Gender Equity in CTE and STEM Education

This OCCRL brief addresses the contemporary issue of gender equity in education and the workplace. Recognized as a concern for the United States, equal pay for equal work emerged as a hot-button issue recently when President Obama signed two executive orders pushing federal contractors on pay transparency and pay equity for women on federally funded programs (The White House, 2014). The President’s concern reflects the fact that many of the jobs that women hold offer lower wages than similar jobs held by men having comparable education and work experience (Toglia, 2013). The pervasive lack of gender equity limits not only income for women but also limits the inherent wealth in the nation’s human capital.

This brief explores the economic and social implications of gender inequity in career and technical education (CTE) and science, mathematics, engineering, and technology (STEM) fields. Further, it discusses factors that influence and barriers that deter entry to CTE for women and girls. This brief also provides a snapshot of the CTE landscape in the State of Illinois, through wage data and student enrollment in CTE programs of study in secondary and postsecondary institutions, and ends with recommendations for practitioners and policy makers.

Defining Gender Equity

Gender equity in CTE can be traced to Title IX of the Educational Amendments of 1972 (Toglia, 2013). Most associate Title IX with female student participation in sports; however, the language in Title IX clearly applies to education as well: “no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving federal financial assistance” (Kaplin & Lee, 2006, p. 1462). Though it has been 40 years since this major federal policy was enacted, women continue to experience underrepresentation in nontraditional CTE fields and STEM programs (National Coalition for Women and Girls in Education, 2012; National Women’s Law Center, 2005).

A nontraditional occupation is defined by law as an occupation wherein women account for 25% or less of those employed (U.S. Department of Labor, 2009). The National Coalition for Women and Girls in Education (2012) examined secondary and postsecondary female enrollment by career cluster between 2009 and 2010 and found:

- Females made up less than 25% of participants in science, technology, engineering, and math programs nationally (21% at the secondary level and 24% at the postsecondary level), and much lower numbers in manufacturing (17% and 11%, respectively); architecture and construction (15% and 10%); and transportation, distribution, and logistics (8% and 7%). (p. 30)

The 1984 Carl D. Perkins Act included funds for states to establish a position for an individual whose sole focus was to diminish gender bias and stereotyping in vocational education (Gathercoal & Stern, 1987; National Women’s Law Center, 2003). In the 1998 reauthorization (Perkins III), the gender equity coordinator position was eliminated, but states were required to use 10.5% of their federal funds to create gender-equity programs specifically for displaced homemakers, single parents, and single pregnant women and $60,000 on activities geared toward establishing gender equity (Scott & Sarkees-Wircenski, 2008). The 2006 reauthorization (Perkins IV) required state performance indicators, or targets, to be met in terms of enrollment and completion of CTE programs that lead to employment in nontraditional fields or risk losing federal funding (Gordon, 2008; National Coalition for Women and Girls in Education, 2008). A major goal of Perkins IV is to provide education for careers or jobs in high-paying, high-skill fields by increasing participation and enrollment of students in nontraditional CTE fields to achieve more equitable outcomes by gender. However, research on career and technical programs of study demonstrates the disproportionate enrollment of women and men in programs that lead to occupations historically dominated by gender, with accompanying salary disparity for those occupations. With the exceptions of nursing and teaching, most women employed in female dominated fields do not earn wages or salaries to ensure their own economic security, let alone one that can support a family (McMahon & Horning, 2011).
A study conducted by the Illinois State Board of Education (ISBE) on 2010–2011 student enrollment by CTE concentrators in secondary and postsecondary education showed females clustered into four areas: health science, human services, and marketing, social science, and fine arts. In 2010, 40% of all female students enrolled in CTE programs, whereas 36% of all male students did. The difference between male and female enrollment in these areas is significant and has been consistently observed in previous years.

Factors and Barriers that Influence Occupational Choices

Many factors influence the career paths chosen by women and men. According to human resource and career development research, students begin to eliminate careers based on gender between the ages of six to eight years (Gottfredson, 1981). By adolescence children’s expectations about work are clearly influenced by traditional gender roles. Carnevale, Smith, and Melton (2011) found that girls, in particular, begin to experience gender biases, stereotypes, and discrimination in high school when they are early in the exploration process. For example, they found that girls were more likely to choose careers that are traditionally female-dominated, such as healthcare professions, whereas boys were more likely to choose careers that are traditionally male-dominated, such as engineering and technology.

Economic and Social Implications

As noted previously, occupations for which women fall within historically female-dominated fields pay considerably lower wages than nontraditional (by gender) CTE fields (National Coalition for Women and Girls in Education, 2012; Tofigl, 2013). Furthermore, the number of women in male-dominated fields, such as healthcare, is significantly lower than the number of men in female-dominated fields. In contrast, women in non-traditional fields are expected to earn significantly less than their male counterparts. For example, nurses, who make up 9% of approximately 3.5 million nurses in the U.S. (U.S. Census Bureau, 2013), have an average median hourly wage of $21.23 in 2010 (U.S. Department of Labor, 2010a). State wages reflect national wages, for women and men, in identical career fields in 2010 (U.S. Department of Labor, 2010b).

