GENDER, INNOVATION, FUTURE PROOFING USING TECHNOLOGY IN OPEN EDUCATION (G.I.F.T.): A PATHWAY TO YOUTH RESILIENCE AND SUSTAINABLE WORKFORCE IN JAMAICA.

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Abstract

The transformation of education through digital innovation and open-access resources has created unprecedented opportunities for equitable knowledge dissemination. However, gender disparities in educational access, technological literacy, and digital economies remain critical barriers to sustainable development. This study explores the intersection of Gender, Innovation, Futureproofing, and Technology (G.I.F.T) in open education, examining how gender-responsive digital strategies can foster a resilient workforce and drive economic growth.

This research acknowledges the persistent gender disparities caused by reading proficiency gaps and societal attitudes toward higher education. Addressing these challenges requires fostering digital literacy among underrepresented groups and designing inclusive technological ecosystems that support equitable learning experiences.

This qualitative study employs a purposive sampling technique, selecting forty-five (45) participants, including educators, policymakers, and students from diverse educational institutions. Data will be collected through questionnaires (30 respondents) and focus group discussions (15 participants). Thematic analysis will be used to identify patterns and best practices that leverage open education and digital tools to promote gender equity in educational institutions.

Specifically, the study examines AI-driven learning platforms, open educational resources (OERs), and digital skill-building initiatives as mechanisms to enhance learning outcomes, address gender disparities, and reduce structural inequalities in education and the workforce. By advocating for inclusive open education models, this research contributes to local, regional, and global discussions on gender and digital transformation, emphasizing open education as a catalyst for gender equity and sustainable development.

Keywords:
Gender disparities, Innovation, Futureproofing, Technology, Open Education, Open Education Resources, Sustainable development

Introduction

Jamaica's Vision 2030 Productivity Section Plan emphasizes workforce development as a foundation for long-term sustainability. Achieving this goal requires closing critical gaps in gender equity and technological inclusion within open education systems to ensure competitiveness in the global economy. The digital age has ushered in a profound transformation in education on a global scale, reshaping the education sector. Open-access platforms, artificial intelligence enhanced tools and digital skills building programmes now offer revolutionary possibilities for inclusive and equitable education. Despite advancements in digital innovation and the increasing accessibility of open educational resources (OERs), systemic gender disparities in education, digital literacy, and workforce participation continue to hinder progress (Bailey & Brown, 2020). These inequalities disproportionately affect marginalized youths, restricting their ability to engage with emerging opportunities and contribute to national development.

In light of the inequalities, which have been shaped by Jamaica's complex social fabric, recent studies underscore the urgency of addressing gender gaps in the Jamaican education system. For example, girls outperform boys in literacy at the primary and secondary level and male enrollment significantly drops at the tertiary level (Bailey, 2014; Ministry of Education, Youth, and Information, 2020). Additionally, while women have played and continue to play an indispensable role in shaping the nation's path forward, they remain underrepresented in the

field of digital technology and innovation led industries as highlighted by reports from the statistical institute of Jamaica in 2021. They purported that only 29% of employed women occupy roles in STEM related sectors, reflecting a deeper issue of gendered access to digital competencies and interests. Evidently, as the country grapples with the advent of digital transformation, educational equity, and social justice, it is clear that Jamaican women have a critical role to play at the forefront of building systems that are sustainable, inclusive, and future-oriented.

This research therefore emerges against the backdrop, proposing an integrated framework centered on Gender, Innovation, Futureproofing and Technology (G.I.F.T) to explore how open education models can serve as tools for transformative change. It aims to identify gender responsive digital strategies that support resilient learning environments and fosters inclusive economic growth in the Jamaican context. The paper is therefore guided by the following research questions: (i) To what extent is gender disparities evident in education? (ii) How can AI-driven learning platforms be designed to address gender disparities in educational access and technological literacy? (iii) What are the best practices for leveraging open educational resources (OERs) to promote gender equity and sustainable development in open education? (iv) How do digital skill-building initiatives impact women and girls' learning outcomes and workforce participation? (v) In what ways can inclusive technological ecosystems foster resilient societies?

