difference: Short-Circuiting the Myth of the Technophobic Girl*, Girl Scouts Research Institute, Girl Scouts of the USA, New York, 2001.

- Integrate computer technology courses throughout the curriculum – demonstrate the relevance of technology in language, arts and social sciences as well as in math, science and engineering.
- Put more “technology” into computer application courses and more “application” into computer technology courses – this will help make application courses that girls already are taking entrees into the more technology-oriented courses, and help make the technology courses more interesting to girls and others who think those courses are too boring or difficult.
- Debunk the stereotype of the computer-geek technology professional and of the boring, isolating nature of technology careers – show students the wide variety of career opportunities for utilizing advanced technology skills and the interesting and interactive nature of workplaces in many of those careers.
- Expose students to more women technology professionals and ensure that the images of people using computers that students see on the walls and in curriculum materials include plenty of women and girls.
- Design the computer technology courses to accommodate the interests and learning styles of girls as well as for boys – e.g., teach the principles and skills in the context of real world applications; create opportunities for collaboration instead of competition; ensure that girls participate equally with boys in putting equipment together and in solving hardware or software problems.
- Actively encourage girls to enroll in the more technology-oriented courses – recruit them in computer application courses; offer girls-only courses to help build their interest and confidence.
- Facilitate and support school or community-sponsored girls’ computer clubs, mentoring programs and summer programs that encourage girls’ technology interests and skills.

The changes required to close the technology gender gap will benefit not only girls and women, but also boys and men, and society in general. The transformations will bring a broader and more balanced computer culture that can better address the rapidly changing needs of our society, in Nebraska and elsewhere. Every step to close the technology gender gap--no matter how local or how small--can make a positive difference.

Appendix A

Methodology and Response Rates

The Computer Course Enrollment Survey form was developed to capture the numbers of girls and boys enrolled in computer-related courses of different types based on the course categories used by the Nebraska Department of Education for its annual curriculum report: Introduction to Computer Applications, Computer Applications I & II, Computer Language I & II, Computer Science, Advanced Business Computing Applications, and Communication/Computer Aided Drafting (CAD).

In order to obtain enrollment data for other computer-related courses or multiple courses in the same category, the form included places to list other courses in two general categories: those that do not require a prerequisite computer course and those that have such a requirement.

In September and October of 2002, the survey was piloted by emailing it to the principals of 30 randomly selected high schools. Responses were received from 10 schools. The results were used to make several adjustments to the form, the most substantial being including a place for the specific name of each course entered under the general categories listed above. The pilot test responses were included in the final database for the survey. A copy of the final questionnaire is included in this appendix.

In November, the project attempted to contact all the public high school principals in the state to request their participation in the survey. The survey form was made available on the Nebraska Commission on the Status of Women (NCSW) website for online entry. An initial attempt was made to reach the principals with assistance from the state Educational Service Units (ESU). An official in the Department of Education sent an email to the technology contacts for the ESUs asking them to forward it to each of their high school principals. The email included a letter from the NCSW Executive Director explaining the purpose of the survey, directions for completing the survey online, and a copy of the survey that could be completed and returned by mail or FAX. This process was not very effective, resulting in about 50 responses after follow-up calls to each ESU. Consequently, hard copies of the survey and a request letter were mailed in January to the principals of every public high school that had not already responded. This resulted in another 110 responses, for a total of 170, including the 10 from the pilot survey.

The response rate for the survey is 56 percent, based on a total of 289 public high schools in Nebraska for the 2002-03 school year. However, data from the 2001-02 Nebraska Department of Education curriculum report show only 268 high schools offering any computer-related courses. That means that nearly two-thirds (63%) of high schools offering computer courses participated in the survey.

The response rate is even higher when weighted by the total number of students enrolled in high school, because all of the high schools in the largest two school districts, Omaha Public Schools and Lincoln Public Schools participated. The participating schools accounted for 68 percent of all students enrolled in grades 9-12 for the 2001-02 school year.

The analysis of the survey data required that all courses listed in the two "other" categories had to be assigned to one of the eight general categories listed above. The assignment was based on the course name (including such terms as *beginning*, *introduction*, *intermediate* and *advanced*) and whether or not it required a prerequisite computer course. The process resulted in the expansion of the category, "Computer Science" to include computer operations, networking and systems design, and "Computer Aided Drafting (CAD) to include engineering and architecture. An additional category, "Web Design & Development" was added that included web page design, development and HTML programming. The percent of enrolled students who were girls was calculated for each course as well as for the total of each type of computer-related course. The results are presented both in terms of the overall mean average (the average based on the total enrollments across schools) as well as the median (the mid-point of the results for individual courses). The median is used because the mean average is dominated by the results from the largest school districts in the state. The median more accurately reveals the pattern across all school sizes.

**Nebraska Girls and Technology Project
Computer Technology Course Enrollment Survey**

School Name _____ School ID Number (000000-000) _____ - _____ - _____
 Contact name _____ phone _____ email _____

Computer Technology Course Enrollments (include only students in grades 9 to 12)
 Year: ___ Fall 2002 _____ Other (specify) _____

I. Computer-related courses Note: You may combine enrollments for different sections of the same course. If you have more than one course of a general type specified below, or a course of another type, use sections II and III below for the additional listings.

Course Type	Code*	Course Name	# of girls	# of boys
Introduction to Computer Applications	270300			
Computer Language I	270401			
Computer Language II	270402			
Computer Applications I	270501			
Computer Applications II	270502			
Computer Science	270600			
Advanced Business Computing Applications	033421			
Communication/Computer Aided Drafting (CAD)	100301			

II. Other beginning computer courses, not listed above, that have no computer course prerequisites.

Course Name	Code*	# of girls	# of boys

III. Other intermediate or advanced computer courses, not listed above, that have computer course prerequisites.

Course Name	Code*	# of girls	# of boys

*Course Code: From Coding Key used for Nebraska Dept. of Education Curriculum Report

You may complete the survey online at www.women.state.ne.us/survey or return the completed survey by FAX to the Nebraska Commission on the Status of Women 402-471-5655 by February 7, 2003.

No results for individual schools or districts will be reported. The results will be presented statewide and for groups of schools classified by size, region or other general categories.

Please direct any questions about the project or this survey to Dr. Patricia Funk, Co-Director, Nebraska Girls and Technology Project, 402-571-4506, patfunk@cox.net, or Connie Snider, NCSW, 402-471-2039, ncswmail@mail.state.ne.us

THANK YOU VERY MUCH FOR YOUR PARTICIPATION.

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