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Contents

FEATURE ARTICLES

Editorial

Dear Reader,

The curated papers in this issue of *JAST*, Volume 15, Issue 3, cover a range of topics that again underscore the journal's multidisciplinary nature.

The first paper, **Effectiveness of Iron Electrocoagulation in Removing COD from Soybean-based Oily Wastewater: Effects of Initial pH and Applied Current on Treatment Efficiency,** reports the efficacy of iron electrocoagulation in removing chemical oxygen demand (COD) from oily wastewater produced from soybean oil processing and posits that the technique can be used as an alternative treatment method for high COD wastewater.

The second paper, **Adopting Factorial Design of Experiments Technique to Analyse the effects of Material Factors on the Tensile Strength of Red Mud Polymer Composites**, presents the results of using a full 2^3 factorial design with two replications and analysis of variance to determine the effect of several control factors, namely, red mud wt.%, pH value, and red mud particle size on the response variable, tensile strength.

Paper three, **Exclusive Breastfeeding: Impact of Breastfeeding Friendly Support in the Workplace**, presents research-informed strategies and recommendations for facilitating lactating women continuing exclusive breastfeeding for at least six months after returning to work.

The authors of the fourth paper, **TVET Integration in Jamaica's Secondary High Schools and Attitudes of School Leadership**, argue that, despite the commitment of the Government of Jamaica to institutionalise Technical and Vocational Education and Training (TVET) in secondary educational institutions, underlying challenges continue to negatively impact its progress; they report on the specific challenges.

Paper five, **A Systematic Literature Review of the State of TVET Research in the Caribbean Over the Past Quarter Century (1996–2021)**, underscored the importance of TVET in developing a skilled labour force capable of functioning in a highly competitive global world, and reviewed the state of research in the region to identify gaps and recommended some areas of focus for future research.

The authors of paper six, **Insiders' Perspective on Higher Education Leadership Development**, used the findings of their study to propose the establishment of a particular vehicle for developing the important competencies that are desirable for HEI leaders.

In the seventh paper, **Globalisation: Building Research Management Capacity and Enhancing Curriculum Development at Jamaica's Leading Public University through Cross-Border Collaborative Partnerships**, the authors used a retrospective analytical approach to describe and discuss examples of cross-border collaborative partnerships that were leveraged to build institutional research management capacity and enhance curriculum development to address important challenges ranging from climate change to sustainable energy; the authors also discuss learning and other benefits that accrued to the subject institution from these cross-border partnerships.

The main findings reported in paper eight, **Impact of Self-Reported Learning Styles Among Doctoral Students in an Online-mediated Health Sciences Programme**, suggest that understanding students' learning styles may assist stakeholders in identifying and using the most appropriate online learning strategies to add the most value to online learners' learning experience.

Paper nine, **The Impact of the COVID-19 Pandemic on the Teaching and Learning Process at a Rural Tertiary Institution**, reports the results of a mixed-method study of the experiences and adaptations of students and lecturers at a tertiary institution in Western Jamaica during the pandemic.

The author of paper ten, **Representations of Jamaica Ahead of its Diamond Jubilee in Four 'Town' Murals**, took a Cultural Studies approach to thematic analysis of four public murals in Kingston and urban St. Andrew, Jamaica, and reported the existence of an imbalance in the murals' racial and gender composition that contributed to a limited depiction of Jamaican identity ahead of its 60th anniversary of Independence on August 6, 2022.

The eleventh and final paper**, Impact of Artificial Intelligence on the Jamaican Job Market: Quantity and Quality**, is a commentary in which the author evaluated the possible impact of AI on the Jamaican labour force by mapping a similar study that was conducted by the International Labour Organization (ILO). The commentary identifies some of the jobs that are most susceptible to AI-enabled automation; the author also discussed some of the broader impacts of AI.

Paul W. Ivey, PhD
Editor-in-Chief

JOURNAL OF ARTS SCIENCE AND TECHNOLOGY

Effectiveness of Iron Electrocoagulation in Removing COD From Soybean-Based Oily Wastewater

Effects of Initial pH and Applied Current on Treatment Efficiency

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University of Technology, Jamaica

Abstract

In this study, oily wastewater (OW) from soybean oil processing plant was subjected to iron electrocoagulation (Fe-EC) to evaluate the method's effectiveness at chemical oxygen demand (COD) removal. Experiments were conducted in a batch-operated electrochemical cell with a pair of cylindrical iron electrodes, placed 3 cm apart and connected in a monopolar configuration. The effects of operating parameters, initial pH (4, 7, and 9) and applied current (0.1, 0.2, and 0.4 A) were studied, and the statistical significance of the parameters and their interaction were assessed using ANOVA. The results showed that an initial pH of 9 and current of 0.4 A favoured the highest COD removals (91.76% and 91.31%, respectively) from OW, and both parameters were statistically significant to COD removal based on a linear regression model without interaction. The findings of this study have demonstrated that Fe-EC is technically capable of removing over 85% of COD from OW produced from soybean oil processing and the technique can be used as an alternative treatment method for high COD wastewater. Further work is required to assess the technique's economic feasibility within the Jamaican context.