Research Problem

Despite Jamaica's commitment to workforce development under Vision 2030, persistent gender inequities and technological exclusion within education systems hinder the country's ability to build a competitive, sustainable economy. Marginalized youths face systemic barriers in accessing digital literacy and open educational resources, limiting their participation in emerging economic opportunities. This study aims to uncover nuanced insights that can inform inclusive policies and educational reforms.

Review of Related Literature

The goals of Vision 2030 and the United Nations Sustainable Development Goals (SDGs), Goal #4 which speaks to Quality Education and Goal #5 which speaks to Gender Equality (UNESCO, 2022) are very important aspects of nation building. Education is a cornerstone of societal resilience and economic growth. Open education, when focused on gender inclusion, innovation, future readiness, and technology, addresses fundamental challenges such as inequality, skill gaps, and limited access to resources. These themes pave pathways for societies to become more adaptable, equitable, and capable of sustaining economic growth over time. This review explores four key themes: (i) Gender Disparities in Jamaican Education, (ii) Technology, Digital literacy, and Gender, (iii) Open Educational Resources, Innovation and Gender Equity (iv) Artificial intelligence (AI) in Education, (v) Societal Attitudes and Gender Norms, (vi) Futureproofing in Open Education; all of which are important in creating resilient and sustainable societies while driving economic progress.

Gender Disparities in Jamaican Education

Jamaica presents a unique educational landscape characterized by what is considered as "a reverse gender gap" where females consistently outperform males across various educational levels (primary, secondary, tertiary). According to the World Bank (2023), "a reverse gender gap exists in enrollment at all levels of education as girls tend to have higher attainment than boys" (p. 2). Additionally, the World Bank (2023) report highlights the disparities between females and males indicating a vast difference in performance at both the CSEC AND CAPE Examinations, with females outperforming males. Socio-economic challenges, cultural norms, and differing attitudes towards education between genders are seen as the main contributing factors, as boys often face more negative societal pressures that devalue academic achievement, leading to higher dropout rates, and lower academic performance (World Bank, 2023).

While females outperform males academically, they face several challenges in transferring their educational achievements into economic empowerment. In a newspaper article written by the Jamaica Observer on a report of a study by Dr. Carol Watson-Williams the findings indicated that despite high levels of education among women, "educational attainment does have the same predictive value for determining social status of males and females due to the ways in which the gender order favors males in Jamaican society" (p.1). Evidently, while education empowers women and girls, enhancing their ability to contribute to society and the economy there are still some disparities. In countries like Pakistan and Chad, where traditional societal roles limit access to education, targeted gender-inclusive open education initiatives have shown a profound impact (Stoet & Geary, 2020; UNESCO, 2021). Resilient societies are built on inclusive foundations, and educating women contributes to better

family health, lower poverty rates, and stronger communities (Lawrence, 2024; World Bank, 2022). Economically, investing in women's education increases workforce participation, boosts productivity, and supports long-term GDP growth (UNESCO, 2022; OECD, 2023). Open education, through flexible and cost-effective resources, offers a scalable way to close gender gaps, creating more stable, equitable societies and stronger economies.

Technology, Digital literacy, and Gender

Technology in open education refers to using digital tools to enhance learning experiences, improve access, and make education more efficient and personalized. Technology creates scalable solutions to address educational inequality, forming a backbone for resilient societies. In China and Finland, AI-powered platforms provide personalized learning experiences, helping individuals acquire the skills needed for modern economies (Lawrence, 2024). Technology ensures continuity of education during disruptions like pandemics, making societies better equipped to handle crises (World Economic Forum, 2021; UNESCO, 2022). Economically, technology enables cost-effective delivery of education, reducing barriers such as high tuition costs or geographic isolation (McKinsey Global Institute, 2023; OECD, 2023). It also accelerates innovation, as learners develop critical skills to enter advanced fields such as IT, healthcare, and renewable energy. This, in turn, supports industrial growth, global competitiveness, and long-term sustainability (Lawrence, 2024; World Bank, 2022). By integrating technology into education systems, communities build the foundations for both economic success and societal resilience.

