

# **Wisconsin Women=Prosperity**

## **K-12 Science, Math, Computer Science, and Vocational-Technical Education:**

### **Continuing Gaps for Girls in Wisconsin**

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**A Report to the Educational Achievement Task Force**

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## **Executive Summary**

Lieutenant Governor Barbara Lawton began the Wisconsin Women = Prosperity Initiative in the summer of 2003 to address the disconcerting results of a study by the Institute for Women's Policy Research regarding inequities in various areas of Wisconsin women's lives. Specifically, the Educational Achievement Task Force was asked to assess Wisconsin women's educational opportunities in the areas of science, math, vocational-technical education, and computer science. This report should be considered as the first of two major studies. The emphasis here is on K-12 education. A subsequent examination, emphasizing post-secondary education will be completed in 2004-05.

The findings in this report suggest that although progress has been made, gender gaps in nontraditional K-12 educational participation and achievement remain. These gaps lead to lower levels of participation in nontraditional occupations, lower pay, and less economic power for women in Wisconsin.

At the K-12 level, a nearly equal number of girls and boys enroll in most math and science courses, except at the most advanced levels and in the area of physics. Much greater discrepancies in female participation exist in computer science and vocational-technical education. Girls have also made progress in bridging the achievement gap, in terms of standardized testing, except at the most advanced levels. This remains of some concern, considering that such high stakes testing often serves as a gateway for access to higher education and scholarship money. There is also cause to be concerned regarding girls' equal access to other educational services in the state, such as special education, gifted and talented education, and career counseling and education.

Continuing deficits in girls' interest, participation, and achievement in science, technology, engineering, and mathematics (STEM) fields decrease their ability to contribute to an economy that needs their full participation. Current data suggests that Wisconsin women continue to make career choices that limit their potential for earnings and advancement, despite the facts that women and minorities will be the majority of new entrants into the workforce, and Wisconsin already ranks near the top in the nation in women's labor force participation.

Research suggests that efforts to improve female participation in nontraditional areas must begin early in the educational process and must be comprehensive in nature; thus the authors suggest areas for additional research, and include policy recommendations for the Wisconsin Department of Public Instruction and local school districts.

## **Charge of the Task Force**

The Wisconsin Women=Prosperity Educational Achievement Task Force chose to focus its research on young women's access to and experiences in the areas of science, mathematics, vocational-technical education, and computer science. Members of the task force believe that skill development in these areas is crucial for young women in their quest to attain higher-paying, nontraditional employment opportunities. These areas of study also provide women with important life skills needed for increased confidence, financial independence, and economic empowerment. Specifically, the task force worked to:

- Identify and measure gender disparities in Wisconsin education at the K-12 level, particularly in the subjects of science, math, computer science, and vocational/technology education.
- Identify barriers that deter young women from taking courses and choosing careers in science, math, computer science, and vocational/technical fields.
- Identify resources and promote instructional practices that encourage young women to choose classes in and enter these nontraditional fields.
- Develop strategies to continually recruit and nurture female students in nontraditional jobs and areas of study.
- Formulate policy recommendations for the Wisconsin Department of Public Instruction (DPI) and local school districts that promote participation and achievement in nontraditional fields of study and nontraditional occupations.

## **Early Educational Experiences**

Any examination of gender differences in education must begin in the early stages of childhood development. Research suggests that the foundation for gender identity is clearly established by age four, and early play and parenting behaviors often reinforce gender stereotypes (Welty & Puck, 2001). This socialization process has a profound impact on the ways boys and girls think about potential careers, and girls begin to eliminate career choices because they are the wrong “sextype” as early as age six (Hanson & Smith, 2001).

Clearly, then, it is important to provide young girls with access to information about nontraditional fields of study and occupations early in their academic careers. Indeed, development and implementation of career exposure curriculum is one of the primary jobs of elementary school guidance counselors. According to DPI Counseling Consultant Linda Krantz (2003), however, such elementary guidance counselor positions are increasingly being cut in Wisconsin, particularly in small, rural districts.

Wisconsin’s state guidance and counseling requirement [Standard (e)] mandates that all students have access to a comprehensive, developmentally appropriate guidance program. According to Krantz, however, this standard can be loosely interpreted. Each district is responsible for developing and approving its own service plan; there is no minimum amount of required time that guidance and counseling personnel must spend in a particular school building, nor a required counselor/pupil ratio. In some districts, then, there may be only one guidance counselor available for all the students in the district; and, by necessity, adolescent issues, high school scheduling, and the post-secondary application process are given priority.

## **Math and Science in the Elementary Classroom**

At the elementary school level, students have little choice regarding what “courses” they take; however, in their book *Failing at Fairness: How Our Schools Cheat Girls*, psychologists Myra and David Sadker (1994) discuss ways in which instruction may vary by gender. For example, their research suggests that teachers, regardless of their gender tend to ask male students three times more questions than their female students and praise male students four times as much as their female students.

National testing data suggests that math and science standardized test score gaps have lessened since the early 1990s, although some concerns remain. For example, despite earning higher grades in school, girls continue to perform at lower levels on high stakes math and science tests, with the most marked differences at the most advanced levels (Salomone, 2003). Scores on the Wisconsin Knowledge and Concepts Exam (WKCE), a statewide standardized test given to students in fourth, eighth and tenth grade, mirror these national trends. According to 2002 results compiled by Wisconsin DPI, there is little difference in performance by gender at the elementary school level, although more boys than girls perform at the “advanced” level. This gender discrepancy continues and worsens in middle school and high school, particularly in science.

**Table 1: WKCE Grade 4 Mathematics Results by Gender  
November 2002, Entire State**

	<b>Enrolled</b>	<b>Minimum Performance</b>	<b>Basic Performance</b>	<b>Proficient Performance</b>	<b>Advanced Performance</b>
<b>Female</b>	30,182	17%	11%	42%	28%
<b>Male</b>	32,088	16%	10%	40%	32%

**Table 2: WKCE Grade 4 Science Results by Gender  
November 2002, Entire State**

	<b>Enrolled</b>	<b>Minimum Performance</b>	<b>Basic Performance</b>	<b>Proficient Performance</b>	<b>Advanced Performance</b>
<b>Female</b>	30,182	5%	18%	59%	16%
<b>Male</b>	32,088	4%	15%	56%	21%

**Middle School and High School**

As students enter middle school and high school, notable differences between girls and boys emerge in course-taking patterns and high stakes test results in math, science, technical education, and computer science. These discrepancies coincide with students’ increased opportunities to make their own choices regarding their education.

**Math and Science Education**

*Course-Taking Patterns.* Overall, since the early 1990s, girls have made great strides in closing the gender gap in math and science enrollment. Both nationally and in Wisconsin, girls are now equally represented in most general and required math and science courses in grades 6-12. However, statewide data also reflects national trends in regard to remaining discrepancies in enrollment in the most advanced science and math courses, as well as in electives in these subject areas (AAUW, 1999; WI-DPI Enrollment Data, 2002-03).

