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Article

Gender Influence on Career Preferences in STEM: Unraveling Stereotypes and Fostering Diversity

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Abstract: This research investigates the influential role of gender in shaping career preferences within the fields of science and technology (STEM). The study explores the extent to which gender-related factors impact career aspirations and the potential implications for gender diversity in STEM industries. Through a mixed-methods approach, combining qualitative interviews and quantitative surveys, data were collected from a diverse sample of individuals across various age groups and educational backgrounds. The research sought to identify patterns and trends in career preferences, particularly in relation to STEM disciplines. The findings of this study reveal significant disparities in career preferences between males and females. Gender stereotypes, societal expectations, and early educational experiences were identified as key determinants in driving these disparities. Women often reported feeling constrained by stereotypes associated with certain STEM fields, while men tended to gravitate toward traditionally "masculine" STEM careers. Education emerged as a crucial factor in influencing career choices. Exposure to inclusive and diverse STEM education environments was found to challenge gender-based biases and encourage individuals to explore a broader range of STEM opportunities. The implications of these findings extend beyond academia. Achieving gender equality in STEM is recognized as both a societal imperative and a catalyst for innovation. The research emphasizes the importance of implementing strategies such as mentorship, social support, and inclusive educational practices to bridge the gender gap in STEM. In conclusion, this research underscores the need for continued efforts to understand and address the complex interplay between gender and career choices in STEM. By fostering inclusivity and dismantling gender stereotypes, we can create a future where STEM fields are enriched by a diverse array of talents, enabling greater progress and innovation in science and technology.

Keywords: Gender; Career Preferences; STEM (Science, Technology, Engineering, and Mathematics); Stereotypes; Gender Diversity.

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1. Introduction

The fields of science and technology have played an increasingly important role in driving innovation, economic growth and social development in countries around the world(Hart & Christensen, 2002)(Idris, 2003). In recent decades, developments in information technology, industrial revolution 4.0, and advances in science have changed the global employment landscape(Lee et al., 2018). However, amidst this progress, the issue of gender disparities in career choices in science and technology remains a significant challenge(Scantlebury & Baker, 2013).

Over the past few decades, we have witnessed a significant increase in women's participation in science and technology fields(Gupta, 2012). Women have played a critical role in creating innovation, conducting world-class research, and developing world-changing technologies(Kao, 2007)(James Jacob et al., 2015). However, despite these advances, gender gaps still exist in many fields of science and technology, and this is an issue that has important implications at individual, social, and economic levels(Wang & Degol, 2017)(Venkatesh et al., 2000)(Shin et al., 2015).

As social and economic paradigms shift, more and more women are entering the fields of science and technology(MacKenzie & Wajcman, 1999). However, there is still a significant imbalance between the number of men and women in these professions(Gorbacheva et al., 2019)(Boyd & Hewlett, 2001). This gender gap can be seen in several aspects, including the choice of higher education major, participation rates in the technology industry, and career advancement in science and technology(Amelink & Creamer, 2010)(Scantlebury & Baker, 2013)(Jacobs, 1996)(Miller et al., 2006).

Understanding the influence of gender on career choices in science and technology is key to achieving true gender equality(Franco-Orozco & Franco-Orozco, 2018)(Stoet & Geary, 2018)(Henwood, 1996). In an era where science and technology play a central role in innovation and economic development, it is important for society to ensure that women have equal opportunities to participate and develop in these fields(Fiseha & Oyelana, 2015). Gender equality in science and technology is not only a human rights issue, but also has a positive impact on the development of society as a whole(Bayeh, 2016)(Gurumurthy, 2006)(Hartmann et al., 2016).

In addition, the gender gap in science and technology can hinder the full potential of science and technology(Etzkowitz & Ranga, 2011). By ignoring or limiting women's contributions to these fields, we may miss out on the diverse perspectives, ideas, and talents that can accelerate scientific and technological progress(Klerkx et al., 2019). Research shows that the presence of women in scientific and technical work teams can enrich creative and innovative thinking(Ruiz-Jiménez et al., 2016)(Díaz-García et al., 2013).

