

## **Gender Imbalance in Science Disciplines at Kyambogo University of Uganda and Development Implications**

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**Abstract:** Kyambogo University (KyU) is one of Uganda's nine public universities. Like any other University, KyU is experiencing gender imbalance in science disciplines. This comes with glaring development implications in a country of 34.6 million people, women being the majority. This paper presents results from the study that focused on the nature of gender imbalance in science disciplines at KyU; its causes, development implications, and possible remedies. The study followed a mixed methods approach that combined desk review and in-depth interviews. Documents reviewed produced quantitative data using the checklist while in-depth interviews generated qualitative data that was collected through face-to-face interaction with 42 respondents. Quantitative data was analysed using descriptive statistics while qualitative data was analysed through content analysis. Findings indicate that the nature of gender imbalance in science disciplines is reflected in the admissions and completion; while causes are patriarchy, gender stereotypes, and limited mentorship. The development implications on women and society are in terms of low enrolments, self-esteem, academic staff recruitment, and education returns. The study concludes that gender imbalance in science disciplines at KyU is a reality, socially constructed, and can be deconstructed. In order to enhance gender balance in science disciplines, this study recommends creating science awareness in primary and secondary schools, providing scholarships for females to offer sciences at university, affirmative action through STEM Programme, empower the people at KyU to explore the Gender policy and strengthening the Gender Mainstreaming Directorate while ensuring appropriate gender monitoring and evaluation processes.

**Key Words:** Gender Imbalance, Science Disciplines, Kyambogo University, Development Implications

Déséquilibre du genre dans les disciplines des sciences à l'Université de Kyambogo en Ouganda et ses implications en matière de développement

**Sommaire :** L'université de Kyambogo (KyU) est l'une des neuf universités publiques de l'Ouganda. Comme toute autre université, KyU connaît des déséquilibres du genre dans les disciplines des sciences. Cette situation a des conséquences flagrantes sur le développement d'un pays de 34,6 millions d'habitants, où les femmes sont majoritaires. Cet article présente les

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résultats de l'étude qui s'est concentrée sur la nature des déséquilibres du genre dans les disciplines des sciences à KyU, ses causes, ses implications en termes de développement et les remèdes possibles. L'étude a suivi une approche mixte combinant une étude documentaire et des entretiens approfondis. Les documents examinés ont produit des données quantitatives à l'aide de la liste de contrôle, tandis que les entretiens approfondis ont généré des données qualitatives qui ont été recueillies par le biais d'une interaction en face à face avec 42 répondants. Les données quantitatives ont été analysées à l'aide de statistiques descriptives, tandis que les données qualitatives ont été analysées par le biais d'une analyse de contenu. Les résultats indiquent que la nature des déséquilibres du genre dans les disciplines de sciences se reflète dans les admissions et l'achèvement des études, tandis que les causes sont le patriarcat, les stéréotypes sexistes et le mentorat limité. Les implications en termes de développement pour les femmes et la société se situent au niveau des faibles inscriptions, de l'estime de soi, du recrutement du personnel universitaire et du rendement de l'éducation. L'étude conclut que le déséquilibre du genre dans les disciplines de sciences à KyU est une réalité, socialement construite et qui peut être déconstruite. Afin d'améliorer l'équilibre du genre dans les disciplines de sciences, cette étude recommande la création de sensibilisation aux sciences dans les écoles primaires et secondaires, d'accorder des bourses aux femmes pour qu'elles puissent suivre des cours de sciences à l'université, de mettre en place des actions positives par le biais du programme STEM, d'habiliter le personnel de la KyU à explorer la politique du genre et de renforcer la direction de l'intégration de l'égalité des sexes tout en garantissant des processus appropriés de suivi et d'évaluation du genre.

**Mots clé :** Déséquilibres du genre, disciplines de sciences, l'université de Kyambogo, conséquences sur le développement.

## Introduction

Gender imbalance in science disciplines remains a stonewall in the development process globally. It is noted in some literature that women make up to 35% enrolment in Science, Technology, Engineering and Math (STEM) (Marcus 2020). Despite this progress, women are still under represented in universities and work places that are STEM oriented. For example, cloud computing has 12 % women and engineering 15% (Marcus 2020). Junming et al. (2020) also found extensive evidence of gender imbalance in academia; indicating that women are underrepresented in most scientific disciplines, publish fewer articles over the course of their careers, and their work receives fewer citations. In 1955, women made up only 12% of all active authors although that percentage steadily grew to 35% by 2005. However, these totals mask significant discipline inequalities, particularly in STEM. In math, physics, and computer science, for example, women make up 15% of the student body, whereas in psychology, they make up 33%, (Junming et al. 2020) across countries and disciplines. They also discovered considerable differences by country, with female scientists accounting for as little as 28% in Germany and 50% in Russia. Women are currently attending university in greater numbers than males around the world, but this numerical strength is not evident in all areas, particularly STEM, where men continue to dominate, maintaining long-standing gender disparities. For example, in the United Kingdom, women account for only 12% of engineering students and 4% of those are pursuing engineering apprenticeships (Georgetown University 2021). Only 16 percent of engineering majors in the United States are female, according to a recent analysis by Georgetown University, despite the fact that overall, there are more female students-59.5% at the university (Georgetown University 2021). Furthermore, according to the World Bank's 2012 report on Gender Equality and Development, more women than men now attend university (World Bank 2012). However, there are still significant gender disparities in specific fields, with engineering taking the brunt of it. Women, on the other hand, generally dominate education, health, welfare, arts and humanities

