Women – an Under-Represented Population in American and International Doctoral Studies

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Abstract The retention of women in doctoral programs continues to be a challenge for higher education today. The PhD is considered the most prestigious and most international of all degrees. This paper reviews the key findings and messages from a range of publications to corroborate the key research evidence relating to the reason why women are not enrolling into doctoral programs. It then explores possible explanations and justifications for the attainment gap between women and men in doctoral programs. The paper addresses some of the reasons why women are more likely than men to dropout of doctoral programs. There is a huge disparity between men and women, who pursue PhD degrees in the fields of science, technology, engineering and mathematics (STEM). This paper will address some reasons why women of color are undereducated and underutilized in the area of STEM, and will focus on aspects of social media, status are able to communicate with peers and faculty. Social media can help students build and cultivate relationships that will have an impact on attrition rates on doctoral programs. The cohort model and peer mentoring programs have been instrumental as well in the growth of doctoral programs for the under-represented population of women.

Keywords: attrition in doctoral studies, women in science, technology, engineering, and math (STEM) fields, technology, social media, cohort model


1. Introduction

Tertiary education and research have become two leading issues in international discussions concerning economic development. An increasing conformity in the midst of decision-makers is that the society in the era following industrialization requires more exceedingly knowledgeable people with technological and specialized abilities in a knowledge-based economy [3]. The procurement of the highest degree awarded by an institution of higher education has turned out to be of principal importance in a society where the transmission of information is the innovative energy, the definitive financially viable renewable to the growth of the economy most important to a knowledge-based economy [3].

Students with the research doctorate, or the Doctor of Philosophy (PhD), represent an institution’s most select and are regarded as the graduates in all likelihood to become the world leaders of tomorrow [10]. It is considered the most distinguished, as well as the most worldwide, of educational degrees. PhD graduates are prepared for professions in academia and research, and for a wide-ranging variety of careers in commerce, government, the not for profit sector and across global settings [10].

2. Global Character of the PhD

The character and structure of research doctoral education has transformed fundamentally following the middle ages. The teachers of that time have been supplanted by various administrators, educational programs, and panels of examiners [11]. The little amount of the fields of study has developed to a collection of almost eighty fields in which research doctorates are granted. Correspondingly, what was previously a small group of privileged trainees in a small number of honored universities has now been replaced by a very large number of doctoral students in a large number of universities [7]. In present times graduates of research doctoral programs have duties in roles and surroundings that were implausible in previous times.

The PhD evolved in a different way in every nation as it extended around the world. It started to adopt the character of the universities that offered it in addition to answering to the requirements of individual civilizations. The PhD, as it is recognized in the present day, has been shaped and guided by scientific developments and economic actuality [7]. The career progressions for different PhD graduates have also become more extensive along with the international requirement for established leadership. It is increasingly anticipated that they will
make valuable contributions in the worldwide realm. Societies turn to their very knowledgeable and accomplished populace to convey their knowledge, their capacity to try out new ideas, and their preferred standard procedures and then relate them to the most urgent economic, technological, and current societal concerns and to those expected for the time to come [7]. According to a World Bank report involvement in the knowledge economy necessitates a novel set of individual abilities. Individuals must obtain advanced credentials and the capability for superior intellectual autonomy. The predominance of doctoral students internationally go to universities in developed nations that are in a position to present distinguished and comprehensive doctoral degree programs, numerous career chances, and high level of affluence [10].

In the developing nations, where a large portion of the world’s students reside, the full amount of available spaces in universities is not enough to keep up with the demand for graduate education [10]. Consequently, the majority of intellectual students in the developing nations are required to journey to educational institutions in foreign parts to achieve superior instruction. Furthermore, the governments of a number of developing nations persuade intelligent students to go out of the country, frequently using scholarships as incentives, as part of a common strategy of increasing capacity so that they are able to be a part of the newest philosophy in Europe and the United States [7].

PhD graduates are essential internationally for their capability to generate and pass on knowledge, offer leadership, coerce the progression of nation building, and promote originality and success [7]. Essentially, since the PhD is the most global of degrees, university processes associated with the assessment of PhD students frequently reflect the plausible remuneration of international views [7]. For example, in various countries outside the United States, international specialists in a field of study often carry out an external assessment of the artifact of the work such as the thesis or dissertation [7]. The increasingly collaborative, global character of research and information creation is also noteworthy. The administration of doctoral research is crossing national borders and may possibly consist of global combined degrees [7]. Worth mentioning as well is the innovative trans-nationalism [3], by means of which an individual country’s educational institutions function in a different country or through distance education.

