Re-examining the gender factored agentic and communal career profession of Information and Communication Technology (ICT) students

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ABSTRACT

This paper examines the narrative about gender influence in students’ career choices and professions is something that needs to be reconsidered to remain relevant in the fourth industrial revolution (4IR) and a society that is always evolving. The 4IR has resulted in disruptive innovation globally, wherefore, the technological innovation that includes artificial intelligence (AI) and robotics. These disruptions, however, may be creative in that as some jobs are lost due to the development of artificial intelligence, new ones are created. Hence, a positive impact on key industries and sectors, like business, health, and education as the globe rapidly moves toward a more digital economy, many low- and middle-income countries face difficulties finding competent workers to fill crucial Information and Communication Technology (ICT) professions in growing markets. The fourth industrial revolution, which involves more than just technological transformation, is drawing attention around the globe. This shortfall is made worse by the underrepresentation of women in ICT-related fields. The demand for ICT professionals/ workers and the supply of job seekers with the necessary technical skills threaten the ability of the country (South Africa) to take part in a powerful driver of growth in the fourth industrial revolution. This paper is a systematic literature review supported by the theory of social cognitive career theory (SCCT) and expectancy value theory (EVT). The findings revealed that gender disparity, inadequate career guidance, and educational career ambition play an enormous role amongst male and female students when choosing ICT as a career choice.

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Introduction

Choosing and enrolling in a higher education degree and, selecting an Information and Communication Technology (ICT) profession, is still conditioned by social and cultural factors characterized by gender stereotypes that continue to attract more men to technical and technological careers and more women to teacher training and social work (Mesquita & Lopes, 2018). However, the nature of gender inequities continues to be intensified, becoming more complex. A study conducted by Holzblatt and Marsden (2022) revealed that for over 40 years, the technology organization.

have embarked in a collective effort to attract more females. Yet, females continue to be underrepresented in ICT related jobs and careers as opposed to other professions. Worse, once hired, women leave the field mid-career twice as often as men.

This difference can be observed in the ratio of men’s and women’s career preferences. Even considering that vocation influences the choices, the stability some careers represent, regarding immediate access to employment and to reasonable salaries also influences the options made by men and women. Nonetheless, literature has been highlighting that both the students’ self-perception and the perceptions about degrees and social encouragement also influence their choices (Mesquita & Lopes, 2018).
The paper aims to establish whether gender disparities and the reasons for female under-representation in IT careers. To understand the reasons motivating their choices not to choose or choose ICT as a career field and identify factors contributing to gender inequality and gaps in the field of IT.

Despite efforts and encouragement for female involvement in an ICT career as a choice, females remain and are still under-represented in career disciplines, such as information technology (IT), applied information systems (AIS) and in computer sciences (CS) (Eccles, 2011).

The likes of Niccolai, Damaske & Park (2022); Lippert and Damaske (2019) believe that transitioning from the pre-school to tertiary or University education or to the next stage of academic career may be a fundamental moment for aspirations. Nonetheless, given the multi-facet paths to adulthood that present no precise direction after pre-school, students may find themselves struggling to be able to make the right decisions about which academic career path to tour. What the next academic decision step should be, a decision shaped by gender and class.

Another research evidence by (Del Carpio & Guadalupe, 2022) points toward the underpinning barriers that preclude more women from enrolling in ICT positions. These suggests that there are several underpinning factors that can be attributed to the male’s or females’ career choices and preferences. These factors include subjective norms, and beliefs are linked with gender-role and gendered patterns. The segregation of the sexes and the ideological concept that males tend to work with “things” for example, technology, and females with “people,” such as in health care (Tellhed, Bäckström, & Björklund, 2018) contributes to the lack of females in ICT careers.

For instance, increase in salary gap; the coexistence of unemployment with labour shortages in gender-skewed sectors (European Commission, 2014). To reach the goal of a more gender-balanced labor market, there is a need for a re-examination of the gender factored agentic and communal profession to adequately understand the reason males and females tend to choose different career paths. Therefore, it is envisaged that an equal representation of males and females in ICT career disciplines will help to reduce the horizontal gender segregation in the labour market.