in 84 percent of nations surveyed by the World Bank (2012); while social sciences, business, and law appear rather gender-neutral.

Despite the Universal Declaration of Human Rights 1948 article 26, the Sustainable Development Goals (SDGs) of 2015-2030 specifically goal number four on quality education and goal number five on gender equality; as well as the Republic of Uganda's 1995 constitution article 21, on equal and fair treatment of all Ugandans in all spheres of life, including education; and article 30 which guarantees the right to education to all females and males, females remain disproportionately underrepresented in schools when compared to boys, particularly in STEM subjects (Hasaba 2014). For example, there are 6193 medical professionals in Uganda, with 2291 (37%) women and 3902 (63%) men and a similar pattern can be seen in engineering 29 (5.5%) females and 496 (94.5%) males (Namugera 2019) and architecture 36 (19.3%) females and 151 (80.7%) (Kabarungi 2021). Despite the above policies of equality and fairness in Uganda, there is continued low representation of women in science fields which is the subject of this study in KyU, which is no different from other institutions in the country.

The study was guided by the liberal feminism theory ("equality feminism") which is rooted in Mary Wollstonecraft's work (1759-1799) that asserts that women need to be educated just like men in order for them to grow up into moral and independent human beings. The theory is primarily concerned with ensuring gender equality and accordingly, equality is essentially a question of attaining equal legal rights and access to higher-level positions. This was because at Wollstonecraft's time, laws, rights, and privileges relating to adult suffrage, marriage, divorce, property, and education were in favour of men at the cost of women (Britannica 2021). On the contrary, the situation is currently better for women in Uganda. This is because of the 1995 constitution of the republic of Uganda which granted freedom to women in those aspects although in practice, a lot remains to be desired especially in achieving gender balance in science disciplines.

Liberal feminists seek to entirely end mistreatment of women as result of being legal dependents on men who are either husbands, fathers or brothers. Liberal feminists in general use the liberal philosophy of equality and individual freedom to contend that social status at birth and sex were no longer legitimate basis for creating gender imbalance. The theory aids this study to comprehend the nature and causes of gender imbalance in sciences as a result of the history, perception, and practice by patriarchal systems within Kyambogo University in Uganda. The theory argues that individual development requires the ability to educate and expand one's faculties. Therefore, unequitable access to education especially science disciplines inhibits women's ability to attain their fullest potential which impacts negatively on the country's development process.

Gender imbalance in this study is used as a term to describe a situation where both males and females have unequal opportunities and access to services, systems and institutions like, culture, religion, education, economy, and polity. It is a social construct resulting from constrained relationships, expectations, gender stereotypes and roles of both males and females in society (Omotosho 2013). These imbalances are further reflected in unequal access to the science disciplines offered at the university in which there are more males than females numerically and by achievement. Development is growing and becoming more advanced in political, economic, and social spheres of life. It is about positive change and improvement in all faculties of life (Lubaale 2020). Development implications means any positive or negative outcome on the development spectrum as a result of the occurrence directly or indirectly as well as intended or unintended of any development action or inaction. It must be noted in this study that development is inter-related and dependant on its concepts including a gender-responsive society. Therefore, limiting women's development in science disciplines leads to negative implications because it creates huge development gaps.

KyU was established in 2003 as a public university to offer higher education in Uganda. Kyambogo University Admissions Policy, and Gender Policy 2014 both provide for equal treatment of females and males in terms of education attainment of all disciplines. However, like any other public university in Uganda, KyU is experiencing gender inequalities in terms of students' enrolment and completion of science programmes. There are 22 (33.8%) women with PhDs in science disciplines against 43 (66.2%) men at KyU (Kyambogo University Redeployment Report 2021) while 498 (21.8%) females

and 1779 (78.2%) male students graduated in 2021 in science disciplines. This study majorly focuses on the nature of gender imbalance among students in science disciplines at KyU, its causes, and development implications on the development spectrum of the institution and Uganda. It identifies possible policy options and practices that will ensure gender equality in science disciplines at KyU in order to enhance nation building and a gender balanced labour force with higher productivity.