For example, Wisconsin girls are approximately equally represented in advanced middle school mathematics courses (those other than math 6, 7, 8), except in geometry (usually the most advanced math class offered in middle school), where they constitute only 35% of 616 middle school students enrolled. Girls are also equally represented in most required and college preparatory high school math courses, although they are underrepresented to some extent in some math electives such as Technical Mathematics (44%) and Applied Mathematics I & II



(40%). Wisconsin girls make up a fairly equal proportion of the students, or in some cases outnumber boys taking Advanced Placement (AP) and college level (CAPP) math courses: AP mathematics--55% female; AP Calculus AB--46% female; AP Calculus BC--44% female; CAPP mathematics--62% female.

Girls have also increased their enrollment in science courses, where they now outnumber boys in such courses as chemistry, biotechnology, and advanced biology. A sizable gap remains in the area of physics, however, where girls comprised 46% of the 23,155 Wisconsin students who took high school physics courses. The gender difference is greater at the advanced level, where only 34% of the 1,349 Wisconsin students who took AP or CAPP physics courses were female (WI-DPI Enrollment Data, 2002-03).

Statewide, a smaller percentage of girls than boys enroll in high school elective applied science courses such as aviation (12%), astronomy (46%), and environmental education (45%). Although a limited number of such courses are offered throughout the state, this discrepancy remains a concern, as many of these courses specifically provide windows into nontraditional science careers (WI-DPI Enrollment Data, 2002-03).

***Standardized Testing.*** As mentioned previously, there is still some concern regarding girls' performances on high stakes math and science tests, particularly in high school, where gender differences become more pronounced and post-secondary scholarship money is at stake. Eighth grade and tenth grade WCKE results illustrate fairly equivalent results for girls and boys, except in tenth grade science, where a notable gender difference in performance at the advanced proficiency level emerges:

**Table 3: WKCE Grade 8 Mathematics Results by Gender  
November 2002, Entire State**

	<b>Enrolled</b>	<b>Minimum Performance</b>	<b>Basic Performance</b>	<b>Proficient Performance</b>	<b>Advanced Performance</b>
<b>Female</b>	32,651	10%	13%	49%	25%
<b>Male</b>	34,795	12%	12%	46%	27%

**Table 4: WKCE Grade 10 Mathematics Results by Gender  
November 2002, Entire State**

	<b>Enrolled</b>	<b>Minimum Performance</b>	<b>Basic Performance</b>	<b>Proficient Performance</b>	<b>Advanced Performance</b>
<b>Female</b>	34,877	13%	13%	48%	22%
<b>Male</b>	36,676	15%	12%	43%	25%

**Table 5: WKCE Grade 8 Science Results by Gender  
November 2002, Entire State**

	<b>Enrolled</b>	<b>Minimum Performance</b>	<b>Basic Performance</b>	<b>Proficient Performance</b>	<b>Advanced Performance</b>
<b>Female</b>	32,651	8%	16%	48%	26%
<b>Male</b>	34,795	10%	14%	44%	30%

**Table 6: WKCE Grade 10 Science Results by Gender  
November 2002, Entire State**

	<b>Enrolled</b>	<b>Minimum Performance</b>	<b>Basic Performance</b>	<b>Proficient Performance</b>	<b>Advanced Performance</b>
<b>Female</b>	34,877	17%	12%	38%	29%
<b>Male</b>	36,676	15%	9%	31%	40%

*Regional Data.* A comparison of student achievement in Math and Science on the WKCE by Cooperative Educational Service Area (CESA) also reveals that the percentage of boys performing at the advanced level on the 10<sup>th</sup> grade exam was consistently higher than the

percentage of girls performing at the advanced level during the 2002-2003 school year. The effect is consistently stronger in science. When the ‘proficient level’ was examined for the same exam and content areas, girls often scored as well or better than boys. This data is displayed in Table 9 and 10. Clearly, such strength in performance is not carried over to the advanced level in every CESA in Wisconsin.

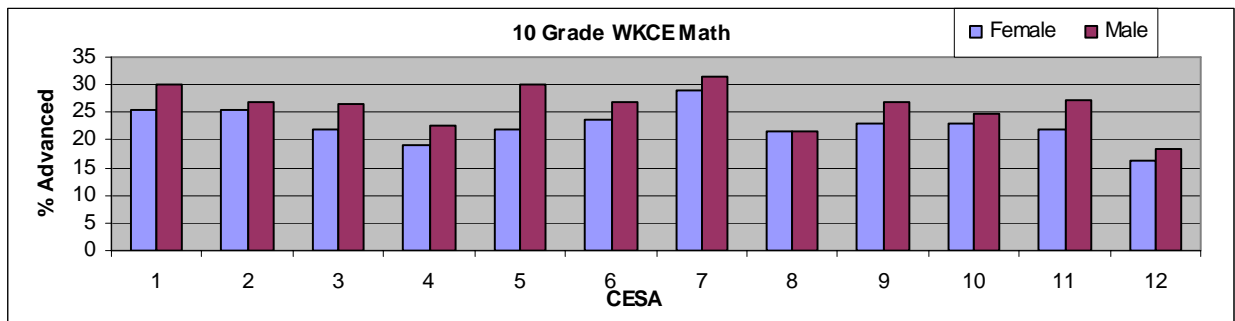
As a point of reference, CESA numbers correspond to the following districts or areas in

Wisconsin:

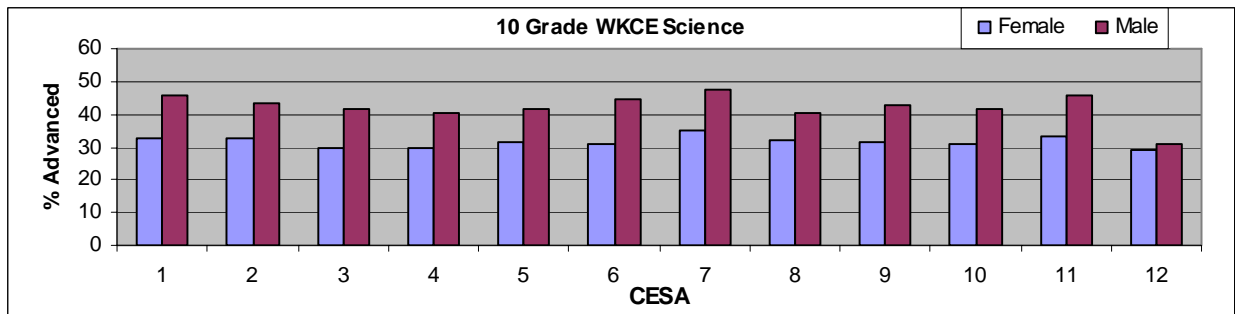
CESA 1 – Milwaukee, South East  
 CESA 2 – Madison, South Central  
 CESA 3 – Platteville, South West  
 CESA 4 – La Crosse, West  
 CESA 5 – Portage, Central  
 CESA 6 – Oshkosh, East Central