Keywords: Chemical Oxygen Demand, Iron Electrocoagulation, Oily Wastewater, Soybean Oil, Wastewater Treatment

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Introduction

The manufacturing/processing industry in Jamaica is relatively small and consists mainlyof food and beverage processing companies. The discharge of wastewater from these companies is governed by the National Resources Conservation Regulations and standards enforced by the National Environment and Planning Agency (NEPA). To achieve compliance, regulated companies employ on-site conventional wastewater treatment methods. Conventional methods employ physical (e.g., filtration and sedimentation), chemical (e.g., chemical coagulation and advanced oxidation), and biological (e.g., aerobic and anaerobic treatment) processes in pretreatment, primary, secondary, and tertiary stages. However, because of excessively high pollutant loading, implemented stages may not be adequate tolower pollutant levels to specified standards.

One standard that is applicable to most local companies, especially the food and beverage sector, is chemical oxygen demand (COD). COD is a key water/wastewater quality indicator, with a standard of <100 mg/L for trade/industrial effluents (NEPA, 2023). COD measures the quantity of oxygen required to oxidize organic and inorganic compounds in water/wastewater; however, it is primarily used to denote organic matter (Kulkarni, 2013). CODindicates a wastewater's oxygen-depletion capacity and its potential environmental impact. Therefore, COD monitoring allows environmental scientists, engineers, and compliance officers to assess wastewater treatment technologies and determine the best organic load reduction strategies.

Oily wastewater (OW) from edible oil processing is typically characterized with high COD,oil and grease, sulphate, and phosphate contents (Un et al., 2009). The wastewater is generated from the large volume of water used in a variety of processes, including refining and equipmentand floor washing (Preethi et al., 2020). Locally, soybean oil is primarily processed, and daily OWgeneration is approximately 370 metric tons (Ferguson, 2023). Settling and decanting of the OWis done onsite and the decanted liquid is channeled to the municipal sewage system (Ferguson, 2023). If treated by the National Water Commission's sewage service that is based predominately on biological treatment, it is anticipated

that the treatment efficiency of OW willbe low. This is due to OW's low BOD/COD ratio, which renders biodegradation ineffective (Rakhmania et al. (2022). Therefore, alternative methods of treatment are needed.

Electrocoagulation (EC) is an attractive alternative to conventional treatment methods. The technique involves generating coagulants in-situ by applying an electric current to metal electrodes. The coagulants can remove pollutants by one or more mechanisms including precipitation, co-precipitation, adsorption, enmeshment, and complexation (Hakizimana et al.,2017; Moussa et al., 2017; Garcia-Segura et al., 2017). EC has been applied to several types of wastewaters and has been proven effective in reducing a wide range of pollutants. The technique is characterized by simple equipment, easy operation, no or minimal chemical addition, and decreased amount of produced sludge (Kabdaşhli et al., 2012; Hakizimana et al.,2017).

The primary goal of this study was to assess the effectiveness of EC as an alternative technology for treating OW from vegetable oil processing. In addition, the study sought to determine the effect of initial pH and current on the extent of COD removal and to develop a mathematical model relating the parameters to COD removal from the wastewater. To the best of the authors' knowledge, there has been limited or no investigation on iron (Fe)-EC treatment of OW from soybean oil processing; therefore, this research contributes to the scientific literature on Fe-EC of OW from this type of edible oil. This study is the first reported applicationof EC to OW in Jamaica and the Caribbean, and its findings can be used to stimulate local and regional interest in the electrochemical technique of EC.

Literature Review

Principles of Electrocoagulation

When a direct current (DC) passes through an EC reactor setup as displayed in Figure 1,the metal (M) of the anode dissociates to give metal cations (M^{n+}) and electrons (e^-) according to the equation:

$$M_{(s)} \rightarrow M_{(aq)}^{n+} + ne^- \quad (1)$$

where n is the number of electrons transferred in the anodic dissolution process per mole of metal atom. The mass of the anode dissolved, m, is determined by Faraday's law:

$$m = \frac{ItM_w}{zF} \tag{2}$$

where I is the current (A), t is the time of operation (s), M_w is the molecular weight of the anode material, and F is Faraday's constant (96,485 C/mol). In the case of Fe electrodes, which are employed in this study, the possible reactions at the electrode surfaces are (Chou et al., 2009; Espinoza-Quiñones et al., 2009):