The integration of technology in education has the potential to bridge educational gaps; however, digital literacy remains uneven across genders. Globally, adolescent girls and young women often have lower digital skills compared to their male counterparts. UNICEF (2023) reported that "For every 100 male youth who have digital skills, only 65 female youth do, across 32 countries and territories analysed" (p. 1). While Jamaica was not a part of the 32 countries analyzed, the disparity is overwhelming. Seemingly, digital literacy in Jamaica is a pivotal factor in bridging gender disparities particularly in the context of a rapidly evolving digital economy. In a limited study conducted by Muturi (2006) she indicated that "the ICT adoption situation in Jamaica is impressive, with more than 80% of women interviewed having access to a variety of common ICTs - Internet access (81%), cell phones (99%), cable/digital TV (83%) and radio (98%), among others"(p.3). The study further indicates that, "With regard to Internet access, about 98% of women in Jamaica have access to the Internet, which implies access to computers and at various locations, including home (61%), work (33%), school (15%) and other places, like the post office, public library, and friends' houses. A small minority (9%) have access at Internet cafés and a negligible 3% through mobile phones" (p.3). Despite the strides of mobile usage among women, there is a disparity relating to internet access and digital skills. The study indicated that "There are also challenges associated with internet access and use among women, including lack of computers (51%), lack of training (56%) and lack of internet connection (41%)" (p.4).

Open Educational Resources, Innovation and Gender Equity

Open Educational Resources (OERs) as defined by UNESCO (2021) are "learning, teaching and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation, and redistribution by others" (UNESCO, 2021). Open Educational Resources (OERs) offers a promising avenue for promoting gender equity in education. By providing free and accessible learning materials, OERs can help overcome financial and geographical barriers that disproportionately affect women and girls. The Commonwealth of Learning (2020) in the Col in the Commonwealth 2018-2020 Guyana report, emphasizes the role of OERs in supporting gender equality. While the emphasis in this report is on Guyana, it is applicable to Jamaica as a Commonwealth nation state. The report states that, "ambitious projects to improve gender equality… are based on community mobilization and address areas such as capacity building and education" (p.4). Jamaica has embraced the need for OERs. Initiatives like EduFocal have leveraged technology to provide accessible learning resources.

Innovation in open education involves creating new ideas, tools, and approaches to improve access to education and address societal and economic challenges. Innovation fuels progress, helping communities become more resilient by overcoming barriers to learning. For example, in India and South Africa, the use of open educational resources (OERs) and mobile platforms has transformed access to education in remote and underserved areas (Lawrence, 2024; Kearney, 2023). These innovations ensure learning continues even during crises such as pandemics or natural disasters, fostering societal adaptability. Economically, innovative tools expand access to skills training, equipping individuals for high-demand sectors and reducing unemployment (UNESCO, 2022; McKinsey Global Institute, 2023). Furthermore, education innovation supports entrepreneurship, as learners gain

resources to start businesses or lead creative projects contributing to economic growth (Robinson, 2023; Stoet & Geary, 2020). By embedding innovation into education, societies build a pipeline of adaptable, skilled individuals, ensuring both resilience and sustained development.

Artificial intelligence (AI) in Education

The benefits of Artificial Intelligence (AI) in education are far reaching. UNESCO's Caribbean Artificial Intelligence Initiative highlights that AI technologies can perpetuate existing gender biases if not carefully managed (UNESCO, 2020). In Jamaica, efforts are being made to address concerns relating to ethics and gender-based concerns with the development of inclusive AI policies and practices. The Ministry of Education has initiated programs to integrate AI into classrooms, aiming to personalize learning experiences while emphasizing the importance of ethical AI use (UNESCO, 2020).