CESA 7 – Green Bay, North East  
 CESA 8 – Gillett, North, North East  
 CESA 9 – Tomahawk, North  
 CESA 10 – Chippewa Falls, North West  
 CESA 11 – Turtle Lake, North, Northwest  
 CESA 12 – Ashland, North

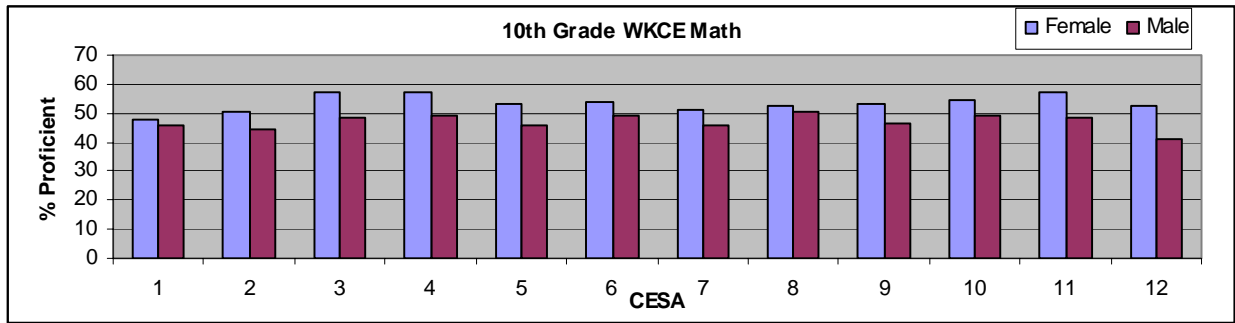
**Table 7: WKCE Math Grade 10 Results, “Advanced Level” by Gender, by CESA**



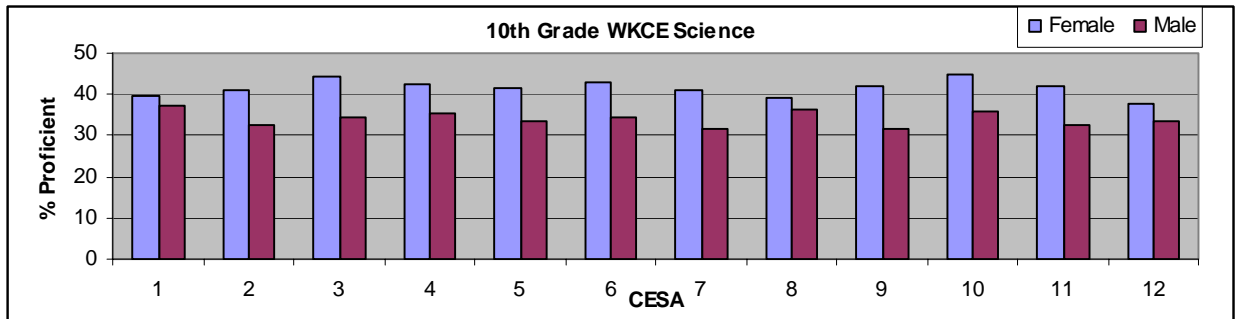
**Table 8: WKCE Science Grade 10 Results, “Advanced Level” by Gender, by CESA**



**Table 9: WKCE Math Grade 10 Results, “Proficient Level” by Gender, by CESA**



**Table 10: WKCE Science Grade 10 Results, “Proficient Level” by Gender, by CESA**



*College Entrance Exams.* To the detriment of girls in Wisconsin, gender differences also remain in scores on college entrance exams, including the ACT, used as one criterion for entry into primarily Midwestern colleges, and the SAT, used as one criterion for entry into primarily East and West coast colleges (WI-DPI, 2003).

**Table 11: 2002-03 Wisconsin ACT Results by Gender**

	<b>Takers</b>	<b>Average Score: Science</b>	<b>Average Score: Math</b>
<b>Female</b>	21,723	21.8	21.4
<b>Male</b>	16,897	23.1	23.0

**Table 12: 2003 Wisconsin SAT Scores by Gender**

	<b>Takers</b>	<b>Verbal</b>	<b>Math</b>
<b>Female</b>	2,292	583	576
<b>Male</b>	2,195	588	612

It should be noted that major gender differences in PSAT scores were somewhat alleviated by adding a writing skills component to the test in 1997 (AAUW, 1999). A writing section and essay component will be added to the SAT in 2005; subsequent results disaggregated by gender should be followed (College Board, 2004).

National data also suggests lower pass rates on AP tests for females; however, such data disaggregated by gender is not available from the Wisconsin DPI at this time.

The reasons for gender discrepancies in testing performance must continue to be researched, particularly in light of the No Child Left Behind Act, which pressures schools to put even greater emphasis on high stakes standardized test-taking.

### **Computer Science**

In its 1999 report “Tech-Savvy: Educating Girls in the New Computer Age,” the AAUW identifies a significant gap in participation and achievement in computer science education among K-12 girls. The report notes that computer science is the only subject in which girls’ test scores have not improved since 1992.

*Course-Taking Patterns.* Researchers suggest that part of the problem is that girls are choosing not to enroll in elective computer science courses, particularly at the 9-12 grade level. When they do take computer courses, girls choose classes that emphasize skills such as word processing and data entry as opposed to classes that emphasize programming and problem

solving. In other words, girls appear to be preparing themselves for lower-paying secretarial positions instead of more lucrative computer-based careers (AAUW, 1999).

Whether or not a difference in the type of computer course taken by boys and girls exists in Wisconsin is difficult to assess. DPI categorizes enrollment in only two types of computer science courses: “Beginning” and “Advanced.” There is, however, a clear drop-off in female participation in computer science courses from middle school to high school, particularly at the advanced level:

**Table 13: Beginning Computer Science Enrollment, Entire State**

	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
<b>Total Male Students</b>	4,893	4,653	4,145	2,577	2,640	2,276	1,617
<b>Total Female Students</b>	4,684	4,398	3,585	1,612	1,179	887	769
<b>Percentage of Female Students</b>	48%	49%	46%	38%	31%	28%	32%

**Table 14: Advanced Computer Science Enrollment, Entire State**

	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
<b>Total Male Students</b>	43	205	517	843	1,167	1,339	1,522
<b>Total Female Students</b>	53	163	397	741	360	444	732
<b>Percentage of Female Students</b>	55%	44%	43%	47%	24%	25%	32%

