INSIGHTS ON EQUITY AND OUTCOMES

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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 2011 study conducted by the Illinois State Board of Education (ISBE) on 2010–2011 student enrollment by CTE concentrators[1] in secondary and postsecondary education showed females clustered into four areas: health science, hospitality and tourism, human services, and marketing. This occupational clustering led to predominantly female occupations that have average median hourly salaries, in Illinois, ranging from $9.93 to $26.26 in 2010 (U.S. Department of Labor, 2010b). Males enrolled in CTE, on the other hand, were clustered into six CTE concentrator areas in both secondary and postsecondary institutions: agriculture, food, and natural resources; architecture and construction; arts, A/V technology and communications; transportation, distribution and logistics; information technology; and law, public safety, corrections, and security. The average median hourly salary in Illinois for these six occupational areas ranged from $13.16 to $34.61 in 2010 (U.S. Department of Labor, 2010b). That same year in Illinois, according to the U.S. Department of Labor's wage estimates, there was almost a $10.00 wage gap between the highest paying female- and male-dominated CTE fields.

Economic and Social Implications

As noted previously, occupations for women that 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; Toglia, 2013). For example, employees in female-dominated fields such as childcare workers; hairdressers, hairstylists, and cosmetologists; and medical assistants earned a national median hourly wage of $11.36 in 2010, whereas employees in historically male dominated fields such as automotive body and related repairers; plumbers, pipefitters, and steamfitters; and electricians earned a national 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).

What factors contribute to this pay differential? Women working out of the home, which 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 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 earned as much or more than her husband (Boushey et al., 2013). Among low-income families, the percentage of female primary breadwinners 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 cannot 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 nation'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 limiting the nation's inherent wealth in human capital for males as well. Males are also affected by gender inequity, specifically in high-demand or high-growth fields such as nursing (ACTE, NAPE, NASDCTEc, & NWLC, 2009). Men who work in historically female dominated fields face obstacles through gender stereotyping and gender assessment (Henson & Rodgers, 2001); however, the labor market is becoming more gender balanced in some occupations (for men in particular), thus prompting more men to consider nontraditional jobs (Jome & Tokar, 1998).

According to the U.S. Department of Labor, since 2007 there has been an increase in the number of men who choose nontraditional careers such as nursing and elementary education. In the field of nursing, men represent about 9% of approximately 3.5 million nurses in the U.S. (U. S. Census Bureau, 2013). According to Wingfield (2009), male nurses sometimes distance themselves from the femininity of the nursing profession by choosing assignments in more male-associated roles such as emergency departments or in administrative positions. Men occupying nontraditional occupations also serve a societal purpose. In the field of education, male teachers function as positive adult role models for many students (Cushman, 2005; Hall, 1996; Rice & Goessling, 2005). Yet, men are still dissuaded from entering the education field because of stereotypes as a female occupation (Foster & Newman, 2005), low salaries, status, and lack of exposure of male role models in the occupation (Rice & Goessling, 2005). So, even in 2014, with the preponderance of dual-income households (Minnotte, Stevens, Minnotte, & Kiger, 2007), barriers remain for women and men who choose nontraditional career paths (Boushey et al., 2013; Jackson, Wright, & Perrone-McGovern, 2010). Examining the origins and factors that influence career choice sheds some light.

[1] The term CTE concentrator is defined by Perkins IV as "a secondary student who has earned three (3) or more credits in a single CTE program area (e.g., health care or business services), or two (2) credits in a single CTE program area, but only in those program areas where 2 credit sequences at the secondary level are recognized by the State and/or its local eligible recipients" (Brooks, 2007, PowerPoint slide 7).

Factors and Barriers that Influence Occupational Choices

Many factors influence the career paths chosen by women and men. According to human and career development research, children 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 classrooms as early as middle school, at the same time that career exploration programs are often provided in schools (Women's Educational Equity Act Resource Center, 2002). Further, evidence from 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 math (STEM) (Lufkin & Wiberg, 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, mechanics and repair, materials production, construction, and other technologies (Levesque, Hensley, Choy, 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 and architecture, engineering technologies, and manufacturing (Snyder & Dillow, 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 & Dillow, 2013, Table 178).

In the postsecondary environment, few females persist or continue to engineering, quantitative, or physical disciplines (Clewell & 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 321.10) in engineering and engineering technologies. In the same year, only 23% of master's degrees and 23% of doctor's degrees were earned by women (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 enrolling in nontraditional CTE programs of study (Burger & Sandy, 2002). The National Women's Law Center (2005) found that counselors incorrectly assumed female students did not have an interest 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 stereotypes and careers. At the same time, Lufkin and Wiberg (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 learners and the processes critical to student transition, retention, and completion of postsecondary education and future employment (Bragg & Bennett, 2012). The need for PTR emerged as Illinois sought to improve 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 underrepresented students 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 element for PTR practitioners and teams (Bragg & Bennett, 2012; Taylor et al., 2012). PTR practitioners also can assist in eliminating gender-related stereotypes or stigmas by disaggregating and analyzing 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 data 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 Manufacturing Expo Career Days and conducting site visits with 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 recruiting and marketing plan was developed and since inception some manufacturing programs have increased student enrollment by over 80% since 2009 (OCCRL, 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 NTO (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, namely gender, are not a direct reflection of the institutions themselves; rather, disparities are rooted in a deeper historical context based upon societal gender norms. Educators have the responsibility to change inequities in school that lead to inequities in the workforce. Multiple barriers influence gender equity and may either prohibit pursuit or 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 OCCRL's PTR case sites:

1. Review counseling and education materials (print and visual) for gender-biased messaging about career and postsecondary options (American Association of University Women, 2011; Lufkin & Wiberg, 2007).
2. Conduct gender equitable professional development for counselors, advisors, teachers, and staff to counter gender-biased course and career selections (American Association of University Women, 2011; Lufkin & Wiberg, 2007; National Women's Law Center, 2007).
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, & NWLC, 2009; NWLC, 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, & NWLC, 2009; Gordon, 2008; NWLC, 2007).
7. Target gender specific groups as part of recruiting activities or an overall strategy (Silverman & Pritchard, 1993).

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