Societal Attitudes and Gender Norms

Societal attitudes and entrenched gender norms significantly influence educational outcomes in Jamaica. Traditional perceptions often dictate the roles and expectations of males and females, affecting their engagement and performance in educational settings (World Bank, 2023). In the 2023 UNESCO report it is stated that, "restrictive masculinities" and negative gender norms can hinder boys' academic achievements and limit girls' participation in certain fields of study. Additionally, there is a digital divide perpetuated by societal norms and stereotypes that discourage girls (and boys) from pursuing certain careers. For instance, a study by Kvasny and Trauth (2008) highlighted how gender biases in education and career guidance can steer girls away from technology and STEM subjects. The research also suggests that gender beliefs and social relations can shape educational outcomes, influencing both boys' and girls' academic trajectories.

Methodology

Research Design and Sampling

This study seeks to discuss the possible gender disparities in open education and technology and ways to address these issues. The study is conducted using the purposive sampling approach. Purposive sampling was selected as it ensures that the participants have the basic knowledge needed to address the research questions. A total of forty-five (45) participants were selected from various backgrounds. The population sample was selected based on three criteria: gender, economic background, and education. Thirty (30) respondents completed the questionnaire while the remaining fifteen (15) individuals participated in the focus group discussion.

Instrumentation

Questionnaire and focus group discussion was used to collect data. The questionnaire was used to explore the concept of gender disparities in education and how gender responsive digital strategies such as open education, AI- driven platforms and digital literacy initiatives can help reduce gender disparities and promote sustainable development in education and the workforce. The standardized questionnaire was the preferred instrument selected as it allows for (1) scalability (2) anonymity, and (3) objectivism. The questionnaire consists of open and closed-ended items and focused on five (5) aspects (i) access to Digital Education, (ii) Attitudes and Digital Literacy (iii) Gender Disparities in Digital Education, (iv) Digital innovation and Inclusive Learning, and (v) Future-proofing and Economic impact. There are twenty-seven (27) questions on the instruments, with six (6) consisting of an open-ended item. The first five (5) questions seek to explore demographic data. Various types of questions were used. A five-point Likert scale was slightly modified and used. Table 1 provides the matrix of the questionnaire showing the number of items.

Additionally, a focus group was used to gather additional data. Focus group discussion was used as it allows for efficiency and provides rich and interactive data. Questions were drafted from the four research questions.

Table 1 - Matrix of questionnaire for Gender Innovation Future Proofing using technology in open education

Research Questions	Items	Examples	Response Mode
To what extent is gender disparities evident in education?	**6-10**	There are gender disparities in education. Have you observed or experienced gender-based barriers to accessing or participating in educational opportunities? Explain	SA, A, D, SD
How can AI-driven learning platforms be designed to address gender disparities in educational access and technological literacy?	**11-14**	AI-driven learning platforms can be designed to address gender disparities in educational access and technological literacy.	SA, A, D, SD
What are the best practices for leveraging open educational resources (OERs) to promote gender equity and sustainable development in open education?	**15-18**	Open educational resources (OERs) can be leveraged to promote gender equity and sustainable development in open education	SA, A, D, SD
How do digital skill-building initiatives impact women and girls' learning outcomes and workforce participation?	**19-23**	Digital skill-building initiatives impact women and girls' learning outcomes and workforce participation	SA, A, D, SD
In what ways can inclusive technological ecosystems foster resilient societies?	**24-27**	Inclusive technological ecosystems can foster resilient societies.	SA, A, D, SD

Administrative Procedure

Since purposive sampling was used, in order to administer the questionnaire, the researchers went to various communities and educational institutions (universities and colleges) over a period of three weeks. The first set of questionnaires were administered and reviewed in week 1. Some questionnaires were deemed unusable because they were incomplete. As such, the process was repeated in the following weeks. Participants who were not able to complete the questionnaire at the time were invited to participate in the focus group discussion.