Many factors contribute to this wage differential. Women working out of the home, who accounts for approximately half of all employees in the workforce today, is one of the most transformative changes to America’s workforce in the 20th century (Boushey, O’Leary, & Glynn, 2013). Drilling down, we find mothers working full-time, living with and contributing to family income as a dual earner, a sole breadwinner in a marriage, or as a single parent (Boushey et al., 2013). In 2009, 40% of mothers were considered breadwinners—defined as either a single, working mother or a married mother who earns much or more than her husband (Boushey et al., 2013). Among non-income families, the percentage of female primary breadwiners is much higher at 66% (Boushey et al., 2013). In 2010 the poverty line for a family of four was $22,050 (U. S. Department of Health and Human Services, n.d.), highlighting a societal and economic reality that women working outside the home can support a family as a sole breadwinner.

This societal change, in light of the wage gap between predominantly female and male occupations, is detrimental to the economic security of many families (McMahon & Horning, 2011) and also “limits a nation’s development, for a woman’s ability to have a healthy economy directly relates to developing its human resources” (Daines, Hartenstein, & Birch, 2000, p.22).

Not only is the wage gap a concern for women, but traditional occupational choice may be limited by the nation’s inherent wage structures and the choices it reflects for men and women alike. Women are affected by the gender inequity, specifically in high-demand or high-growth fields such as science, technology, engineering, and mathematics (STEM) (Institute of Medicine, 2011). This inequity is perpetuated from childhood, where girls are often provided in schools (Women’s Educational Equity Act Resource Center, 2002). Further, evidence from the National Science Foundation research (2003) indicates that by middle school, girls begin to question their confidence in math and science classes and lose interest. These are critical gateway courses to nontraditional and high-skill, high-wage, and high-demand careers in science, technology, engineering and mathematics (STEM) (Lufkin & Wilber, 2007). A review of the Current Population Survey (CPS) in 2011 found female engineers and architects accounted for only 13.6% of all women employed 16 years of age and older (U. S. Department of Labor, 2012). Whereas there has been an increase in girls taking math and science courses in high school (Gavin, 2000), a perception still exists that girls are not as proficient at quantitative fields as are boys (National Science Foundation, 2003). A review of CTE in the U.S. from 1990–2005 found male public high school graduates in 2005 earned, on average, between .05 and .30 more Carnegie credits than their female counterparts in computer technology, construction, production, and other technological (Levesque, Hurley, Hoy, Cataldi, & Hudson, 2008). In 2009, male public high school graduates earned, on average, between .15 and .19 more Carnegie credits than their female counterparts in computer and information sciences, construction, engineering technologies, and manufacturing (Snyder & Dilliw, 2013, Table 178). The largest Carnegie credit difference between male and female high school graduates was found in engineering technologies, .24 and .05, respectively (Snyder & Dilliw, 2013, Table 178).

In the postsecondary environment, few females persist or continue to engineering, quantitative, or physical disciplines (Cowell & Campbell, 2002). In 2011, females earned only 18% of bachelor’s degrees (National Center for Education Statistics, 2013, Table 325.45) and 26% of associate’s degrees (National Center for Education Statistics, 2013, Table 325.45) in engineering and engineering technology; women earned 16% of doctor’s degrees in engineering and engineering technology (National Center for Education Statistics, 2013, Table 325.45). Additional barriers hinder gender equity in nontraditional CTE fields and STEM fields for women in K–12 education. School guidance counselors may be reproducing culturally accepted female norms or perceptions that may deter female students from transitioning into non-traditional fields (Brodie & Goefting, 2001). Women counselorsincorrectly assume that female students lack the competencies necessary to succeed in historically male-dominated career fields. Counseling literature, as well as curriculum literature, also supports gender stereotyping in nontraditional CTE careers. Kerka (2001) found that images in books, videos, and displays influenced students’ perceptions about gender stereotypical and careers. At the same time, Lufkin and Wilber (2007) found interactions with female role models could be just as powerful as images or advertisements.

Focus on Gender Equity in CTE Programs of Study and STEM in Illinois

The Office of Community College Research and Leadership (OCCRL) at the University of Illinois at Urbana-Champaign developed the Pathways to Results (PTR) process to address equity gaps among special population groups and the processes critical to student transition, retention, and completion of postsecondary education and future degree attainment. The PTR process details the journey of students from program enrollment to graduation (OCCRL, 2012). This process provides programs of study (POS) and student outcomes. OCCRL attributes the need to focus on equity and student outcomes for many reasons including, but not limited to, shifting demographics in the U.S. and Illinois and the underperformance of historically disadvantaged groups in the education pipeline (Bragg & Bennett, 2012, Taylor et al., 2012). Ensuring that all student groups have access to and matriculate from programs of study at rates relative to and representative of others within a given institution is a critical feature for PTR practitioners and teams (Bragg & Bennett, 2012; Taylor et al., 2012). PTR practitioners also can assist in eliminating gender-related stereotypes or stigma and analyze student-level data to identify gaps among groups of students and develop equity-guided solutions (Bragg & Bennett, 2012; Taylor et al., 2012).