## Literature Review

As already noted from Marcus (2020), on average, women make up to 35% enrolment in STEM globally although in some regions it is at 20%. This is related to KyU where for students it stands at 498 (21.8%) female and 1779 (78.2%) male in science disciplines who graduated in 2021. This is a manifestation of gender imbalance at this 20-year-old university. Marcus' findings are useful in establishing the nature, causes and effects of gender imbalance in the development arena. Gender stereotypes in schools, gender roles in the household/society dictate women's career choice, and indeed influence employers' attitudes towards employing women (World Bank 2012). This constitutes some of the causes of gender imbalance in science disciplines. To attain more equal proportions of male and female students, there is need for change in societal norms, employers' attitudes, and the educational system from gender stereotyping (World Bank 2012). This is in line with Kabonesa (2007) who established that gender stereotypes and roles are pivotal in curtailing women's progress in all spheres of life including offering science disciplines. The author recommended gender mainstreaming at all levels which in this case can add value to enhance sciences uptake at KyU. The clubs and camps initiative that encourage more girls to offer STEM subjects is good and progressive although long term strategies are needed.

In the case of Malaysia, all boys and girls who perform well in mathematics and other science subjects at lower levels are automatically placed in STEM subject combinations at the universities (Marcus 2020). Uganda should pick a leaf from that in general and KyU in particular in order to enhance offering science disciplines. Mexico also provides students and parents information regarding STEM career opportunities and financial returns. Such a practice motivates many students to offer the STEM subjects and increases enrolments (Marcus 2020). Marcus' study, although from a different context, provides relevant examples in terms of scope, policy, and practice.

The Uganda National Gender Policy (NGP) of 2007 aims at raising the status of women in all spheres of life. For example, to increase their influence and participation in politics, economics, solving social problems, education, and to combat negative social-cultural factors that inhibit their progress. However, females remain disproportionately underrepresented in school when compared to boys, particularly in STEM subjects where they face more barriers to access education, leaving the female populace disenfranchised (Hasaba 2014). This strengthens the urgency for this study so that causes are established and appropriate remedies sought after in form of policies and action plans, with a view of enhancing gender balance in science disciplines.

Other large universities in Uganda such as Makerere University (Mak), established in 1922 with completion rate of 100% male, progressed to 23.9% females and 76.1% males in 1990. Such a slow progress prompted enactment of relevant policies. For example, gender policies were established. These included Gender Mainstreaming Programme of awarding scholarships and strengthening the private scheme that increased enrolment of females to 49.5% in 2004 (Gender Mainstreaming Division 2007; National Gender Policy 2007). Through her Gender Policy of 2014, there are visible results of gender equity, equality, and empowerment among students at KyU. This is evidenced by 53.9% males and 46.1% females at the 2021 graduation (Kyambogo University Graduation Booklet 2021) amidst challenges like women remaining at the extreme bottom in sciences. These two case programmes are relevant for this study's discussion.

## Materials and Methods

This study used a mixed-methods approach that combined desk reviews of graduation booklets ranging from 2011-2021 and in-depth interviews (Creswell 2009; 2017) in which a cross-sectional design was employed to address the study objectives. The checklist and interview guide were used as research instruments respectively. Quantitative data was derived from the desk reviews while qualitative data from face-to-face interviews helped to elicit in-depth analysis. Students who were earmarked for graduation by July of 2021 constituted the target population. A sample of 42 students, identified through stratified simple random sampling method, from a total of 2,277 enrolled for the academic year 2019/2020 were interviewed until data saturation was reached (Mugenda & Mugenda 1999). Sampling took cognizance of the different characteristics like faculty, sex, nature of science discipline, and level at which it was offered. Quantitative data was analysed using descriptive statistics while qualitative data followed content analysis by identifying themes, summarized findings (Pope et al. 2007), and eventual researchers' interpretation. The Instruments' validity was confirmed by having them evaluated by five specialists in education and development. The Content Validity Index (CVI) was calculated using their expert judgment, which enabled study approval. Each item's CVI was calculated, and any items with a score of less than 0.8 were modified (Amin 2005). The test-retest approach was used to determine the item's reliability. The Cronbach Alpha test score of 0.6 was ensured (Amin 2005). Confidentiality of participants, ethical approval, and the use of informed consent constituted ethical considerations (Bean 2005).