Method of Analysis

Since this is a qualitative study, a thematic approach was used to analyze and interpret data collected. A thematic approach was selected as it enhances depth and rigor of the research. Nowell et al. (2017) notes that when properly applied, thematic analysis ensures “transparency and rigor in qualitative research” (p. 1). The findings are used to make recommendations that should be beneficial to students, practitioners, and other relevant stakeholders.

Limitations
The study is limited on account of the fact that the data collected cannot be construed as representative of the population.

Findings
This chapter provides a detailed description of the findings obtained from the questionnaires completed by thirty (30) respondents and from the focus group discussion. In addition to the presentation of the data, the chapter has a discussion of each research question in context of the current findings. *Table 2* summarizes the socio-demographic characteristics of the sampled respondents for the questionnaire and focus group.

Table 2 - Matrix of Demographics - questionnaire and focus group discussion for Gender Innovation Future Proofing using technology in open education.

Characteristics	Questionnaire	Focus group
Gender		
Male	11	9
Female	19	6
Age Cohort		
Under 18	3	1
18-24	6	3
25-30	1	1
31-35	9	3
36-40	4	5
41-45	2	1
46-50	2	
Over 50	3	1
Academic Qualification		
High school	3	1
Community college/University	6	6
University (1st degree)	13	3
University/Postgraduate (Masters/PhD)	5	3
Vocational/ Technical		2
Other	3	
Professional Grouping		
Student	6	4
Government worker	10	

Private sector	7	7
Unemployed	2	3
Self employed	5	1
Socio Economic Status		
Lower class	7	4
Middle Class	20	8
Upper Class	3	3

Research Question 1
To what extent is gender disparities evident in education?

Most of the respondents (22 of the 30 respondents) 73.3%, believed that there is a gender disparity in education. When asked if the discrepancy is towards males or females, 14 of the 22 respondents (63.6%) indicated males while the remaining 36.4% indicated females. In the focus group discussion, 11 of the respondents (73.3%) indicated a disparity towards males.

Research Question 2
How can AI-driven learning platforms be designed to address gender disparities in educational access and technological literacy?
The questions associated with this research question included an open-ended section allowing respondents to give their own personal input.

Twenty-three of the respondents (76.6%) indicated that gender sensitivity content is important in reaching individuals especially with promoting various occupational fields that may be dominant to a particular gender.

In relation to technological literacy 27 respondents (90%) indicated that learning platforms should be developed to include a particular language of a country and to understand the use of gender-based language, especially in the Jamaican context where male expression is different from females and the dialect varies. Skills building and mentorship/apprenticeship programme for youths especially males/unattached youths was also another suggestion put forward with 19 respondents. (63.3%).

Research Question 3
What are the best practices for leveraging open educational resources (OERs) to promote gender equity and sustainable development in open education?
Most of the respondents 63.3% indicated accessibility to the internet, promoting online/blended learning in schools and technology integration. The additional 36.7% indicated the need for international collaboration and resource rooms/centers in schools.

Research Question 4
How do digital skill-building initiatives impact women and girls' learning outcomes and workforce participation?
Increased confidence and earning power along with increased participation in workforce development and removing stereotypes tied for 50/50 answers.

Research Question 5
In what ways can inclusive technological ecosystems foster resilient societies?
90% of the respondents indicated providing learning at their own pace as a way in which these tools can help support equitable learning experiences. 90% of respondents also indicated that providing free/subsidized education as their responses. The remaining 10% indicated accessibility of the internet and training and support in the use of technology was given as responses.

Discussion

The research conducted explores the extent of gender disparities in education and examines potential solutions through AI driven learning platforms, open educational resources (OERs), and inclusive technological ecosystems. Generally, there is a perception in Jamaica that there is a gender disparity between males and females. While the majority of Jamaicans have access to the internet (through school, home, cellphone, community) and technological devices (smartphone, tablet, desktop), their uses are limited especially if the individual is not engaged in aspects of educational advancements. From the research conducted, males are seen as the marginalized group as it relates to education and educational access, mostly as a result of financial barriers, low digital literacy, and societal and cultural perceptions.