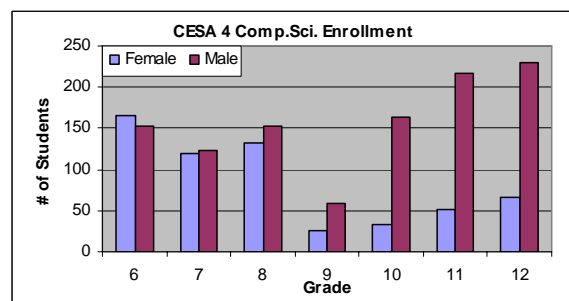
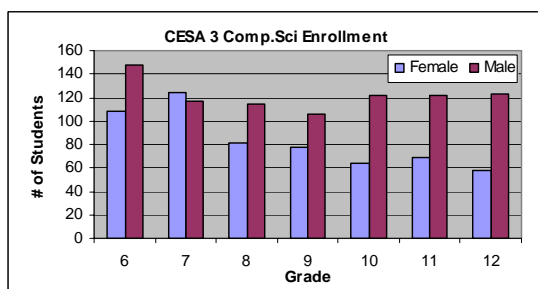
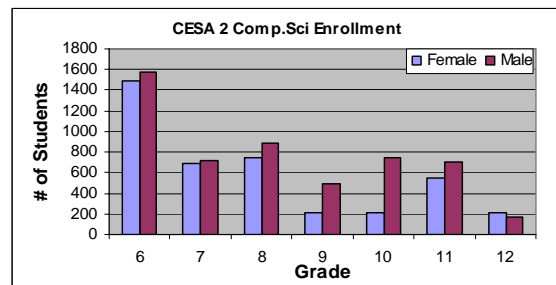
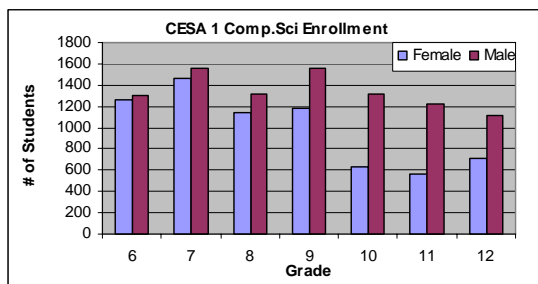
In addition, girls comprise only 17% of the 1,090 Wisconsin students enrolled in AP and CAPP computer science courses.

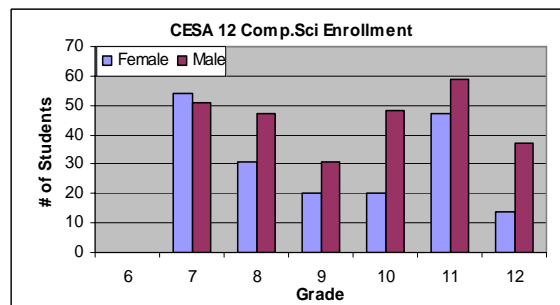
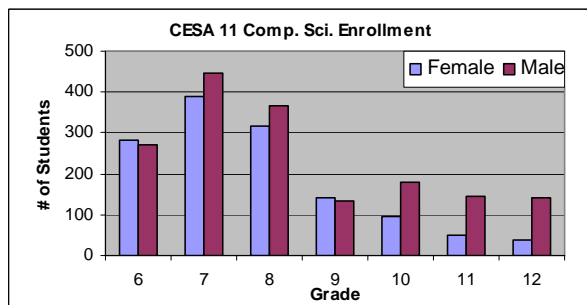
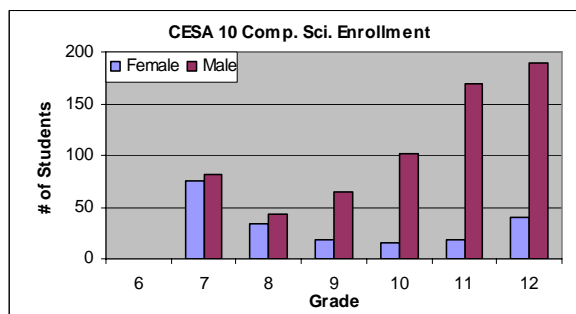
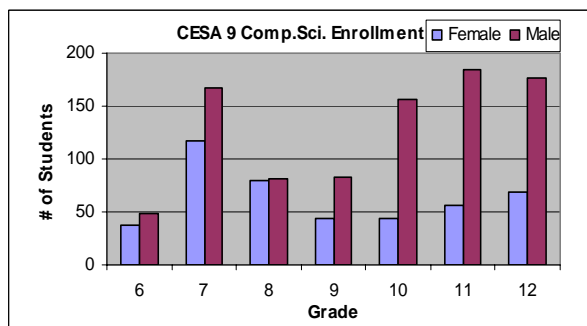
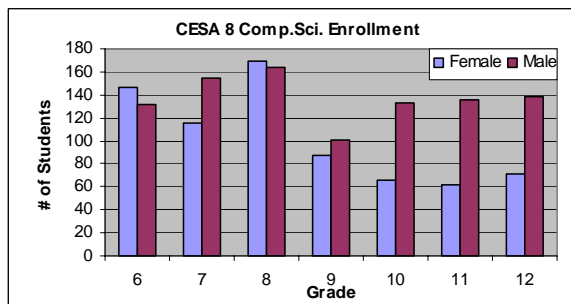
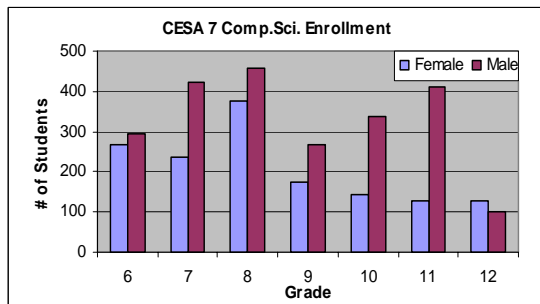
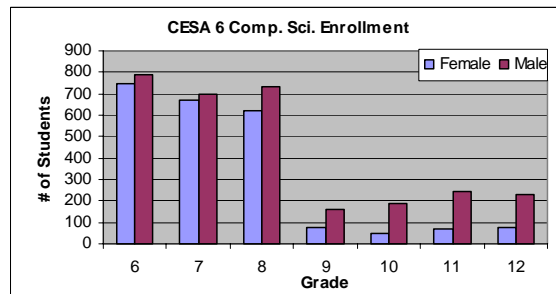
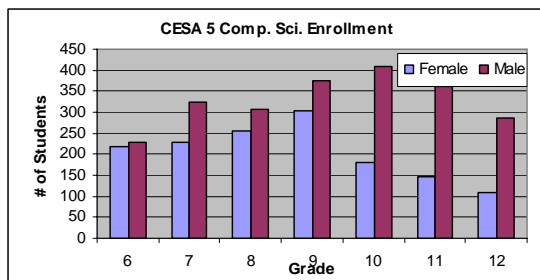
**Regional Data.** An examination of the enrollment in computer science classes by CESA also reveals an interesting pattern. In most CESAs the number of girls enrolling in a computer science class was competitive with the number of boys enrolling through middle school, though the number of boys enrolling by grade was higher than girls in all but three sixth grades, one

seventh grade and one eighth grade. After eighth grade, two phenomena can be observed. The first is that in CESA 2, 6, and 11 the number of both boys and girls enrolling in computer science classes dropped off dramatically. The most significant drops occurred in CESA 6 where the number of boys dropped from over 700 in 8<sup>th</sup> grade to just over 100 in 9<sup>th</sup> grade and the number of girls dropped from over 600 in 8<sup>th</sup> grade to just 80 in 9<sup>th</sup> grade. This may be explained by course offerings in area districts, however.