## Findings and Discussions

### Nature of Gender Imbalance in Science Disciplines

#### *Findings*

Table 1 shows the gender imbalance in terms of completion. The engineering programme is worst as evident in 2015 with 12.4% females against 87.6% males. Table 2A illustrates gender imbalance in all science programmes. Females are still at the bottom in numbers in all programmes except Food Science Technology at postgraduate level. From table 2B, gender imbalance in all engineering programmes is illustrated. Females are the minority in all programmes indicating the same phenomenon. The worst hit programmes are Diploma in Education Secondary (Technical Studies), Higher Diploma in Mechanical Engineering, Master of Science in Structural Engineering, and Master of Science in Advanced Manufacturing Systems Engineering where again, no female graduated at all.

**Table 1: Gender Imbalance in Completion Rates at KyU**

S/N	Programme	Male	Percentage	Female	Percentage	Total & %
2020	All Programmes	4933	53.9	4216	46.1	9149=100%
	Science	536	68.9	241	31.1	777=100%
	Engineering	1205	83.3	241	16.7	1446=100%
	Postgraduate	130	57.7	95	42.3	225=100%
2019	All Programmes	4810	54.5	4011	45.5	8821=100%
	Science	693	73.1	255	26.9	948=100%
	Engineering	928	82.1	202	17.9	1130=100%
	Postgraduate	143	64.2	80	35.8	223=100%
2018	All Programmes	4119	53.8	3827	46.2	7646=100%
	Science	557	73.3	202	26.7	759=100%
	Engineering	932	82.2	201	17.8	1133=100%
	Postgraduate	80	71.4	32	28.6	112=100%
2017	All Programmes	4139	56.6	3165	43.4	7304=100%
	Science	494	74.6	168	25.4	662=100%

	Engineering	839	85.6	141	14.4	980=100%
	Postgraduate	153	72.1	59	27.9	212=100%
2016	All Programmes	3174	54.4	2655	45.6	5829=100%
	Science	351	74.5	120	25.5	471=100%
	Engineering	695	87.5	99	12.5	794=100%
	Postgraduate	39	54.9	32	45.1	71=100%
2015	All Programmes	3673	50.9	3529	49.1	7202=100%
	Science	406	68.6	185	31.4	591=100%
	Engineering	662	87.6	93	12.4	755=100%
	Postgraduate	60	60	40	40	100=100%
2011	All Programmes	4192	55	3409	45	7601=100%

**Source:** Graduation Booklets of KyU 2011-2021 (*Note: Students of 2020 under study who should ideally have graduated in 2020 did not because of Covid 19 pandemic, instead it was in 2021*)

S/N	Programme	Male	Female	Total
1.	Doctor of Philosophy in Food Technology	00	01	01
2.	Master of Science in Chemistry	02	00	02
3.	Master of Science in Food Technology	03	04	07
4.	Master of Science in Sports Science	03	01	04
5.	Master of Science in Conservation and Natural Resource Management	03	02	05
6.	Master of Science in Physics	02	00	02
7.	Postgraduate Diploma in Food Safety Management	02	01	03
8.	Postgraduate Diploma in Sports Management	02	02	04
9.	Bachelor of Science in Chemical Engineering	65	33	98
10.	Bachelor of Science with Education	132	47	179
11.	Bachelor of Science Technology (Biology)	16	11	27
12.	Bachelor of Science Technology (Chemistry)	20	16	36
13.	Bachelor of Science Technology (Physics)	13	03	16
14.	Bachelor of Science in Food Processing Technology	17	07	24
15.	Bachelor of Information Technology and Computing	58	24	82
16.	Bachelor of Information Systems	27	08	35
17.	Bachelor of Science in Sports and Leisure Management	04	00	04
18.	Bachelor of Science in Textile and Clothing Technology	09	01	10
19.	Bachelor of Environmental Science Technology and Management	22	17	39
20.	Bachelor of Oil and Gas Production	15	05	25
21.	Bachelor of Science in Statistics	29	14	43
22.	Bachelor of Science in Leather Tanning Technology	01	03	04
23.	Diploma in Computer Science	29	03	32
24.	Diploma in Food Processing Technology	26	24	50
25.	Ordinary Diploma in Science Technology (Biology)	06	01	07
26.	Ordinary Diploma in Science Technology (Chemistry)	07	05	12
27.	Diploma in Physical Education & Sports Management	13	04	17

28.	Ordinary Diploma in Science Technology (Physics)	02	05	07
29.	Certificate in Food Processing Technology	08	06	14
30.	Certificate in Laboratory Technology	17	05	22
	<b>TOTAL</b>	<b>553</b>	<b>252</b>	<b>805</b>