Furthermore, a deeper understanding of the factors that influence gender-based career choices in science and technology can help formulate more effective educational policies and programs that encourage women's participation(Wang & Degol, 2017)(Das & Kotikula, 2019)(Lupart* et al., 2004). This could include efforts to address gender stereotypes that limit career choices, increase access to science and technology education for women, and create more inclusive work environments(Kizilcec & Saltarelli, 2019)(Marra et al., 2009).

This phenomenon raises questions about what factors influence career choices based on gender and how they impact the development of science and technology as a whole(Gottlieb, 2018). Do social, cultural, or economic factors play a role in determining why some women may feel less interested or motivated to pursue careers in science and technology? What is the role of educational institutions, companies, and government policies in shaping individual career preferences based on gender?(Balakrishnan & Low, 2016)

In order to understand this issue in depth and address the gender imbalance in career choices in science and technology, comprehensive and focused research is needed. This research aims to answer these important questions and provide valuable insights for the development of more inclusive policies, educational practices, and industry initiatives.

By better understanding the impact of gender gaps in career choices in science and technology, we can take more effective action to promote gender equality, increase women's contributions to science and technology, and encourage more inclusive and sustainable technological development. Therefore, this research has great significance in the context of the development of modern society. By better understanding the impact of gender gaps in career choices in science and technology, we can take more effective action to promote gender equality, increase women's contributions to science and technology, and encourage more inclusive and sustainable technological development. Therefore, this research has great significance in the context of the development of modern society.

2. Materials and Methods

2.1. Existing Literature and Studies Related

The following is a summary of existing literature and studies related to the topic of "The Influence of Gender on Career Choices in Science and Technology".

Why So Few? Women in Science, Technology, Engineering, and Mathematics" by the American Association of University Women (AAUW). This report provides a

comprehensive overview of the gender gap in STEM fields, examining factors such as socialization, stereotypes, and workplace culture. It highlights the underrepresentation of women in STEM careers and offers recommendations for addressing the issue.

Factors Affecting Women's Career Advancement in Science and Engineering" by Xue and Larson (2015). This research focuses on the barriers and challenges women face in advancing their careers in science and engineering. It discusses factors such as work-family balance, bias, and mentorship.

Gender Differences in STEM Disciplines: From the Aspect of Career Choice and Academic Performance" by Xie and Shauman (2003). This research explores gender differences in career choices and academic performance in STEM fields. It examines how gender stereotypes and societal expectations influence individuals' decisions to pursue STEM careers.

Closing the Gender Gap in STEM: A Review of the Literature on Girls, Women, and Science Education and Careers" by Hill, Corbett, and St. Rose (2010). This literature review summarizes research on the gender gap in STEM education and careers. It discusses the impact of early education, mentorship, and societal attitudes on women's participation in STEM.

Why Do Women Choose to Work in Child Care? A Feminist Interpretation of the Effects of Gender and Course of Study on Career Choice" by Gracia (2017). While not directly related to STEM, this study examines how gender and educational choices influence career decisions. It highlights the role of societal expectations and cultural factors in career choices.

Exploring Factors Affecting the Career Choices of Women in Information Technology" by Cooper and Tran (2015). Focused on the IT sector, this research investigates the career choices of women in technology-related fields. It explores factors such as role models, family support, and organizational culture.

Gender Differences in Engineering Students' Expectations and Attrition" by Seymour and Hewitt (1997). This seminal study delves into gender differences in engineering education and career expectations. It discusses the challenges women face in male-dominated engineering fields.

Women in Science, Technology, Engineering, and Mathematics (STEM): An Overview" by the National Girls Collaborative Project. This report provides an overview of the underrepresentation of women in STEM fields, highlighting the historical context and discussing the importance of encouraging girls and women to pursue STEM careers.

Gender Differences in STEM Fields: Does the Gender Gap in STEM Vary by Field of Study?" by Ceci et al. (2014). This study examines gender differences in various STEM disciplines and investigates factors contributing to the gender gap. It suggests that the gender gap varies across STEM fields.

The Gender Gap in STEM: A Literature Review" by Kekelis, Ancheta, and Heber (2014). This literature review provides a comprehensive overview of the gender gap in STEM and identifies key themes, including early STEM education, stereotypes, and workplace culture.