The second phenomena occurs in CESAs 1, 3, 4, 5, 7, 8, 9, 10 where the number of boys enrolling in computer classes after 8<sup>th</sup> grade either grows or remains constant while the number of girls enrolling in the same classes drops off dramatically. The most significant disparity between boy and girl enrollment numbers occurs in CESA 10 where girls make up only 9.6 percent of the students enrolled in computer science classes in the 11<sup>th</sup> grade. Enrollment in CESA 12 exhibits a combination of the two phenomena described above. The series of tables below show the enrollment by grade level and CESA for girls and boys in Wisconsin.

**Table (Series) 15: Computer Science Enrollment by CESA**





**Reasons for Discrepancies.** The AAUW report suggests that this lag in participation is the result of a general disenchantment with “computer culture,” which fosters a “we can, but we don’t want to” attitude when it comes to computer science. Girls who participated in focus groups almost never reported overt discrimination (i.e., were told they were less competent,



unable to enroll in computer courses), yet most did not predict that they will want to learn more about or become more involved with computers in the future.

Female participants rejected overall generalizations about gender, but described “a highly developed set of beliefs” about boys’ and girls’ relationships to computer technology. For example, when asked to describe a person who is “really good with computers,” most described a male. Girls also described themselves as more “socially evolved” than boys, and thus were more interested in interacting “with humans, not machines.” Focus group members also described information technology-related careers not as too difficult, but as a “waste of intelligence,” and in some cases, materialistic and short-sighted (AAUW, 1999).

### **Vocational-Technical Education**

*Course-Taking Patterns.* The greatest gender gap in Wisconsin schools persists in vocational-technical education. Few technical education courses are offered at the sixth and seventh grade levels, but approximately equal numbers of Wisconsin girls and boys enroll in those that are. By eighth grade, however, when more courses are offered and students have greater individual choice regarding their schedules, females account for only about one-third of those taking vocational-technical education courses. Enrollment is even more disparate in high school courses, where girls make up only 14% of the 123,217 Wisconsin students taking technical education courses, including courses in construction, communications & electronics, engineering, manufacturing, transportation, and broad based technology (WI-DPI Enrollment Data, 2002-03).

*Interventions.* Previous efforts to increase technical education enrollment have not resulted in much success. For example, in 1999, DPI, in conjunction with UW-Stout, launched the “TACKLE Box Initiative,” a four-year, statewide program meant to address vocational

inequity. In the Model District Initiative, a K-12 component of TACKLE Box, action research groups in Janesville, Wausau, and Appleton assessed and attempted to reduce tech-ed gender inequities at the district level. Teams identified factors that affect girls' choices to participate in technical education classes, including five suggested by Welty and Puck (2001): sense of self and social fit; classroom climate; curriculum and instruction; role models, mentors & peers; and messages from counselors. Team members then carried out interventions such as revising curriculums and guidance materials (to make them less-gender biased), developing tech-ed themed extra-curricular clubs, and putting together nontraditional career fairs.

While members of each team suggested that the project increased their individual awareness of gender equity issues, none of the interventions resulted in increases in enrollment over the time of the study (Scholl & Volin, 2003). Resource materials that were developed for use by districts statewide also seem to have had little effect (or perhaps were not well accessed by other districts); statewide female enrollment in tech-ed courses has actually decreased by four percent since 1999 (WI-DPI, 2004).

Research suggests that mentorships may be helpful in recruiting and nurturing students in nontraditional fields (Zirkel, 2002). Unfortunately, girls looking for female role models in technical education will not find them in Wisconsin schools; approximately 90% of Wisconsin's full-time technology education teachers are male (WI-DPI, 2004).

Researchers, as well as TACKLE Box team members, acknowledge that progress in attracting girls to nontraditional technology education courses and careers will need to be made on an incremental basis, utilizing multiple approaches (Welty & Puck, 2001; Scholl & Volin, 2003).

## **Career Counseling and Education**

Another area of concern for girls in Wisconsin schools is career counseling and education. Research suggests that girls may be best served by differential counseling approaches, and that women use different criteria than men when making career decisions (Gilligan, 1982; Malcom, 2000). DPI counseling consultant Linda Krantz explains that there is great variation in the quantity and quality of career education programming received by students across the state; again, Wisconsin state counseling Standard [e] leaves much room for interpretation. Krantz recommends better standardizing career education, perhaps in the form of a short required course.

A good time to intervene or offer such a course in the future would be during the eighth and/or tenth grade year. Recently, WI-DPI has used funding from the Carl Perkins grant to develop a Holland Career Inventory to be administered to eighth and tenth grade students via computer. According to Krantz, the system will provide feedback for students regarding areas of career interest, and will also provides a wealth of information regarding possible careers, including what education is necessary, pay scales, etc. WI-DPI is hoping the computer format will be more appealing to students, will make the inventory easier to administer, and will provide more useful and comprehensive career information (Krantz, 2003).

The above innovation by WI-DPI sounds promising; however, subsequent sections of this report show that some kind of specific career counseling intervention for young women remains necessary. Despite hearing messages that “girls can be anything they want to be,” women are still clustering in traditional, lower-paying jobs.

## **Special Education**

Nationally, there is growing concern regarding gender discrepancies in special education referral, diagnosis and service provision. For some time, twice as many boys as girls have been labeled as having disabilities and have received mandated special education services (Rousso & Whemeyer, 2001). This gender difference is even more marked in Wisconsin, where girls comprise only 33% of total students classified as having a disability. Female students comprise a lower percentage of students in all disability categories:

**Table 16: Special Education Student Count as of December 1, 2002**

<b>Primary Disability Description</b>	<b>Males</b>	<b>Females</b>	<b>Total</b>	<b>Percentage Female</b>
Autism	2,559	520	3,079	17%
Cognitive Disability	7,091	5,623	12,714	44%
Deaf-Blind	4	3	7	43%
Emotional Behavioral Disability	13,072	3,465	16,537	21%
Hearing Impairment	861	744	1,605	46%
Specific Learning Disability	33,258	17,185	50,443	34%
Other Health Impairment	6,532	2,728	9,260	29%
Orthopedic Impairment	864	644	1,508	43%
Significant Developmental Delay	1,763	769	2,532	30%
Speech or Language Impairment	18,803	9,702	28,505	34%
Traumatic Brain Injury	250	113	363	31%
Visual Impairment	284	189	473	40%
<b>TOTAL</b>	<b>85,341</b>	<b>41,685</b>	<b>127,026</b>	<b>33%</b>

Source: Nancy Fuhrman, Special Education Team, WI-DPI

While on the surface these numbers may look primarily like bad news for boys, they may also have serious consequences for girls. A portion of the under-representation may be explained by biology, but research suggests that gender bias in the special education referral process also exists (Rousso & Whemeyer, 2001). A review of the literature suggests that in comparison to boys:

- Girls are older when admitted to special education, suggesting they wait longer to receive assistance.
- Girls must have more significant deficits in order to receive special education services and supports (particularly when IQ measurement is used as an indicator).
- Girls, once admitted for special education services, are more likely to be placed in more segregated and restrictive classroom settings.
- Girls who experience learning problems may exhibit more passive behaviors; therefore, they may be disregarded as needing services, especially when the problem is “only” in math.
- Girls with disabilities leave school to less successful vocational outcomes than both males with disabilities and nondisabled males and females.