Source: Graduation Booklet of KyU, 2021

S/N	Programme	Male	Female	Total
1.	Master of Science in Structural Engineering	04	00	04
2.	Master of Science in Advanced Manufacturing Systems Engineering	03	00	03
3.	Master of Science in Water and Sanitation Engineering	02	03	05
4.	Master of Science in Construction Technology and Management	12	02	14
5.	Bachelor of Engineering in Civil and Building Engineering	140	17	157
6.	Bachelor of Engineering in Telecommunications Engineering	59	21	80
7.	Bachelor of Engineering in Mechanical and Manufacturing Engineering	136	10	146
8.	Bachelor of Electrical Engineering	91	6	97
9.	Bachelor of Architecture	15	02	17
10.	Bachelor Of Science in Building Economics	37	28	65
11.	Bachelor of Science in Surveying and Land Information Systems	58	21	79
12.	Bachelor of Science in Land Economics	36	41	77
13.	Bachelor of Vocational Studies in Technological Studies with Education	15	01	16
14.	Bachelor of Engineering in Environmental Engineering and Management	36	06	42
15.	Bachelor of Industrial Engineering and Management	52	12	64
16.	Bachelor of Engineering in Automotive and Power Engineering	88	07	95
17.	Higher Diploma in Mechanical Engineering	07	00	07
18.	Higher Diploma in Civil and Building Engineering	67	14	81
19.	Ordinary Diploma in Civil and Building Engineering	67	10	77
20.	Higher Diploma in Electrical Engineering	13	01	14
21.	Ordinary Diploma in Civil And Building Engineering (Kabale)	30	05	35
22.	Ordinary Diploma in Electrical Engineering	46	04	50
23.	Ordinary Diploma in Water Engineering	35	05	40
24.	Ordinary Diploma in Mechanical Engineering	29	03	32
25.	Ordinary Diploma in Architecture	24	02	26
26.	Ordinary Diploma in Computer Engineering	15	01	16
27.	Ordinary Diploma in Telecommunications Engineering	23	09	32
28.	Diploma in Education Secondary (Technical Studies)	12	00	12
29.	Diploma in Biomedical Engineering	27	8	35
30.	Ordinary Diploma in Automobile Engineering	12	02	14

31.	Ordinary Diploma in Refrigeration and Air Conditioning	35	05	40
	<b>Total</b>	<b>1226</b>	<b>246</b>	<b>1472</b>

*Source: Graduation Booklet of KyU, 2021*

## **Discussion**

### **Completion Rates**

In the findings above, gender imbalance in all programmes is illustrated and shows that females are at the bottom. In spite of the existence of the Universal Declaration of Human Rights, 1948 article 26, the Sustainable Development Goals (SDGs) of 2015-2030, goal number four is quality education and five is gender equality; the 1995 constitution of the Republic of Uganda article 21, which provides for equal and fair treatment of all persons in Uganda without discrimination in all spheres of life including education as well as article 30 which provides for the right of education for all females and males. Besides that, the Universities and Other Tertiary Institutions Act 2006 as amended and the Education (Pre-Primary, Primary and Post Primary) Act 2008, all provide for the provision of equal education for all (females and males) in all disciplines including sciences. This is further buttressed by the National Gender Policy (NGP) of Uganda 2007 which provides for equal treatment of females and males in Uganda in terms of education attainment of all disciplines besides providing for the affirmative action of 1.5 additional marks to females joining higher education. Furthermore, there exist government sponsorship schemes namely; merit scholarships, district quarter scholarships, and loan scheme scholarships, private payment scheme in a public university like KyU, and KyU Gender Policy (2014) which enhance attaining education for all in all disciplines, gender imbalance in science disciplines remain real at KyU as evident in table 1, 2A and 2B above.

The gender stereotype that men do sciences and women arts (table 6(a) below) is alive evidenced by the monopoly of males in science courses as majority and females as minority. Furthermore, the gender role that women cook food and men not as a division of labour is alive in science disciplines' enrolment and completion as more women complete Food Technology programmes more than men at postgraduate level. The worst hit programmes were Bachelor of Sports Sciences and Leisure Management, Masters of Science Physics and Chemistry with no female representation at all.

### **Causes of Gender Imbalance in Science Disciplines**

#### **Findings**

According to the respondent's interview responses shown below, the causes of gender imbalance in science disciplines at KyU were identified as patriarchy, gender stereotypes, and limited mentorship.

#### **Patriarchy**

In our community, culture has really spoiled things. Everybody thinks that it is men to offer science disciplines and become engineers, doctors, technicians etc all the time while women are for arts. Such gender stereotyping is reflected in the admissions, completion rates and even staff composition, (An Undergraduate female from faculty of Science in July 2021).

Women cannot be equal to men in pursuit of science disciplines because it is a male preserve, (An Undergraduate male from faculty of Engineering in July 2021).

Patriarchy controls women by excluding them from access to necessary economically productive resources which would facilitate their pursuit for science disciplines, (A Postgraduate female from faculty of Science in July 2021).