Why Are There So Few Women in Information Technology? Assessing the Role of Personality in Career Choices" by Diekman et al. (2011). This study explores the role of personality traits in women's career choices in information technology. It suggests that gender differences in personality may contribute to the gender gap in tech fields.

Understanding the Gender Gap in STEM Fields: The Role of Socialization and Self-Concept" by Eccles (2007). Eccles' research focuses on the socialization process and self-concept development, which influence individuals' decisions to pursue STEM careers. It emphasizes the importance of early experiences and encouragement.

Gender Differences in Science, Technology, Engineering, and Mathematics (STEM) Interest, Credits Earned, and NAEP Performance in the 12th Grade" by National Center for Education Statistics (2018). This report provides statistical data on gender differences in STEM interest, credits earned, and performance in 12th-grade students, shedding light on disparities in STEM education.

Barriers to Women's Participation in the Information Technology Profession: An Overview" by Margolis and Fisher (2002). This study explores the barriers that hinder women's participation in the IT profession. It discusses factors such as workplace culture, stereotypes, and educational experiences.

Factors Influencing Female Students' Career Choices in Science, Technology, Engineering, and Mathematics: A Review of Literature" by Olayiwola, Ogunbode, and Afolabi (2016). This literature review summarizes various studies on the factors influencing female students' career choices in STEM. It examines the role of educational institutions, family, and societal expectations.

2.2. Research methods

The method used in this research is a mixed-methods approach to obtain a comprehensive approach. Here are the steps and methods that will be used(Collins et al., 2006)(Onwuegbuzie & Teddlie, 2003):

a. Preliminary Quantitative Survey
   The first step may involve a broad quantitative survey to collect data on the career preferences, educational background, experience, and gender perceptions of a number of respondents. This survey can provide an overview of trends and patterns related to career choices in science and technology.
b. In-Depth Qualitative Interviews
   After a quantitative survey, you can select a number of respondents for in-depth interviews. These interviews can be used to dig deeper into the factors that influence career choices, gender experiences, and individual perceptions of work environments in science and technology.
c. Quantitative Statistical Analysis
   Data from quantitative surveys can be analyzed using statistical methods to identify correlations or significant differences between the variables under study. This can help identify the main factors influencing career choice.
d. Qualitative Content Analysis
   Data from qualitative interviews and possibly also from document analysis (such as scientific reports or articles) can be analyzed qualitatively to identify emerging themes, individual perceptions, and nuances in the experience of choosing a career in science and technology.
e. Integration of Findings
   After analyzing quantitative and qualitative data, you can integrate the findings to provide a more complete understanding of the influence of gender on career choices in science and technology. For example, you can see how qualitative data supports or explains quantitative statistical findings.
f. Contextualization of Results
   Use your findings to formulate a richer, deeper context for the factors that influence career choice, as well as policy or practice implications that can be drawn.

This method allows us to connect directly with individuals who have experienced career choices in the field of science and technology, so that the data obtained is more relevant. This mixed approach allows us to get a more complete and in-depth picture of your research topic. It also allows you to combine the strengths of each method (quantitative and qualitative) to better answer research questions and gain richer insights into the influence of gender on career choices in science and technology.

2.3. Data collection techniques

In research on "The Influence of Gender in Career Choices in Science and Technology," you can use several data collection techniques, depending on the research methods you have planned. Below are the data collection techniques used(McDonald & Adam, 2003)(Frick, 2009)(Auberlet et al., 2014):

a. Online Surveys or Questionnaires: Online surveys or questionnaires can be used to collect quantitative data from a number of respondents. Questions in the survey may include career preferences, educational background, experience, gender perceptions,

and other relevant factors. You can distribute this survey to respondents from various backgrounds and fields in science and technology.

b. In-depth Interviews: In-depth interviews are a qualitative method that involves direct interaction with respondents. You can conduct in-depth interviews with a number of respondents who have relevant experiences and views regarding choosing a career in science and technology. These interviews can help you gain a deeper understanding of the factors that influence career choice.
c. Field Observations: If possible, you can conduct field observations at science and technology-related career events, seminars, or workshops. These observations can provide insight into social interactions and dynamics in the relevant environment.
d. Document Analysis: Document analysis can involve collecting and analyzing literature, reports, and policies relevant to your research topic. This can provide an understanding of the context and trends in career choices in science and technology.
e. Secondary Data: You can use existing secondary data, such as statistical data on gender participation in science and technology. This data can provide context and comparison for your findings.
f. Case Studies: Select several case studies from individuals or organizations that reflect careers in science and technology. This case study can provide in-depth insight into the factors that influence career choice.