3. Women in Doctoral Studies

Doctoral studies are known for being highly intense and rigorous; however, this experience is intensified for females. Female students often engage in multiple roles with numerous responsibilities while simultaneously pursuing doctoral studies [22]. Personal and professional needs do not cease during this process; they become key contributors to stress. Stress adversely affects the physical and emotional well-being of female doctoral students and affects their ability to persist through the program [20]. According to a study conducted by Oswalt and Riddick [40], female doctoral students self-reported higher levels of stress in comparison to their male counterparts. Haynes et al., [20] highlights various stress-related factors affecting student achievement and personal satisfaction.

Demands of pursuing doctoral studies divert attention away from students’ physical and social needs to academics that consume the greater portion of their life [26]. While doctoral programs become a central aspect of a student’s life, balancing personal, professional, and academic responsibilities generate challenges that create neglect toward personal well-being [18]. A study conducted by Oswalt and Riddick [40] marked financial, academic, and career challenges as significant stressors faced while pursuing doctoral studies. Juggling multiple roles intertwined with multiple stressors create conflicts within the lives of female doctoral students.

4. Women in STEM

As globalization continues, Ong, Wright, Espinosa, & Orfield (2011) note America must focus on engaging the interest of all Americans in the fields of science, technology, engineering, and mathematics (STEM). This calls for recruitment of minorities, particularly women, to meet the country’s growing need for innovation and technology. In a study conducted by Ong et al., [39] women of color were shown to be grossly under-represented at the doctoral level in areas of STEM. The market of females absent from these fields represents a significant source of exploited human capital to which the nation could vastly benefit [12].

In the United States women of color are undereducated and underutilized in STEM areas [29,38]. As programs direct attention toward extending STEM education to minorities, females of color continue to be neglected from these efforts [39]. Ethnic diversification is critical to optimizing STEM education due to the diverse perspectives that could potentially present innovative approach to scientific discovery [9]. Failure of America to engage women in STEM fields demonstrate a tragic failure to employ available resources within its own nation allowing for competitive gains by other countries. Expanding STEM education to women of color has the potential to add significant knowledge to the field and advance the country. Moreover, the expansion of STEM education opportunities provides justice and equity.

While recruitment of minority women in STEM fields has been emphasized, retaining women of color is another important issue. Ong et al. [39] identify the initial year of STEM doctoral studies for women of color as a critical point where many leave the program due to issues related to finances, support, and program structure. Graduate education at the doctoral level serves as the catalyst for systematic change in the promotion, development, and well-being of a diverse community, nation, and world. The influx of doctoral students enrolling in American universities continues to grow, yet there remains an under-represented population attending classes. Despite the growing awareness of the increasingly critical need to attract domestic and international students to graduate programs, the data continue to reflect a significant gap of women—in every race and origin—in the disciplines of science, technology, engineering, and mathematics enrolling in doctoral STEM programs.
5. Equitable Representation

The population of American women and girls in science, technology, engineering, and mathematics (STEM) fields has risen in the last decade, yet women are still concentrated in certain disciplines and most science professions continue to be gender segregated [36]. Equitable representation would offer females equal access to upper management, prestigious STEM careers and add novel perspectives to the scientific and technological fields. In the United States, gender disparities in STEM programs emerge as early as middle school [33]. Girls take as many science classes as boys do, and even outperform boys, but do not continue to study science once in college. Hanson [19] reported that African American females have shown greater interest in science than their Caucasian peers, and college women represent over 50% of all undergraduate life-science classes, yet only make up 25% in the study of physics [32]. In the field of technology, the proportion of women has declined since the mid-1980s (Spertus, 2004). In the engineering field, trends have leveled out within the last ten years, with women earning 35% of chemical engineering degrees, and a mere 14% in electrical engineering [32].

At the doctoral level of women who obtain STEM degrees, the percentage continues to decline. The Commission on Professionals in Science and Technology [13] reported though women earn almost one-half of mathematics bachelor’s degrees, only 27% continue to earn doctoral degrees. The CPST [13] continues to report that across all STEM fields, that women of color is under-represented, and drops at each level of advanced degree attainment. Academic STEM employment is a particular issue because faculties educate and influence students. Although the employment in STEM careers for women has increased, the rate is slow and there is continued disparity across disciplines. Men, at any career stage, are more likely to obtain a STEM position, including holding a high ranking position than women [28].