These discrepancies must be studied further in order to ascertain their causes and effects, for both girls and boys.

### **Gifted and Talented Education**

National evidence regarding participation in gifted and talented education programming provides mixed evidence for girls. In their study *Gender Gaps: Where Schools Still Fail Our Children*, the AAUW (1995) suggests that enrollments in gifted programs favored girls; however, girls dropped out of high school gifted tracks at a faster rate than boys. More recent information from Salomone (2003) suggests that girls today may face under-representation in gifted and talented programs.

In Wisconsin, there is currently no easy way to assess whether these national patterns exist at the state level. Standards for referral and entry into gifted and talented programs vary by district, and no statewide participation or drop out numbers are collected by DPI. Due to recent budget cuts, there is no longer a gifted and talented coordinator at DPI.

## **Implications for Wisconsin's Economy**

Better, more welcoming educational opportunities in science, technology, engineering, and mathematics (STEM) fields will be crucial to women's success in an economy that would benefit from their full participation. Opportunities for employment in the United States are growing most rapidly in areas that require knowledge and skills in the STEM fields. Business leaders in a variety of fields, especially information technology, are concerned over a potential critical shortage of skilled workers in the U.S., threatening their ability to compete in the global marketplace (Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, 2000). Businesses benefit from diversity of their workforce, which provides a broader base of ideas and ways of understanding from individuals from different backgrounds and perspectives, offering ways to attract new markets.

***Women in the Work Force.*** The Department of Labor suggests that women and minorities will be the majority of new entrants into the workforce, and Wisconsin already ranks near the top in the nation in women's labor force participation (Nakkoul, 2000; IWPR, 2002). Now more than ever, for many women, a well-paying job is an economic necessity; for example, in Dane County, two-thirds of working women are heads of household. Most women work because of economic need, and often their income makes the difference in whether a family is at or below the poverty level (Nakkoul, 2000).

Despite a dramatic increase in overall educational attainment, however, women are still clustered in many of the same lower-paying, less prestigious career areas that they were 20-30 years ago. Nontraditional occupations are defined by the U.S. Department of Labor as jobs in which 25 percent or fewer of the workers are of one gender. Of the 508 occupations tracked by the U.S. Department of labor, 441 are classified as nontraditional for women. Over 80 percent of

women work in just 20 occupations (Nakkoul, 2000). Resulting pay disparities also remain. According to the IWPR (2002), Wisconsin ranks 39<sup>th</sup> in the nation for ratio of female to male earnings, with women earning only 69.8 cents for every dollar earned by men.

*Study of Students Graduating from the University of Wisconsin-Milwaukee.* The findings of a study conducted by the University of Wisconsin-Milwaukee Employment and Training Institute (ETI, 2000) support the suggestion that girls leaving Wisconsin public schools continue to make career choices that result in lower pay and less occupational variety for them as adults. This study examined the employment experiences of Milwaukee Public Schools students who graduated from the University of Wisconsin-Milwaukee from 1989-1998.

The ETI study suggests that women continue to pursue degrees in traditionally female-dominated (and lower-paying) occupational areas. The top three degree areas for women were education, nursing, and social work. The study also suggests that women remain highly concentrated in these areas; for example, 19 percent of female graduates, or 305 students, studied in education areas. Male graduates reflect a more diverse portfolio. The top major among men, Accounting, had only 87 graduates.

Data suggests differences in wage levels for men and women even when they pursue similar degrees. For example, the study found that the average annual starting salary for a male graduate with a degree in Nursing was \$38,068 while the starting salary for a female graduate with a degree in the same area was \$34,508. The most vivid example of inequality from the study is that of graduates with a degree in Accounting. Males who graduated with an Accounting degree from the University of Wisconsin-Milwaukee from 1996-1998 had an average salary of \$68,824 at the end of 1999. In contrast, females who graduated in 1996-1998 with a degree in Accounting had an average salary of \$36,688 at the end of 1999, almost 50

percent less than their male classmates. The table below projects lifetime wages for men and women, utilizing a 3 percent inflation rate:

**Table 17: Projected Lifetime Wages for UW-Milwaukee Graduates**

**Lifetime Wages for Graduates**

Starting Salary	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30
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**UWM Female**

**Graduates**

Average Female

Graduate	\$33,948	\$39,355	\$45,623	\$52,890	\$61,314	\$71,080	\$82,401
Registered Nurses	\$34,508	\$40,004	\$46,376	\$53,762	\$62,325	\$72,252	\$83,760
Elementary Education	\$37,788	\$43,807	\$50,784	\$58,872	\$68,249	\$79,120	\$91,721
Social Work	\$27,864	\$32,302	\$37,447	\$43,411	\$50,325	\$58,341	\$67,633
Accounting	\$36,688	\$42,531	\$49,306	\$57,159	\$66,263	\$76,817	\$89,051

**UWM Male Graduates**

Average Male Graduate	\$45,820	\$53,118	\$61,578	\$71,386	\$82,756	\$95,937	\$111,217
Accounting	\$68,824	\$79,786	\$92,494	\$107,226	\$124,304	\$144,102	\$167,054
Criminal Justice	\$37,012	\$42,907	\$49,741	\$57,663	\$66,848	\$77,495	\$89,838
Finance	\$42,112	\$48,819	\$56,595	\$65,609	\$76,059	\$88,173	\$102,217
Electrical Engineering	\$51,952	\$60,227	\$69,819	\$80,940	\$93,831	\$108,776	\$126,101

\*data from <http://www.uwm.edu/Dept/ETI/jobs/uwmmps.htm> using 1999 wages

***The Potential for Women in Nontraditional Occupations.*** The earning potential for women increases significantly (by 20-30 percent) when they enter nontraditional occupations (NTOs), with an even greater increase when they are offered supportive services in preparation for an NTO career. Hourly wage data from the Dane County Job Center placements, July 1999 to May 2000, shows the following annualized wage comparisons:

- Men - \$18,179
- All Women - \$16,224
- NTO Women - \$17,908
- NTO Women who received preparatory services - \$22,678

Women who enter nontraditional occupations are also frequently offered more opportunities for career advancement due to built-in career ladders. Also, there are often better



opportunities in nontraditional employment for women via benefits such as health insurance or retirement plans and paid vacation (Nakkoul, 2000).

Wisconsin educational policy at the K-12 level should emphasize a commitment to attracting more girls into nontraditional fields and postsecondary education in general. As more women pursue these paths they will become empowered through financial self-sufficiency and independence. Wisconsin's economy will benefit from the availability of more skilled labor and a more diverse workforce contributing new ideas to industries and receiving increased wages. Fostering economic self-sufficiency will allow women to gain higher self-esteem, and perhaps help to lower the number of families considered "working poor" or reliant on public assistance.