This paper seeks to understand the ideological concepts that males and females have over chosen ICT career disciplines. The paper was guided by the theories of SCCT and EVT as theoretical background and supported the research inquiry by a systematic literature review. The method was deemed appropriate for analyzing the thoughts and findings, reporting on the gaps, and concluding by proposing a solution for this paper. Its further attempts to determine whether gender disparities play a role when choosing a career field as a career choice of preference. The rationale behind this approach is that the paper was founded on the literature findings and judging by the nature of the problem that the project attempts to solve.

The following research objectives emerged. The paper strives to establish whether gender disparities influence students’ career choices; explore the perceptions students have pertaining to IT careers and examine the factor that pushes students to choose a particular career profession.

**Literature Review**

**Theoretical Background**

The 21st century is an era of great technological advances. This is largely due to the level of innovation in the fields of artificial intelligence, robotics, and automation. However, for a variety of reasons, Higher Educational students are often hesitant to enroll in Science, Technology, Mathematics, and Engineering (STEM) degrees. This is more so apparent for female students as opposed to their male counterpart as research suggests that these students often doubt their ability, lack confidence, and feel that it is a male-dominated sector (Funke, et al., 2015). Within the classroom at Higher Educational Institutions (HEI’s) as well as within the workplace, there are often fewer females than men.

Although there are many reasons for this, the notion of the male scientist still dominates society (Tondeur et al., 2016, Funke, et al., 2015). Within the South African context other factors, such as gender inequality, cultural aspects, and social norms influence the career choice of many women.

Research indicates that most emerging economies lack qualified individuals to fill vacancies within the STEM sectors. The shortage is exacerbated by a low representation of women. Although developed countries have started to focus on closing the gender gap, less attention has been given to emerging economies (Powell & Chang, 2016).

Mesquita and Lopes (2018) sustained that it should be noted that women and men have different career options, with more women in professions related to social action, education, and social sciences and more men in professions related to engineering. The public sector is a major employer of women, jobs such as teachers and nurses, which can be a factor in the wage gap between gender. The authors further revealed that these differences between science, math, and humanities indicate that there is an impact on career expectations between genders, even among students of similar performances in science and who reported the same level of enjoyment of science.
Mesquita and Lopes (2018) aver that females seek employment or work as health professionals more than boys, who see themselves as becoming information and communications technologies (ICT) professionals or engineers. Further highlighted the following factors:

i. Social encouragement: characterized by positive reinforcement of family and peers.

ii. Self-perception: their good performance in mathematics and by their interest in challenges

iii. and problem-solving, as an asset in a successful career.

iv. Academic exposure: previous experiences with the area of computer science.

v. Career perception: the familiarity with the area and the realization that this is a career with social impact.

The paper also underlines those uncontrollable factors, such as having a family member in a Computer Science related field, having a family member with a Computer Science degree, and geography, were statistically insignificant. Factors such as early exposure to technology, age of first computer exposure, access to mobile devices, natural aptitude, and topical depth/breadth of existing pre-college and Computer Science curriculum also do not contribute to the choice of Computer Science related careers.

More importantly, the effort to recognize and understand gender, and behavioral disparities have an elongated history that has ignited prominently in discourse and has agitated arguments that have raised public awareness and interest (Mishkin et al., 2016). Although, similar investigations into these issues are few, most often scenario, weak in theory or perhaps inadequate progress made. This paper strives to reinvigorate such inquiry, as the paper was grounded in two theories, the social cognitive theory, and expectancy-value theory.

Grounded theory

The quest for capacity will give rise to a job market that may become increasingly isolated. Computers and digitization will replace low-skilled and low-wage jobs (Powell & Chang, 2016). The higher-paid jobs requiring more skills are less likely to be replaced. This increased dichotomization can lead to an increase in social tensions. Sáenz, and López-Sáez (2010) avers that the shortage of females in advanced technology and ICT-associated discipline remains a challenge.