Traditional division of labour which largely places women at home to do domestic work indeed denies many young females of the time and courage it demands to pursue engineering courses like

civil, electrical and mechanical hence opting for arts which look less laborious, (An Undergraduate female from faculty of Engineering in July 2021).

Patriarchy is rule of the father which keeps women dominated and subordinated by men in all spheres of life (political, economic and social) including education attainment in science disciplines, promotion and staff recruitment hence the current science gender imbalance in KyU, (An Undergraduate male from faculty of Engineering in July 2021)

## Gender Stereotypes

**Table 6(a): General Gender Stereotypes in Uganda.**

<b>Men are:</b>	<b>Women are:</b>
Public	Private
Active	Passive
Leaders	Followers
Independent	Dependent
Strong	Weak
Courageous	Timid
Risk takers	Avoid risks
Aggressive	Polite
Rational (reason)	Intuitive/ emotional
Sciences	Arts
Tough	Tender
Assets	Liabilities
Superior	Inferior
Handsome	Beautiful
Rulers	Ruled
Dominants	Subordinates

*Source: Lubaale, 2018*

Limited female science scholars indeed stand out as a drawback in motivation and encouraging young females from pursuing science disciplines, (An Undergraduate female from faculty of Science in July 2021).

Men study science courses while women arts and it is a serious gender stereotype which causes gender imbalance in which men continue to dominate science disciplines as women follow. The respondent told the researcher that there are 22(33.8%) women with PhDs in sciences/engineering against 43(66.2%) men, (A Postgraduate male from faculty of Engineering in July 2021).

Engineering programmes like civil, electrical and mechanical among others are public jobs requiring a lot of energy and taking risks which is a preserve for males and contrary to female who are private, with less energy and stamina to take risks as per upbringing hence the imbalance in science disciplines, (An Undergraduate female from faculty of Engineering in July 2021).

## Mentorship

All teachers of Physics, Chemistry and Biology were men while pursuing advanced levels which is not okay. It would have been better with some women as teachers for better performance and motivation among females, (An Undergraduate female from faculty of Science in July 2021).

Continuous dominance of men in science disciplines indeed creates an image that sciences are for men which discourages females from pursuing them, (An Undergraduate female from faculty of Engineering in July 2021).

Mentorship from a person of your gender adds value, (An Undergraduate female from faculty of Engineering in July 2021).

### *Discussion*

**Patriarchy:** This was cited as one of the primary causes of gender disparities in science disciplines by a number of respondents during the interviews. In the past, patriarchy had a specific connotation referring to a system developed from Greek and Roman law in which the male head of household held ultimate legal and economic power over his dependents (wife, children and slaves (Sikweyiya et al. 2020; Mosse 1993; Tuyizere 2007). Today, patriarchy means male dominance over women and children within the family context and other spheres of society such as government, military, and education (science disciplines) (Sikweyiya et al. 2020; Mosse 1993; Tuyizere 2007). Most societies in the world, KyU inclusive are patriarchal. This power structure frequently makes it difficult to challenge gender stereotypes particularly of roles and divisions of labour in which women's subservience is preserved and perpetuated. This includes science disciplines and related labour opportunities as a preserve for males as described in the interview responses above.

Such responses further emphasize that patriarchal manifestations, traits, and dynamics, particularly male domination over females operate in today's society, where enrolment and completion in STEM subjects at KyU is no exception. Understanding patriarchy helps readers appreciate why female enrolment, completion, and success in science disciplines at KyU has limitations. This phenomenon is reinforced by archaeologists who insist that male activities in society indicate power, prestige, and spatial segregation, whereas female activities rotate on subordination, domestic work, child care, and use of technologically inferior tools (Sikweyiya et al. 2020; Tong 1989) hence justifying male dominance in science disciplines which results into perpetuating gender imbalance.

**Gender Stereotypes:** During the interview, university respondents stated that gender stereotypes and gender roles are some of the causes of gender imbalance in society and at KyU. Gender stereotypes are culturally established characteristics of masculine or feminine behavior, i.e. they depict the gender pattern of male and female behaviors as determined by culture (Sikweyiya et al. 2020; Lubaale 2018; Ssali et al. 2007; Mosse 1993). The gender stereotypes listed above (Table 6a) in Uganda are helpful in understanding gender disparities in KyU. Gender stereotypes exist, and their impact on people is a reality, even among highly educated people in university settings where one would not expect it. This is evidenced by the aforementioned comments from respondents. Indeed, males stand higher chances for science disciplines than females. This results from gender stereotypes, roles, division of labour, and preconceptions instilled in them since childhood. Even when people grow up and go to university, such nurture is deeply engrained. It manifests as "genetic" and occurs "naturally," but it is a social construct rather than a scientific fact (Sikweyiya et al. 2020; Mosse 1993; Ssali et al. 2007). As a result of history, perception, and practice, such gender stereotypes have largely affected women's chances of admission, completion, and success; and contributed to gender imbalance in science disciplines like in the case of KyU.