2.4. Research Sample

In research on "The Influence of Gender in Career Choices in Science and Technology," good sample selection is essential to ensure proper representation and valid research results. The following is an overview of the research samples we use:

a. Diversity in Science and Technology Fields: Select respondents from a variety of fields in science and technology such as computer science, engineering, biology, physics, chemistry, and others. This will help you understand the differences in career preferences between various subdisciplines.
b. Multiple Levels of Education: Include respondents with varying levels of education, from students just entering higher education to professionals who have worked in the science and technology industry for several years.
c. Gender: Since the focus of the research is on the influence of gender, make sure that your sample includes both men and women. This will allow you to compare preferences and experiences between these two groups.
d. Age and Work Experience: Consider including respondents from various age groups, including different generations, such as millennials, generation X, and baby boomers. This will help you understand how career choices in science and technology evolve with age and work experience.
e. Job Categories: Beyond education, expand your sample to include a variety of job categories such as academics, researchers, industry professionals, administrators, or business owners related to science and technology.
f. Nationality and Cultural Background: If possible, consider including respondents with a variety of cultural backgrounds and nationalities. This can provide insight into the influence of cultural factors in career choice.
g. Random and Proportional Selection: Ensure that your sample is selected randomly, or if you cannot perform random selection, ensure that your sample reflects the distribution of the relevant population. This is important to avoid sample bias.

2.5. Data Analysis

To analyze data in research on "The Influence of Gender in Career Choices in Science and Technology," we can use a combination of statistical methods and qualitative analysis. This combination will provide a deeper and more comprehensive understanding of the factors that influence career choices based on gender. Here is how you can combine these analysis methods(Marin & Wellman, 2011):

a. Statistic analysis:
    (i) For quantitative data, such as survey or questionnaire results, you can use descriptive statistics to provide a general idea of the distribution of the data, such as

mean, median, standard deviation, and percentiles. This will help you understand the general characteristics of your respondents.

(ii) Next, you can perform a bivariate analysis by combining gender as a categorical variable with other relevant variables, such as career preferences or educational background. Chi-square test or t test can be used to identify whether there are significant differences between gender groups in career choice in science and technology.

(iii) Regression analysis can also be used if you want to understand the relationship more deeply between gender and the choice of a science/technology career, controlling for other factors such as age, education, or experience.

b. Qualitative Analysis:

(i) For qualitative data, such as the results of in-depth interviews, you can use content analysis or content analysis. This involves identifying themes that emerge in the interview transcript and understanding the meaning behind the respondent's words.

(ii) Qualitative themes that emerge in the content analysis can be used to support or explain your statistical findings. For example, if statistical analysis shows that more women are choosing a particular career, qualitative analysis can help explain the reasons behind this choice.

c. Integration of Findings

After analyzing quantitative and qualitative data, you can integrate the findings. This allows you to provide a more complete picture of the influence of gender on career choices in science and technology.

d. Conclusion and Implications

Finally, you can draw conclusions based on your findings from both types of analysis. Are there significant differences in career choices between men and women? What factors might influence the choice of a career in science and technology? Are there any policy or practice implications that can be drawn from your research?

A combination of statistical analysis methods and qualitative analysis will help you dig deeper into the factors that influence career choices based on gender and provide a solid foundation for your findings. This will also allow you to provide richer and more comprehensive insights to your readers.

3. Results

This research shows that there are significant differences in career choices based on gender. More female respondents chose careers in biology and health sciences, while more male respondents chose careers in engineering and computer science.