Advent research studies have shown that negative attitudes towards computers and technology demonstrate that female exhibit more undesirable computer as opposed to male, hence, female has a less intent to use technology and computers than male (Beyer, 2014; 2008). Therefore, selecting ICT related career choice as a profession has conventionally not been a top precedence among females (Mishkin, Wangrowicz, Dori & Dori, 2016). The underlining gap is that there are few females who major in ICT related career as career choice of preference, this is a clear indication that female is under-represented.

Many reports on gender differences and behavior have been documented, specifically in line with educational choice in technology-related fields (Tellhed et al., 2018; Wang & Degol, 2017), very little has been documented on applying the two theories as specified above to fully grasp the intent of gender disparities in terms of career choices. Importantly, this paper expounds and explores the relevancies in the existing literature to deliver an insightful and detailed discussion on each theory.

Through the exploration of comprehensive review and giving relevance to academic scholars, an absolute solution useful in addressing gender disparities, inequality is recommended, and gaps are resolved. These sets of theories provide the underpinning foundation upon which this paper is based.

A paper in Vancouver, British Columbia, Canada conducted by over 7000 high school students, the report reveals that the career professions and career choice of interests in ICT field and computer science for the female is comparatively lesser than that of male (Bernhardt, S., Braun, P., & Thomason, 2018; Foust-Cummings, Sabattini & Carter, 2008). The authors further maintained that a similar report was also seen in higher education which revealed, only 4% of female colleges in their first-year level showed intent to enroll in ICT related fields in the US.

While other research studies have shown that some career paths in ICT course programme may discourage females. As it is claimed that one of the major setbacks are the concept of “geek factor”. Females sometimes imagine a career in ICT computing as a lifetime in segregation filled with code writing and debugging (Foust-Cummings et al., 2008). The concept of “geek factor” plays a part and influences both males and females, but its effect is seeming to have more of a negative effect on female students (Cornwall, Byrne, & Worthy, 2018).

Powell and Chang (2016) added, globally, the tech field have built this concept of “geek” or “nerd” culture, which in most cases, has attracted more males than females. Further sustained that in several countries’ female faces cultural severities and stereotypes that demoralizes them from acquiring the relevant skills and techniques required to take part in the ICT work field.

Therefore, the paper is grounded using the mediating theoretical concepts of gender differences in educational choice from three leading career choice theories; social cognitive career theory (Lent et al., 2000) and Eccles' expectancy value theory (Eccles, 2011; Eccles, 1987, 1994; Diekman, Steinberg, Brown, Belanger & Clark, 2017).
Social cognitive career and expectancy value theories

Before the researcher(s) presents the discussion on social cognitive theory, we take a glance at Bandura’s quote which is in relation to the agentic perspective who once said, “to be an agent is to intentionally make things happen by one's actions”. Bandura (1986; 2001) further defined agency as a component that encompasses talents, belief systems, self-regulatory aptitudes, competencies, and dispersed functions over which an individual’s influence is practiced or exercised. As opposed to existing as a discrete entity in a specific arena, and so is the social cognitive theory. Given the core attributes of agency, it allows an individual to play a part in their self-development, acclimatization, and self-adjustment with time.

While Brown (2002) referred to SCCT as a perspective that balances or builds conceptual connections with, other theories of educational career choice and career development. Incorporating constructivist beliefs about an individual’s ability to influence their own development and surroundings, SCCT has been inspired and influenced by several key developments in vocational psychology, other psychological and counseling domains, and the cognitive sciences (Brown, 2002).

Research has shown that these theories impact educational and career choices in ICT related fields (Tellhed et al., 2018; Eccles & Wang, 2016; Wang, Eccles & Kenny, 2013). The expectancy value theory forecasts that males who majors and females who are non-majors slight differ in approach to computer technology in terms of self-efficacy and values considering their diverse levels of computer exposure and experiences.

Ono and Zavodny (2005) alluded to expectancies of success, for example (self-efficacy) are fundamental principles in educational and occupational choices. Female often have low self-efficacy, thinking that they pose minimal normal aptitude in male-dominated domains such as ICT/ IT/AIS and CS. This self-efficacy is imprecisely lower as compared to their real capabilities or enactment (Mata, 2019; Annabi & Lebovitz, 2018; Lehman, 2017; Beyer, 2014; 2008). It is arguable that computer self-efficacy is influenced by computer exposure and experience (Wilson, Kickul, Marlino, Barbosa & Griffiths, 2009). Consequently, this may result in the reasons behind the dearth of female’s low computer self-efficacy as some females may be less intuitive with programming experience than males do (Beyer, 2008; Beyer, DeKeuster, Rynes, & DeHeer, 2004; Katz, Aronis, Allbritton, Wilson, & Sofia, 2003).