### **Conclusion**

In conclusion, the authors find that although progress has been made, Wisconsin must do more to increase girls' interest, participation, and achievement in the STEM fields. In addition, parents, teachers, counselors, and policy makers must find ways to help girls better utilize the skills they've gained as they make career decisions and life choices.

Several areas not addressed in this report remain important for future study, including STEM education in the Wisconsin Technical College and University systems, the possible problem of a "brain drain" within the state, and K-12 teacher education regarding gender equity issues. In addition, it should not be assumed that problems and potential solutions apply equally to all groups of women in the state. For example, information regarding differences in educational attainment and achievement among women from different racial and ethnic groups and geographical areas was difficult to obtain, but is crucial to our understanding of how to address problems and learn from success stories.

In addition to these suggestions for areas of future study, the authors offer the following policy recommendations for WI-DPI and school districts, as well as a sampling of statewide “Best Practices,” programs that serve to recruit and nurture girls and women in nontraditional fields.

## POLICY RECOMMENDATIONS

### *Recommendations for Wisconsin Department of Public Instruction*

- Expand data collection to allow more complex analysis of course-taking patterns and test results, and better targeting of programs.
  - Disaggregate enrollment reports and WCKE test results by gender *and* ethnicity, race, class, disability.
  - Disaggregate AP test taking and course taking data by gender *and* ethnicity, race, class, disability.
  - Collect data regarding gifted and talented program participation.
  - Develop baseline measures for gender equity in course taking and test results (including college entrance and AP exams), and monitor participation and results.
- Standardize career education.
  - Capitalize on the implementation of the newly developed Holland Career Inventory at the eighth and/or tenth grade level by adding a statewide required short course in career education.
  - Provide support for districts trying to maintain elementary school counselors.
- Actively pursue increased funding of gender equity efforts.
  - Utilize a higher percentage of Carl Perkins federal funds.
  - Pursue other grant possibilities (for example, AAUW).
- Collect and disseminate best practices and curriculum information.
  - Provide easily accessible and well maintained links via the DPI Web site.
  - Provide publications to local districts.
- Review, and if necessary, revise state educational standards (in counseling, math, science, computer science, and technical education) to explicitly address gender equity issues.

### *Recommendations for School Districts*

- Develop a comprehensive plan to address gender equity, beginning at the kindergarten level and including activities and standards at each subsequent grade level.
- Review instructional materials and the school environment to identify and eliminate gender bias (AAUW provides plans and publications to assist in this task).
- Recruit female teachers in nontraditional subject areas, especially technical education.
- Develop relationships with local businesses, technical colleges, and universities to help capitalize on local economic and human resources, provide access to future educational and employment opportunities, and build on the Grow Wisconsin economic clusters.
- Promote action research by teachers within the district regarding gender equity efforts. Track student participation rates and achievement over time.
- Develop school and extracurricular programs using guidelines from the list of suggestions on the following page (“Key Components of Successful Nontraditional Course Recruitment Programs for Girls”).

## **Key Components of Successful Nontraditional Course Recruitment Programs for Girls**

- Programs must be targeted to young girls; the foundation for gender identity is clearly in place by age four, and research shows that girls begin to eliminate career choices because they are the wrong “sex-type” as early as age six (Welty & Puck, 2001; Darke & Clewell, 2000).
- Programs must also be comprehensive and continuous. One-time events such as career fairs, guest-speakers, trips to labs, etc. seem to have little impact unless they are part of a sustained effort to call attention to nontraditional options for girls (Scholl & Volin, 2003).
- Programs must simultaneously consider and address key influences that impact girls’ decisions to enroll in nontraditional courses or pursue nontraditional occupations: social fit, classroom climate, curriculum and instruction, role models and mentors, and messages from counselors (Welty & Puck, 2001).
- Research suggests that adolescent girls form very strong social bonds with female peers, and prefer educational experiences that allow them to work together with classmates. Recruitment strategies that target groups of girls (taking advantage of “the herd instinct” and peer pressure) are more likely to result in significant increases in enrollment in nontraditional academic areas. Extracurricular clubs may be particularly effective (Welty & Puck, 2001; Darke & Clewell, 2000).
- Informal, integrated programs that utilize community resources such as museums, parks, health care facilities, research facilities, television and radio stations, government and university laboratories, industrial and commercial sites, and cyberspace allow girls to see how learning about science, math, computers, etc. connects with “the real world.” Girls often cite the failure to make this connection in the classroom as a reason for avoiding math, science, computer, and technology classes (Hanson & Smith, 2001).
- Programs coordinated with local and national organizations such as Girl Scouts, 4-H, Boys’ and Girls’ Clubs, Big Brothers/Big Sisters have also shown promise and allow for multi-generational learning and mentoring opportunities (Hanson & Smith, 2001).
- Mentoring programs are most successful when they provide girls with sustained, long-term relationships with women in nontraditional roles. Matching a minority student with a mentor from a similar racial background also seems to increase the positive impact of such a program (Zirkel, 2002).
- Whereas most curricular materials focus primarily on the nontraditional contributions of “superstars” such as Marie Curie, mentor programs allow girls to see and be inspired by “everyday women,” thus providing more attainable goals for girls interested in pursuing careers in science, math, and technology (Welty & Puck, 2001).
- Programs must also involve parents, as their influence is crucial in the development of their children’s gender identities. Parents’ support of daughters in nontraditional areas is also a key component of many success stories (Welty & Puck, 2001).
- The above recruitment and instruction strategies benefit ALL students involved, and may be particularly helpful for reluctant or at-risk learners (including minorities and students with disabilities) who have traditionally met with less success in these areas (AAUW, 1999).

## **Best Practices: A Sampling of Programs in Wisconsin that Recruit and Nurture Girls and Women in Nontraditional Fields**

- **National Science Foundation (NSF)** independent federal agency established in 1950 to promote and advance scientific progress in the U.S.
  - Committed to enhancing the current rate of participation of women and girls in Science, Technology, Engineering, and Mathematics (STEM) education and careers
  - Implementation and Development Projects fund projects that build on existing research about gender and STEM infrastructure to create positive, permanent change in academic, social, and scientific climates
  - Information Dissemination Activities (IDA) to promote strategies, research results and resources to accelerate efforts to increase women's involvement in STEM
  - Graduate Research Fellowships with a special component, Women in Engineering and Computer and Information Science
  - Research Planning Grants and Career Advancement Awards to support women scientists and engineers
  
- **Wisconsin Initiative in Math, Science, and Technology in Education (WIMSTE)**
  - Comprehensive School Reform Demonstration grant program at Bowler Elementary (very high poverty, Native American, disability, and at-risk population).
    - 18% increase for female students in grade 4 science scores for proficient and advanced students
    - 27% increase for female students in grade 8 science scores for proficient and advanced students
  