Three teams in Illinois, Illinois Central College, Lake Land College, and Southwestern Illinois College, received grants...
from the Illinois Community College Board (ICCB) from 2009–2011 to implement PTR. The teams found female and minority students were underrepresented in their manufacturing programs of study. Below is a brief review of each team’s collection, solutions, and sustainability activities followed by a brief discussion of how Illinois is strengthening secondary and postsecondary CTE and STEM programming for all special population learners.

Illinois Central College

Illinois Central College (ICC) conducted a four–day transcript study with two district high schools to analyze student coursework and course progression from high school to ICC. Common themes emerged from the data and the team developed numerous solutions geared towards improvements in several processes: marketing, recruitment, counseling, advising, instruction, and curriculum development. Sustainability activities that evolved include ICC’s participation in the Illinois Manufacturing Expo Career Days and conducting site visits in each area high school to form or strengthen partnerships and increase exposure to manufacturing POS and careers.

Lake Land College

Lake Land College (LLC) focused on the manufacturing career cluster to identify reasons for low enrollments. Among other activities, they convened a focus group comprised of female students in area secondary schools who were interested in STEM–related careers. Findings revealed a need to target marketing specifically to females to increase their interest and enrollment, introduce and expose manufacturing careers to younger–aged students, incorporate social media in recruiting, identify same–sex role models, and add same–sex instructors to manufacturing courses.

Southwestern Illinois College

Southwestern Illinois College (SWIC) identified a lack of skilled workers as an area of concern in the manufacturing career cluster. Data collection identified a lack of a marketing plan for manufacturing as a contributing factor to the negative perception surrounding manufacturing careers and low enrollment in courses. A new recruitment and marketing plan was developed and since inception some manufacturing programs have increased student enrollment by over 80% since 2009 (OCCLR, 2013). Additional implemented solutions include creating a user–friendly website, updating college staff on program changes each semester, visiting high schools, and conducting a manufacturing camp for secondary CTE teachers.

STEM and the New Look Project

From FY03 through FY09, Perkins State Leadership funds distributed through Illinois State Board of Education (ISBE) and Illinois Community College Board (ICCB) provided support for the New Look Project as administered through the Illinois Center for Specialized Professional Support (ICSPS). Originating as the NTIO (nontraditional occupations) Look Project, this initiative provided technical assistance, professional development, resources, and financial support through mini–awards for high schools and community colleges to identify and strengthen secondary and postsecondary CTE programming for special population learners. From FY10 through FY14, the Project was continued through ICCB for CTE professionals at Illinois community colleges. Three hundred twenty–two (322) research–based activities for special populations have been enacted as a result of this Project.

Recommendations for Practitioners

Whereas CTE enrollment and wage data trends are a reflection of the larger society, secondary and postsecondary institutions can begin to reduce gender disparities by assisting in overcoming barriers and stigmas related to gender and occupational roles. In many instances lower enrollments, and ultimately completion, for certain subgroups, institutions can begin to reduce gender disparities by assisting in overcoming barriers and stigmas related to gender and occupational roles. As one way to implement these strategies, consideration of CTE fields or surface once women enroll in a CTE field. For instance, students considering a CTE or nontraditional field may experience: pressure from parents and/or peers that may stem from a negative perception of CTE programs; a lack of resources such as adequate information and role models; gender bias, which ultimately may impact curriculum design, inadequate career counseling that may impact job placement, or a lack of mentorship for women in CTE. Below are recommendations for practitioners and policy makers to reflect on their own CTE environment and experiences according to the literature presented and OCCLR’s PTR case sites:

3. Conduct institution–wide evaluations to understand if and how gender equity is promoted (Lufkin & Wiberg, 2007; National Women’s Law Center, 2007).
4. Increase institution exposure to nontraditional careers through career fairs, workshops, grant incentive, non–gender–biased print materials, literature, and visuals (Gordon, 2008; Lufkin & Wiberg, 2007; Silverman & Pritchard, 1993).
5. Provide student access to nontraditional role models as instructors or mentors that lead to job shadowing opportunities (ACTE, NAPE, NASDCTEC, & NLWC, 2009; NLWC, 2007).
6. Create or provide opportunities for students to take part in pre–technical training programs, after school activities, or summer camps (ACTE, NAPE, NASDCTEC, & NLWC, 2009; Gordon, 2008; NLWC, 2007).
7. Target gender specific groups as part of recruiting activities or an overall strategy (Silverman & Pritchard, 1993).

References


Office of Community College Research and Leadership. (2013). *Pathways to Results™ project profile update*. Champaign, IL: Office of Community College Research and Leadership, University of Illinois at Urbana–Champaign.


---

**About the Author:** Carmen Gioiosa is a doctoral candidate in Education Policy, Organization and Leadership with a specialization in education administration and leadership at the University of Illinois at Urbana–Champaign and currently works as a Graduate Research Assistant for OCCRL.

**Office of Community College Research and Leadership:** This publication was prepared pursuant to a grant from the Illinois Community College Board (ICCB Grant Agreement Number 2014–00266). Copyright 2014 Board of Trustees, University of Illinois.