Therefore, the EVT suggests that an individual is most probable to take part in activities that the individual believes that he/she can dominate and still poses high subjective task value for them. Expectations for success (domain-specific beliefs about one’s personal efficacy to master the task), again, it also is determined by the self-confidence that individuals pose in their various capabilities/abilities and the individuals’ approximations of the challenges of the various options to be considered. EVT foretold that the self and task-associated belief systems were molded based on individuals’ experiences with the interrelated actions, and the individuals’ subjective analysis of these experiences.

Ultimately, narrowing the arguments and discussion in the context of this paper, these sets of theories highlighted the important concepts that career choices are associated with discernment of competence, for example (what should be done, and anticipated career goal accomplishment); (what should I aim for, in relative to diverse career fields or profession). In overall, the SCCT suggests that when choosing a career path or making an educational career choice, it is often influenced by students’ self-efficacy as alluded to by Bandura (2001). Who described SCCT as the individual's superficial capability to thrive in a domain, and to expect accomplishments, which is apparent in goal satisfaction of diverse career possibilities. Equally, the EVT suggests that when choosing a career path or making an educational career choice, it is often influenced by the students’ expectations of achievement and subjective task worth or value, which the student connects with different coeducational career preferences (Eccles, 1987, 1994). Notably, EVT narrates expectations of success to the students’ supposed aptitude to satisfy diverse.

Gender and communal goal preference

Henchey (2022) studies suggest that women are less interested in the ICT career field of paper than males, this were due to the set of beliefs that ICT profession that they cannot achieve communal goals, according to studies on the relationship between gender and preference for communal aims (McGuire & Leaper, 2016; Dasgupta & Stout, 2014). This is not to suggest that women who pursue engineering do not care about agentic aims. Instead, studies have demonstrated both men and women value status and accomplishment outcomes in nearly identical ways (Henchey, 2022). The fact that women are more likely to prefer communal aims prevents them from picking careers that are seen as being exclusively agentic.

Arguably Tellhed et al. (2018) asserted, although males and females repeatedly choose different types of career professions, contrary, some career choices or paths have emerged newly from being one-sided (male-dominated) currently to double-sided (gender balanced). Which is formally described as 60/40% males versus females (European Commission, 2014; National Science Foundation, 2017). In the USA and in Sweden, these concerns are associated with career choices. In the context of this paper, very little is known about why some types of career fields interest both genders and learning about gender disparities and behavior when choosing career paths, might serve as a pointer to how to encourage gender balance in students, particularly in gender skewed disciplines (Hillesland, 2019; Cheryan, Ziegler, Montoya, & Jiang, 2017).

While Mesquita and Lopes (2018) added that the major advancements that have occurred over the past century are reflected in a multidimensional perspective on women’s status, which also highlights the advantages of education in boosting women's participation in the labor market as well as in social and political spheres. Other programs that support salary transparency, access to higher
education, the battle against gender violence, and, more recently, opportunities to enter and excel in fields with a male preponderance in the workforce have strengthened this progression.

Considering this discourse Lent et al. (1994), Lent et al. (2000) and Lent and Brown (2006) believe that an individual chooses their respective careers path or profession through learning experiences, experiences that they have, and relationships with others. The learning experiences may be inspired by these three variables, namely self-efficacy, Outcome expectancies, and goals. Self-efficacy tries to examine how much a person believes they can succeed in a certain endeavor or career. While outcome expectancies examine the results a person expects from choosing a particular vocation. On the other hand, goals, measure how strongly a person wants to do something and is influenced or solely determined by self-efficacy and outcome expectations. The intention to pursue and maintain a professional choice is referred to as a goal in this paper.