6. STEM Internationally

Women also experience many of the concerns that American women face in STEM programs internationally. In a study of Swedish postdoctoral fellowships, females had to score 20% higher in the merit review process to be rated the same as men [25]. In Italy, women researchers are able to advance their careers by 50% to that of their male colleagues, and in the United Kingdom, women have accounted for half of the biology graduates over the last three decades, yet hold less than 10% as college professors [25]. The international evidence suggests that women are under-represented due to cultural differences among countries, and not due to innate differences, and that workforce policies vary between nations [25].

Researchers describe the under-representation of female presence in the United States and internationally in STEM programs and careers:

(1) Teacher conditioning between girls and boys during science and mathematics instruction varies. The classroom climates for girls in K-12 schools taking science, mathematics, and technology and for women in college taking the same subjects are “chilly and cool.” Girls and women are treated differently than boys and men in subtle and overt mannerisms. Girls are asked low level questions, not given adequate wait-time between questions, or ignored completely, whereas, boys are given more attention and praise by the teacher [37].

(2) An insufficient amount of role models contributes to the under-representation of women in science, technology, and mathematics. Women look for other females, in such fields as faculty, professors, executives, physician doctors, astronauts, and politicians, as role models for balancing career and family. Women in the STEM field benefit from other females who serve as mentors and who are cognizant of the gender differences and parental expectations between women and men. In most cases, when women perceive their STEM program or career as excessive and it begins to outweigh their role as a mother, they leave their collegiate studies or careers in higher rates than men [13].

(3) Women experience a lack of confidence and encouragement when obtaining postdoctoral degrees in STEM fields. Women’s confidence may also drop in the first year of their science and engineering studies due to discouragement at academic difficulties and poor teaching. Women may be inadequately prepared, lagging behind their men peers in some aspects of science achievement and lack the confidence to regain ground, and retreat [1].

(4) Women’s gender suffers from bias and discrimination in the STEM workforce, which leads to slower advancement in academic science careers. Gender schemas, generalities of traditional female roles, and mental constructs are factors that prohibit many women from advancing in the STEM fields and further doctoral studies [36].

The research has led to initiatives that educate and generate interest to improve female interest in the United States and internationally in STEM programs and careers. New K-12 Common Core Standards, establish goals for every grade level, for every child in the subjects of science, mathematics, and technology. The standards target girls and women from preschool through high school to seek and build confidence, offer role models, and provide support in chilly and cool climates. Colleges offer undergraduate and doctoral program STEM program incentives, through funding, career placement, and fellowships—locally and internationally—to bolster female interest in the field. The National Science Foundation (NSF) sponsors ADVANCE projects in higher education across the world to reduce gender disparities at the collegiate level [34]. These projects endeavor to increase women’s representation in science professorships and campus administration, through gathering data, reviewing policies, supporting women’s research and leadership development, and attention to equity in hiring, retention, and climate [35].

7. History of Women PhD Doctoral Candidates

Historically, gender has always played a role in the success in one’s academic career. Traditionally, female doctoral students left academia in greater numbers than men for several reasons. Reasons for attrition include feeling their careers may not appeal to the public or lack
PhD is one of the fastest growing higher learning occupations, doubling between 1996 and 2007 ([14]; cited in Stehlik, [47]). According to the U.S. annual survey of graduate enrollment and degrees, women have earned the most degrees for the first time in history [5]. From 2008-2009, women earned 50.4% doctoral degrees in the United States and remain in higher education after completion [5]. However, the doctoral disciplines are not consistent: only 22% of women earned 22% of degrees in the engineering field, 27% math and computer science fields [5]. Conversely, 60% of women earned doctoral degrees in social and behavioral sciences and 67% in education. The greatest improvement of doctoral recipients within one year, which occurred in health sciences at 70% [5]. The year 2010 marked the first time in history where women earned most of the doctoral degrees in biology and agricultural sciences [5]. Implications of the growth in women doctorates exist only in the aforementioned fields of study.

In Australia, the Doctor of Philosophy (PhD) degree has been viewed as “intellectual currency,” a knowledgeable pathway toward research in Education, Arts, and Social Sciences ([47], p.4). The Australian Council for Research (ACER) notes one of the fastest growing higher learning occupations in Australia is the PhD, with doctoral graduates twice the amount between 1996 and 2007 ([14]; cited in [47]). Research states, in Australia, the average age group is 45, in which the majority are women [47]. Implications are that women are in pursuit of the PhD to reflect or add onto career objectives as opposed to establishing a new career. Moreover, women may find that waiting until midlife for doctoral opportunities tend to mesh well when balancing time with marriage and children. It is important to note that in 2006, approximately 66% of doctoral students were male. After 2006, the trend shows female doctoral students at 50.4%, compared to 44.4% in 1998 (DETYA, 1999, cited in Edwards et al. [14]). Further findings include adding to legitimacy in lifelong academic learning goals, and contributing to a body of research and societal interests [47] For holistic perspectives of Australian women deem knowledge and wisdom as a driving force for most doctoral pursuits.