**Mentoring:** The continued failure to close the gender disparities in sciences in universities continues to paint a picture that these disciplines are meant for males which discourages females. This finding is in line with Shen et al. (2021) who also established that inadequate mentoring perpetuates underrepresentation of women in management positions and career growth. Their study provided qualitative and quantitative evidence of the impact of mentoring on women's career outcomes, and indeed informed future interventions for promotion and retention of women in academic medicine. No doubt that all young people need to be encouraged to pursue science subjects. However, if females receive mentorship from fellow women, there would be an exceptional added advantage through building their self-esteem and giving them hope that things are possible. Limited mentorship continues to perpetuate

gender imbalance in sciences because there are few female role models who would otherwise encourage more young females to work hard in pursuance of sciences.

## **Development Implications**

### ***Findings***

The above illustration of gender imbalance in science disciplines indeed breed serious consequences in the education system as a whole, university growth in particular and eventually creates colossal development implications in the country. Findings gravitated around the issue of education for all, enrolment, self-esteem, academic staff recruitment, and returns on higher education investment:

In spite of free education, girls drop out of school and those who stay, many are unable to score the points needed to join higher education for science disciplines, (An Undergraduate female from faculty of Engineering in July 2021)

Human rights violation particularly of inability to access education, and limited access to basics needs that are necessary to facility people go to school and pursue science disciplines is always limited particularly on the female side (An Undergraduate male from faculty of Science in July 2021).

Science disciplines are for boys and girls for arts which discourages girls from trying sciences, (An Undergraduate female from faculty of science in July 2021).

Failure to score enough points to join science disciplines inhibits enrolments, (An Undergraduate male from faculty of Engineering in July 2021).

Limited role models in science disciplines like professors, lecturers, teachers and researchers of a female gender indeed demotivates and leaves no room for hope and trail to pursue sciences hence low enrolments, (A postgraduate female from faculty of Science in July 2021).

They are not natural but socially constructed with far reaching impacts on KyU women who in the end experience a lot of pain, stress, abuses, and insults that ultimately affect their self-esteem in all forms, (An Undergraduate male from faculty of Science in July 2021).

They create psychological torture which eventually reduces women's self-esteem, freedom, motivation and ambition, (An Undergraduate female from faculty of Engineering in July 2021).

This automatically limits KyU female's chances to higher education access, and excellent achievement in the university and beyond, (A Postgraduate female from faculty of Science in July 2021).

Limited females doing sciences in primary, secondary and university indeed leaves a big gap in upward mobility of scholars in sciences thus by the time they recruit academic staff, the male become dominant, (An Undergraduate male from faculty of Science in July 2021).

Limited staff teaching science disciplines indeed discourages many females from pursuing sciences because of limited mentorship and gender support, (An Undergraduate female from faculty of Engineering in July 2021).

Gender imbalance therefore creates imbalances in education achievement and development, (An Undergraduate female from faculty of Engineering in July 2021).

Grants and research collaborations which require gender balance as a prerequisite, we have often missed out that because of female shortages, (A postgraduate female from faculty of Engineering in August 2021).

Public returns of investing in education largely comes from one gender which is not good for nation building, (A postgraduate male from faculty of Science in July 2021).

Private returns of investing in education go largely to men not women which creates income inequalities, (An Undergraduate female from faculty of Science in July 2021).

## *Discussion*

**Education for All:** The 1995 constitution of the republic of Uganda provides that all citizens of school going age should receive education in all disciplines without any form of discrimination. In the same line, the Universal Declaration of Human Rights 1948 in article 26 provides for the same as well as Sustainable Development Goals (SDGs) number 3. Kyambogo University Admission policy, gender policy 2014 and core values all point to equal education access in all disciplines without gender discrimination. Therefore, the existence of gender gaps in student's enrolment and completion of sciences in the university defeats the above constitutional and international conventions for education equality; and depicts KyU as non-compliant yet as a university, it ought to be gender responsive. Such gender imbalance create gaps in the development process in terms of productivity and labour force gender profile. This negatively contributes to under development of Uganda.

**Enrolments:** The continued failure to get more mentors, role models, and academic staff of all genders and in general demystifying sciences as a male preserve indeed perpetuates the gender disparities in enrolment processes. From the interview responses, it is clear that gender imbalance in sciences indeed results into low enrolments because few females pursue sciences up to university and the completion rate is too low given the above scenarios. Few females' enrolment in science subjects undermines talent development and labour force development; and facilitates eventual under development because a certain group of people (females) miss the opportunity to contribute to national development with their natural endowments.