In other words, according to the Social Cognitive Profession Theory (SCCT), a person's choice of career profession is most like to be determined by how much they trust in their own abilities and skills as well as how likely they are to experience favorable outcomes from choosing a certain career (Lent et al., 1994; Lent et al., 2005). Through interest, self-efficacy, and outcome expectancies are connected to a person's goals in an indirect way (Lent et al., 1994). A person is more likely to be interested in a career and be more ambitious about pursuing it if they have high expectations for the career and believe that it will lead to favorable outcomes. One can learn more about a person's academic and career aspirations by looking at their self-efficacy, result expectations, and ambitions.

**Conclusions**

This paper presented valuable insight and offered a substantive analysis of the issues with gender factored influence that underpins students’ career choices and profession. Subsequently the papers’ report was conducted using the two theories of SCCT and EVT. Based on the literature discourse and findings, it is evidenced that gender bias exists between females’ low computer attitudes than their male counterparts and confirms those obtained by another research. Although, the findings suggest that both males and females have different career ambitions, as males will be more comfortable with an agentic type of career while the female would settle for communal career professions. Most female students perceive IT career profession or career as male-dominated fields, with is termed geeky and nerdy perceptions. In most often case, students believe that ICT career program such as programming, machine learning C#, C++, and python maybe regarded as too technical and practical. Hence, it is better understood by males as compared with females (Sáinz & López-Sáez, 2010).

Yet, and in line with the findings, it cannot be overemphasized that even though females hold less optimistic computer attitudes than male, their mindsets towards computers are inconsequential. On the other hand, that both males and female show demonstrate different computer attitudes and behavior could necessitate that they differ in their stimuliuses and curiosities in considering the use of computers, and their eventual use of computers (Sáinz and López-Sáez, 2010), coupled with the role that computer technology plays in their lives. The Literature suggests that early computer preparation will create better platforms that encourages student’s computer attitude, in turns, it reduces the gender stereotypes and bias.

In general, our findings prove that when choosing a career field as a profession, certain factors are considered essential behavior and cultural beliefs that drives males and females toward their choices. Career courses differ between males and females; females’ career paths are most likely to be influenced by pre-defined communal functions, affiliations, and responsibilities. As such females are commonly classified as primary caregivers. Inferring from these social assumptions about female roles, female is more likely to experience career disruptions due to these responsibilities (Mishkin, Wangrowicz, Dori & Dori, 2016), hence the relative underrepresentation of female in ICT career fields.

In conclusion, the literature findings suggest that gender bias is one major factor amongst many others, it is reported to have a direct link to female’s career underrepresentation and inequality to unambiguous and inherent gender preferences that sideline females from career prospects. Findings reveal that numerous and conceivable factors namely, inadequate career guidance and exposure, computer attitude, computer self- efficacy and computer nervousness. Which in turn has to do with students’ beliefs of his or her capability to undertake a task using computers. On the other hand, computer nervousness is associated with the predisposition of a student to be uncomfortable, fearful, or frightful about the use of computers. The findings establish that students’ lack of experience in ICT leads to negative attitudes and undesirable interest for most students to choose ICT.

Notably, the SCCT and EVT narrates expectations of success to the students’ supposed aptitude to satisfy diverse demands, which in turn rest on upon the intellectual capability and, it is influenced by stereotypes (Eccles, 1987, 1994). Subjective task value concern’s goal serenities, which entails pleasure and long-term goals. It is evidenced, that these set of beliefs’ self- efficacies, self-competency, self-proficiency, learning experiences leads to students’ aptitude, educational goals and ultimately informs their reasoned action or career choice decision to either choose ICT related profession as a choice of preferences or not.

Research findings has shown that these SCCT and EVT theories impact on educational and career choices in ICT related fields (Tellhed et al., 2018; Eccles & Wang, 2016; Wang, Eccles & Kenny, 2013). The expectancy value theory forecasts that males and females who majors and non-majors slightly differ in approach to computer technology fields in terms self-efficacy and values considering their diverse levels of computer exposures and experiences.
For further research activities in relation to this paper, it will be interesting to see an investigation into a qualitative study wherefore, the interplay of the underpinning factors being interrogated through participatory observation for much richer and in-dept analysis.

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