In 2012, women doctoral recipients in the United States have become more prevalent [30]. According to the National Science Foundation (2012), women awardees grew from 37% in 1991 to 46% in 2011. Although the total number of men earning doctoral degrees has also increased 2002, the majority of all the degrees earned have been from women from the United States [30]. Current trends in fields of study occur among women in Science and Engineering (S&E) fields. Women awarded S&E doctorates at 42% in 2011, up from 30% in 1991 [30]. Among race and minorities, African American awardees increase of 67% in the past twenty years more than doubling the amount of Hispanic or Latino doctorates [30]. Women earn the majority of all doctoral degrees in five fields: life sciences, social sciences, humanities, and education, excluding lucrative fields of physical sciences and engineering. The fastest growing subfields of doctoral degrees among women are in physical (computer and information) sciences and engineering [30]. Statistics reveal steady growth, yet not equal to male counterparts.

8. Growth in Women Doctoral Candidates in the U.S. and Abroad

Technology enhances and extends the educational experience. Women doctoral students’ persistence may be contingent upon student progress and social interaction in technology [16]. Golde & Dore [17] declare the women doctoral students’ persistence may be contingent upon student progress and social interaction in technology. Golde & Dore [17] declare the most academically capable, academically successful, and most carefully selected doctoral students are least likely to complete their chosen academic goals. Structural resources and services assist in the growth of virtual leadership programs designed to target women locally and abroad. The research findings suggests universal tools such as Blackboard, LinkedIn, and Dropbox assists students as a communication tool for peers and faculty [46]. Through social media options, women can cultivate and sustain relationships. Technological tools outside of the instructor for both women and men PhD students make learning cohesive. However, women feel a sense of connectivity through communication tools such as social media, and use social media more than men . Research reveals students engage in the learning process when using informal support systems such as Facebook and LinkedIn [46]. Doctoral students utilize resources based upon interested students within the United States and overseas. Distance education utilizes virtual resources. Technology applied in education must be interdependent upon pedagogy and technology. Distance education students find success with instructors who create a clear framework outlining the goals, delivery, and structure of distance education programs with clear benchmarks for success. Evolving technological advances
enhance academic opportunities and resources for men and women doctoral students. However, student opportunities work interdependently in academia. Women do not receive equal technological opportunities as men, due to male employers not perceiving women as their equal. Moreover, doctoral students’ satisfaction of the educational experience defines their perception of the program. When women do not feel accepted or equal to their counterparts, isolation and attrition occurs. Virtual schools should strive for excellence in program structure. School officials should be conscientious of effectively communicating with their students to avoid attrition factors. The attrition rates are 10%–20% higher within distance programs due to students feeling isolated from peers and faculty members [43]. The goal for all doctoral students within a virtual educational leadership community is to become successful socially, academically, and technologically.

Women continue to compete for equality in salaries, which includes women doctorates. Persistence in women doctoral candidates proves equal footing in adjusting to technology in the 21st century. With the evolution of technology, researchers suggest leaders within the virtual environment should pay more attention to identifying tasks and assisting each team member in developing a sense of belonging within the virtual group [2]. Further research suggests women doctoral students benefit from the cohort model or peer mentoring program to facilitate growth of doctoral programs within this setting [15], and to assist students in becoming community leaders.

10. Conclusions

As growth continues for representation of women pursuing doctoral studies, widening participation and improving the quality of doctoral education programs has become a central concern for many government and private institutions throughout the country (Barnes & Randall, 2010). Evidence has shown professional and personal responsibilities, typically assumed by women, contribute to disparities between females and males pursuing doctoral degrees (Hyun, Quinn, Madon, & Lusting, 2006). Inequitable representation of women undertaking doctoral studies, particularly in STEM related fields which are in greatest demand, continue to challenge the United States ability to compete with other nations (CPST, 2007). Recruitment of women in STEM fields is necessary to advance innovation and technology, which is necessary to contribute to America’s growing knowledge demands (Ong et al., 2011). In a growing knowledge-intensive economy, focus is expanding on achieving higher-levels of knowledge through expansion and reform of doctoral education to drive global competition.

References