The research indicates that a significant majority of respondents believe that gender disparities exist in education. Interestingly, the majority of these respondents indicated that the disparity is towards males. This finding suggests that gender disparities in education are perceived differently across respondents, highlighting the complexity of the issue. According to UNESCO (2020), gender disparities in education are influenced by a combination of social, cultural, and economic factors, which can vary significantly across regions and contexts. The view is that women are perceived to be stepping away from prescribed gender/cultural roles and seeing education as an important steppingstone to financial freedom and economic stability.

AI-driven learning platforms must be designed and implemented to be able to adapt to the users' needs and cultural specificities. Gender-sensitive content is crucial for promoting various occupational fields, especially those dominated by either gender. Both males and females must be sensitized to understand that jobs are not necessarily gender specific, especially in the Jamaican context where men are looked down on for having careers perceived to be female roles and women are seen as too masculine for having perceived male dominated careers. Additionally, developing learning platforms that include adaptation to local languages and understanding gender-based language nuances, particularly in the Jamaican context is necessary to promote understanding and flexibility. These findings align with the work of Kvasny and Trauth (2008), who highlight the importance of gender-sensitive content and localized language support in educational technologies. Furthermore, developing skills-building initiatives and mentorship programs, especially for unattached youths are particularly important in addressing gender disparities in educational access and technological literacy. Outside of social media usage, many individuals are unable to use the internet and the resources available in an intellectual way. Allowing for these initiatives will show the value and importance of technology in attaining an education. It also lends itself to more individuals taking part in online classes and other online programmes aimed at personal development. The research findings underscore the multifaceted nature of gender disparities in education and highlight the potential of technological solutions to address these challenges. The majority of respondents recognize the importance of gender-sensitive content in AI-driven learning platforms. This suggests that personalized and culturally relevant educational tools can play a crucial role in promoting gender equity.

OERs are critical aspects to promoting gender equity. The research identified accessibility to the internet, promoting online/blended learning in schools, and technology integration as key best practices for leveraging OERs. Additionally, the need for international collaboration and the establishment of resource rooms/centers in schools is also essential. These findings suggest that a combination of technological integration and collaborative efforts can significantly enhance gender equity in education. UNESCO (2020) supports this by advocating for the development of inclusive OERs that are accessible and culturally relevant, ensuring that all learners have equal opportunities to benefit from these resources.

The study found that increased confidence and earning power, as well as increased participation in workforce development, were the most cited impacts of digital skill-building initiatives. These findings underscore the importance of digital skill-building in empowering women and girls, enhancing their learning outcomes, and promoting their participation in the workforce. Research done by Brooks-Harris et al. (1996) and Denner & Dunbar (2004) supports this, highlighting that gender-sensitive educational content can significantly improve girls' interest and performance in traditionally male-dominated fields. Moreover, the emphasis on skills-building and mentorship programs indicates the need for targeted interventions, particularly for unattached youths. Gender-inclusive education strengthens communities and unlocks economic potential, while innovative tools and future-ready systems ensure adaptability and competitiveness. Technology enhances education's reach and impact, supporting both individual progress and societal transformation.

It is believed that providing learning tools that allow for self-paced learning and offering free/subsidized education are essential for fostering resilient societies and by extension equitable access. Additionally, the importance of internet accessibility and training/support in the use of technology is also important. These findings suggest that

inclusive technological ecosystems can significantly support equitable learning experiences for underrepresented groups by providing flexible learning opportunities and ensuring access to necessary resources. According to UNESCO (2020), creating inclusive and accessible technological ecosystems is crucial for achieving gender equity and sustainable development in education.

Conclusion

Addressing gender disparities in education requires a comprehensive approach that integrates technological solutions, culturally relevant content, and targeted interventions. The findings from this research suggest that AI-driven learning platforms, OERs, and inclusive technological ecosystems can play a significant role in promoting gender equity and sustainable development in education in the Jamaican context. By providing equitable learning experiences and fostering resilient societies, these strategies can help bridge the gender gap and empower underrepresented groups to achieve their full potential.

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