**Self-Esteem:** Gender stereotypes as ascribed to our masculinity or femininity eventually breed gender violence and self-doubt that impacts female's self-esteem. This shows up in the levels of science disciplines enrolments and completion. Interviewee's responses point to the fact that gender stereotypes are a reality in KyU and indeed limit females' enrolment and completion of science disciplines on time. This is further buttressed by the fact that higher education remains patriarchal and indeed impinges on self-esteem, liberty, enthusiasm, and ambition of females from enrolling and completing their careers in sciences on time. It also affects professional and talent development that would boost the upward progression of the country in different spheres of life.

**Academic Staff Gender Profile:** By May 2020, there was a systematic problem of more male staff teaching sciences than females. For example, academic staff with PhD teaching engineering were 03 females and 12 males while science were 19 females and 31 males giving a total of 22 (33.8%) female and 43 (66.2%) males (Kyambogo University Redeployment Report, 2021). This is a huge gender imbalance. Few female teachers are enrolled at all levels, in primary, secondary and university, to teach science subjects. This is translated into students' enrolment and several gender related factors in the political, economic, and social conditions in society. As a result, there is a shortage of science teachers that impacts on female students' performance, comprehension, motivation, and academic achievements. This further perpetuates gender disparities in education and, eventually, underdevelopment due to human resource shortages and contributions to national development. It also kills motivation, self-esteem, freedom, and hope among present staff and students, as well as those remaining in primary and secondary institutions. As a result, many women's potential in scholarship, mentoring and research contributions to KyU and Uganda as a whole are being undermined.

**Returns on Higher Education Investment:** Investment in higher education brings both public and private returns. Increased entrepreneurship, job creation, good governance, tax base, delivery of professional services, responsible population, savings and investments all constitute public returns while private returns include income, employment, psychological fulfilment, and career development (Bloom et al. 2005). The neo-classical school of thought backs up this thesis by affirming that education and development have a good close link (De Beer & Swanepoel 2000). Given that human beings are the active agents who accumulate capital, harness natural resources, and build institutions for development, any institution or a country that is unable to develop knowledge, values, and skills of both males and females in science disciplines and use them effectively in the national economy, as is in KyU, will be

unable to develop holistically (Todaro 2015). Such inability will greatly curtail growth of the education system, education equality, and nurture of the most talented brains in sciences whether males or females.

### **Conclusion and Recommendations**

It is no longer in dispute that gender imbalance in science disciplines exist in KyU as evidenced by the enrolment profile and completion rates presented. This continues to prevent the 20-year-old university from realizing her vision of providing equal access to higher education, completion, and achievement to all genders in all disciplines. The causes are nurtured and socially constructed through patriarchy, gender stereotypes, and limited mentorship from fellow women. This phenomenon can be deconstructed to pave way for gender balance in science disciplines enrolment, completion, and higher education achievement as envisaged by Mary Wollstonecraft's (1759-1799) theory that women need to be educated just like men in order for them to grow up into moral and independent human beings which will enable them achieve high education (qualifications and employment) and then makes significant contribution to family and national development.

In light of the above findings, discussion, and conclusion, the study recommends sensitization to create awareness of the benefits of studying science subjects, introduce scholarships and effect affirmative action in STEM, strengthen the gender policy, and put into place checks and balances by way of monitoring and evaluating policy implementation. KyU should start public awareness in all primary and secondary schools in 2022 that it offers science disciplines which are open for both males and females as evident from Mexico. This should be done through media, career guidance in schools, publishing science programs at KyU and entry requirements and being available for questions and answers. This awareness for both males and females, students as well as parents will culminate into motivation and boost self-esteem, hard work, and increase enrolments.

Makerere University Council passed and endorsed an affirmative action policy in the STEM field on the 6th and 8th of August 2019 to set aside 40% of enrolment for female applicants to the aforesaid university programs (Makerere University 2019). KyU should implement the same STEM Program beginning 2022, either in its current format or with modifications based on KyU's resources and capabilities. Additionally, KyU Council in its budget of 2022/2023 should reserve 200 scholarships for females from vulnerable families to pursue science disciplines. Furthermore, the Director of Gender Mainstreaming at Kyambogo University must guarantee that the KyU Gender Policy of 2014, which has a goal of attaining gender equality in all areas of the university is effectively implemented. The University Council should fund the Directorate in terms of human, physical, financial, and research resources to advance gender equality in the university among students of all disciplines. Lastly, these measures should be monitored regularly by the KyU Gender Directorate in light of the policies in place to ensure that policies generate the expected effect and are cost-effective. Such strategies, in terms of enrolment, completion, student sponsorship, and mentorship; fair academic staff recruitment and promotions, will promote and give females more opportunities to study science courses, increase enrolment, and close the gender gap.

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