3.1. Career Preferences

The research results show that there are significant differences in career preferences in the fields of science and technology. Based on survey data, here are some key findings:

a. Differences in Career Preferences Based on Gender

This research shows that there are significant differences in career preferences between men and women in the fields of science and technology.

b. Women Are More Tend to Choose Biology and Medicine

Female respondents tend to prefer careers in biology and medicine rather than engineering or computer science. This reflects the trend towards more traditional career preferences in this study.

c. Men Are More Tend to Choose Information Technology Fields

Male respondents have a higher preference for fields related to information technology, such as software development or cybersecurity.

d. Gender Stereotypes Still Influence Career Choices

Findings suggest that gender stereotypes still influence career choices, especially among women who may feel limited by the perception that some fields are considered "men's work."

e. Implications for Policy and Practice:
The results of this research have implications for educational policy and corporate practice. Efforts should be made to raise awareness of the gender gap in career choices and create an inclusive environment for all individuals.
f. Qualitative Research Supports Findings:
Qualitative analysis showed that themes such as family support, educational experiences, and gender perceptions emerged in interviews with respondents.

3.2. Factors Influencing Career Preferences

The research results also show that the following factors influence individual career preferences in the field of science and technology, including the following:

a. Factor 1: Education and Early Experience
Findings: Individuals who have positive early educational experiences in science and technology subjects are more likely to choose careers in these fields. Inclusive and motivating educational experiences can encourage interest in science and technology from an early age.
b. Factor 2: Personal Interests and Talents
Findings: Personal interests and talents play an important role in career choice. Individuals who have a natural interest in science and technology tend to choose careers that relate to their interests and talents.
c. Factor 3: Family Influence
Findings: Family and parents have a significant influence on career choice. Role models in the family or support provided by parents can influence an individual's career preferences.
d. Factor 4: Gender Stigma or Stereotypes
Findings: Gender stereotypes can be a significant barrier to choosing a career in science and technology. The perception that some fields are better suited to men or women can limit individual career choices.
e. Factor 5: Job Experience and Opportunities
Findings: Early work experiences or internship opportunities can influence career choice. Individuals who have the opportunity to work in an environment relevant to science and technology are more likely to pursue a career in this field.
f. Factor 6: Influence of School and Higher Education
Findings: Higher education programs and educational institutions can play an important role in career choice. The quality of science and technology programs can influence career interests and choices.
g. Factor 7: Industry Trends and Job Opportunities
Findings: Job opportunities in science and technology fields may also influence career preferences. Consideration of job opportunities can be an important factor in career choice.
h. Factor 8: Social Support and Mentoring
Findings: Social support from friends, mentors, or communities that support career development in science and technology can provide additional encouragement for individuals.
i. Factor 9: Financial Considerations
Findings: Financial considerations such as salary or earning potential in a particular field may also influence career preferences, especially for individuals considering financial stability.
j. Factor 10: Cultural and Social Barriers
Findings: Cultural or social constraints such as certain social or cultural norms can also influence career choices, especially in societies that have certain norms regarding gender roles.

The results of this research will help understand the factors that influence career preferences in science and technology. With a better understanding of these factors, steps can be taken to encourage diversity in career choices and create a more inclusive environment in science and technology fields.

4. Discussion

The results of research on the role of gender in choosing a career in science and technology can have important impacts and implications in several aspects. Below, I will discuss some of the possible impacts of the results of this research as well as policy implications and actions that can be taken:

a. Increase Awareness of the Gender Gap: Research results showing significant differences in career choices based on gender can increase awareness of the gender gap in science and technology. This helps people better understand that differences in career preferences do not only stem from individual interests, but are also influenced by social and cultural factors.
b. Understand the Factors that Influence Career Choice: This research can help us better understand the factors that influence individual career choices. These include the role of education, early experiences, gender stereotypes, and social support. This knowledge can assist educational planners and professionals in guiding individuals toward careers that match their interests and talents.
c. More Inclusive Policy Development: The implications of this research could involve the development of more inclusive education policies and corporate policies. These policies may include removing gender barriers, promoting diversity, and creating equal opportunities for all individuals.
d. Wider Educational Initiatives: The results of this research can provide a foundation for broader educational initiatives aimed at inspiring individuals from diverse gender backgrounds to choose careers in science and technology. Educational programs can be designed to dispel gender stereotypes and activate interest among teens and college students.
e. Increased Industry Awareness: Industries in science and technology can use the results of this research to better understand gender gap challenges and take concrete steps to increase diversity in the workforce. This can include inclusive training programs and the promotion of equal career opportunities.
f. Opportunities for Further Research: The results of this research can identify areas that require further research. Future research could be used to dig deeper into the factors influencing career choice and to test the effectiveness of initiatives aimed at closing the gender gap.
g. Support Gender Equality: A better understanding of how gender influences career choices can help promote gender equality in many fields, including science and technology. This can contribute to achieving broader gender equality goals in society.
h. Overcoming Gender Stereotypes: This research can help identify the role of gender stereotypes in career choice. This can encourage efforts to overcome gender stereotypes that influence individuals, especially women, in choosing or avoiding science and technology fields.
i. Public Policy Action Plan: Governments and educational institutions can use research findings to design more inclusive education policies and to encourage women's participation in STEM fields. This can include educational programs specifically designed to address gender gaps.
j. Further Studies: This research may inspire further research to better understand the complexities of career choices based on gender. Follow-up studies could try to identify specific factors that contribute to differences in career preferences and how these factors can be changed or moderated.
k. Coaching and Mentorship: The findings of this research can motivate educators, researchers, and professionals in the science and technology field to act as mentors, especially for individuals who may feel limited by gender stereotypes.

This research confirms that there are real differences in career preferences between men and women. Men and women tend to have different interests in science and technology. Gender stereotypes still influence career choices in science and technology. Women often feel limited by the perception that some STEM fields are considered "men's work," while men may gravitate more toward fields that are considered "masculine." Early

educational experiences and awareness of career opportunities in STEM fields play an important role in determining an individual's career preferences. Inclusive education and awareness of the variety of opportunities in STEM can change an individual's outlook on careers in these fields. These findings have significant implications for gender equality in science and technology. Differences in career preferences may contribute to the gender gap that still exists in STEM industries. While there are challenges to achieving gender equality in STEM, this research also highlights opportunities to create positive change. Social support, mentorship, and inclusive educational approaches can help overcome these barriers. We therefore need to continue working to create an environment that is inclusive and stimulates the interest of individuals, regardless of gender, in the fields of science and technology. Inclusive education, awareness raising, and concerted efforts from all stakeholders are needed to address differences in career preferences based on gender. It is important to disseminate these findings to policy makers, educators, and other stakeholders who can contribute to positive change in how we view and support career development based on interests, not gender.

5. Conclusions

In conclusion, this research sheds light on the significant influence of gender on career preferences in the fields of science and technology. The study has revealed distinct differences in career aspirations between men and women, emphasizing the role of societal expectations, educational experiences, and stereotypes in shaping these preferences. The findings underscore the persistent impact of gender stereotypes on career choices. Women often find themselves constrained by the perception that certain STEM fields are traditionally "male-dominated," while men may be inclined toward areas considered "masculine." These biases, rooted in societal norms, continue to shape the career trajectories of individuals, potentially contributing to the gender gap prevalent in STEM industries. Education and awareness play pivotal roles in determining career preferences. Early educational experiences and exposure to diverse career opportunities in STEM can significantly alter individuals' perceptions and choices. Inclusive educational environments that encourage all students, regardless of gender, to explore STEM fields are essential in challenging and reshaping traditional gender roles. The implications of this research extend beyond academia. Achieving gender equality in the fields of science and technology is not only a matter of social justice but also vital for driving innovation and progress. Strategies such as social support, mentorship, and inclusive educational practices can help overcome the barriers identified in this study. In essence, this research highlights the need to continue examining and understanding the complexities of gender's role in career choices within the STEM disciplines. Gender equality in STEM is not merely a moral imperative; it is essential to harness the full spectrum of talent available and to advance greater achievements and innovations in science and technology. As we move forward, it is imperative that educational institutions, policymakers, and society as a whole work collaboratively to create an environment that is inclusive and supportive, enabling individuals to pursue STEM careers based on their interests and aptitudes, rather than being influenced by gender stereotypes. Only through such concerted efforts can we strive towards a future where STEM fields are truly diverse and reflective of the rich tapestry of human talent.

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