- **Women's Bureau**
  - Girls' E-Mentoring (GEM-SET) Program connects young women in high school with professional women in science, engineering and technology
  
- **Girl Scouts**
  - General
    - Kelly Johnson, production engineer: believes Girl Scouts promote strong individuals with good leadership skills, and they offer a wide range of activities to allow girls to develop their interests
  - Riverland Council (La Crosse)
    - Program that offer girls opportunities to explore science and math fields; 420 girls in western Wisconsin participating in these events supporting girls in STEM fields
  - Fox River Area
    - Programs to give girls hands-on math and science experiences
    - Programs that offer career exploration opportunities in STEM fields
    - Organized outings that utilize local museums and planetariums to expose women to related STEM fields

- Lac Baie Council
  - Standard badges in STEM fields
  - Organized outings to expose girls to astronomy, anthropology, orienteering
  - Cookie Sale introduces math and business to girls
- Birch Trails Council
  - Rise and Shine outreach program delivered to low-income and minority students during the school day (K-5); sessions revolve around math and science
  - Programs introducing girls to the forest industry, astronomy, geology, conservation and environmental education and biology
- Black Hawk Council
  - 57% of all Girl Scouts in the region have completed badge work or recognition in math or the physical sciences
  - Programs to engage girls in land stewardship projects
  - Partners with numerous organizations to provide a wide range of science and technology opportunities
- **Wisconsin FFA (High School Program)**
  - Close to 40% of students in agricultural education are female
  - 60% of leadership in local chapters is female
- **UW System**
  - General
    - Opening Workshop for new UW System STEM educators
    - Curriculum Reform Institute to address issues that often discourage women and minorities from pursuing study in STEM fields
    - Spring Retreat for faculty participants to showcase their work that resulted from Opening Workshop or Curriculum Reform
    - Women and Science Program provides information and resources to faculty via a system wide listserv
  - UW-Parkside
    - LEGO Robotics for Girls offers exposure to engineering and science as students build their own robots and program them
  - UW-Oshkosh
    - Science Safari Day – hands on sessions for 300 area Girl Scouts regarding science and math topics
    - Cognitively Guided Instruction (CGI) addressing women/girls and Native Americans in the mathematics area
  - UW-La Crosse
    - Girls in Science Program for talented girls interested in science in grades 6-8 for academic experiences in STEM fields
    - Young Scholars Program for highly motivated students who enjoy learning offers a wide variety of learning opportunities

- UW-Eau Claire
  - Challenges and Choices program for young women in grades 6-8 to expose them to women working in STEM and NTO fields
  - Science Institute for students ages 12-16 to provide opportunities for exceptional students to explore a science topic intensively for a one-week period
  - Women in Information Technology Systems (WIC) creates a supportive environment for female students and attracts women to majors in this area
- UW-Stout
  - STEPS: Summer Technology and Engineering Preview for Girls, a one week introduction to the world of manufacturing for 160 girls entering 7<sup>th</sup> grade to expose women to the opportunities for STEM careers
- UW-Stevens Point
  - Women & Science Day junior and senior high girls attend workshops on a wide range of science topics to promote careers and education in science
- UW-Platteville
  - Women in Engineering Summer Institute – one week interactive summer residence programs to provide women in grades 9-12 the opportunity to visit one of the top engineering schools in the country
  - Women in Engineering Fall (Spring) Career Day one-day event for women in grades 8-12 to provide information about the engineering profession
  - Mentoring and Outreach visit grade, middle and high schools to present interactive demonstrations to encourage students to consider engineering as a profession
  - Women in Engineering Mentor Center a place for students to meet with their peer mentor groups and houses the local chapter of the Society of Women Engineers and a work and storage area for the Hand-Tool Program
  - Female faculty, staff and students serve as Program Ambassadors for the Women in Engineering Program, focusing on pre-college students visiting the campus, female students and their families may enjoy having a luncheon with the Director or a Program Ambassador to connect with other women engineers and to learn about the program
  - Expanding Your Horizons – annual conference (intervention strategy) to nurture 6<sup>th</sup>-8<sup>th</sup> grade girls' interest in science and math courses and careers (over 75 girls participate each year)
- UW-Madison
  - With Edgewood College runs Expanding Your Horizons offering career session activities for 6<sup>th</sup> – 8<sup>th</sup> grade girls
  - Women in Science and Engineering Leadership Institute (WISELI)
    - Mission of increasing the participation and advancement of women in academic science and engineering
    - Collecting information on patterns of assigning resources
    - Developed climate workshops for Department chairs

- Increasing the diversity of candidate pools for faculty and administration positions
  - Running laboratory management workshops
  - Life Cycle Research Grant Program – funds available at critical junctures in the research careers when research productivity is affected by personal life events
  - Celebrating women in science and engineering grants
  - WISELI seminar series
  - Leadership development for non-tenure-line women
  - Tenure-line conversion for non-tenure-line women (converting academic staff positions to faculty positions)
  - Leadership development/mentoring for senior women
  - Developed networking opportunities for women scientists and engineers
  - Awards and recognition of women scientists and engineers
  - Camp Badger Exploring Engineering Program – one week residential program for Wisconsin teenagers who will be entering 8<sup>th</sup> grade in the fall
- UW-Milwaukee
  - High School Scholars Summer Program in Biomedical and Laboratory Sciences
  - Clinical Laboratory Sciences Program promotes and develops successful careers for women in health sciences
  - Society of Women Engineers networking support and programs to develop interest in engineering
  - WISE (Women in Science and Engineering)
  - College for Kids (K-8) offers a challenging and innovative curriculum for girls to actively explore STEM fields and knows the importance of modeling by example and tries to find women to teach classes that are traditionally associated with men
  - Noncredit engineering course offerings
  - Web Development, Design or Administration Certificate program
  - UWM Center for Science Education has outreach modules that promote women as scientists
  - Women’s Resource Center a drop-in center that offers services to identify and eliminate barriers in reaching academic, professional and personal goals
- **Wisconsin Technical College System**
  - Programs to develop and support women in STEM since the 1970s
  - Coordinates funding and guidance to the colleges in order to increase the enrollment and graduation of students in high wage, high technology programs
  - Until 5 years ago, there was one person identified per college as a resource person for gender equity activities, now a broad range of staff
  - Chippewa Valley & Nicolet Area offer an interactive technology camp for 11<sup>th</sup> and 12<sup>th</sup> graders to explore NTO and technical careers
  - Fox Valley provides an NTO recruitment and retention program



- Gateway offers a Young Women in Technology, Pre-Technical Summer Camp for women entering 11<sup>th</sup> or 12<sup>th</sup> grade
- Lakeshore provides a NTO program in cooperation with local job centers, providing community based outreach
- Waukesha County provides a pre-technical learning project for high school age girls and a program for recruitment and retention of men and women in NTO programs for their gender
- Western Wisconsin coordinates career development services for women through a combination of resources and offers collaborative activities with local high schools

Note: Information reported above was collected through an informal email survey conducted by Task Force Co-Leader Carol Sue Butts.

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