At the anode:

$$Fe_{(s)} \rightarrow Fe^{2+}_{(aq)} + 2e^- \tag{3}$$

At the cathode:

$$2H_2O + 2e^- \rightarrow H_{2(g)} + 2OH^- \tag{4}$$

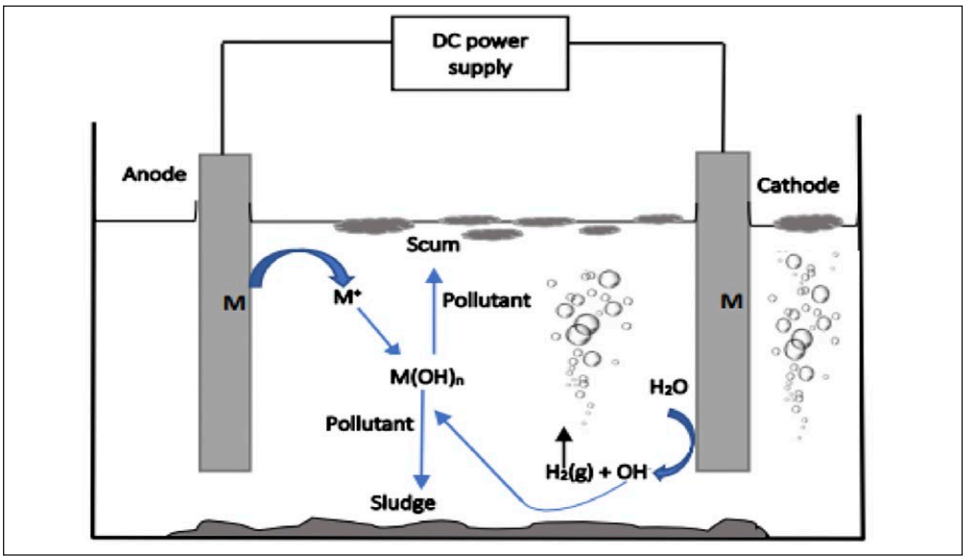

Figure 1. Schematic of the EC process

The metal ions generated from the dissolution of the sacrificial anode undergo hydrolysis producing several coagulant species including insoluble hydroxides, oxides and oxyhydroxides.These coagulants destabilize the repulsive forces that keep particles suspended in water (Cañizares et al., 2009; Moussa et al., 2017). Destabilized pollutants can settle as sludge at the base of the EC cell or float as scum on the surface of the wastewater with the aid of the hydrogen bubbles produced at the cathode (Manilal et al., 2020).

Parameters Influencing the Electrocoagulation Process

Several operating parameters, including initial pH, current (or current density (J)), electrolysis voltage (U), inter-electrode spacing (d), supporting electrolyte type (SEt), electrolyte concentration (SEc), pollutant initial concentration, electrolysis time (t), mixing speed, electrode material and reactor design are known to influence the pollutant removal efficiency of an EC process. Many EC studies have determined how the parameters and their interactions impactspecific pollutant removal, including the studies done by Chou et al. (2009), Elnakar and Buchanan (2019); El-Taweel et al. (2015), Gatsios et al. (2015), Sontaya et al. (2013), and Yavuz& Ögütveren (2018). Two of the most studied parameters are initial pH and current.

Initial pH

The pH of the solution influences the speciation of coagulant (Gomes et al., 2018; Moussa et al., 2017). The studies done by Lakshamanan et al. (2009) and Sasson et al. (2009) showed that the ratio of Fe^{2+} ions to total Fe declined as the initial pH of the solution increased.Lakshamanan et al. reported that Fe^{2+}: total Fe fell from >0.7 to <0.5 when the pH increased from 6.5 to 7.5, and no Fe^{2+} was present at pH 8. Oxidation of Fe^{2+} to Fe^{3+} was the reason givenfor the decline in Fe^{2+}. The overall reactions occurring in the EC reactor at acidic, neutral, and alkaline pH as proposed by Manilal et al. (2020) and Ghernaout et al. (2008) align well with Lakshamanan et al.'s findings. These are:

$$\text{At acidic pH: } 2Fe_{(s)} + 6H_2O_{(l)} \leftrightarrow O_{2(g)} + 4H_{2(g)} + 2Fe(OH)_{2(s)} \quad (5)$$

$$\text{At neutral pH: } 3Fe_{(s)} + 8H_2O_{(l)} \leftrightarrow Fe(OH)_{2(s)} + 2Fe(OH)_{3(s)} + 4H_{2(g)} \quad (6)$$

$$\text{At alkaline pH: } 2Fe_{(s)} + 6H_2O_{(l)} \leftrightarrow 2Fe(OH)_{3(s)} + 3H_{2(g)} \quad (7)$$

The $Fe(OH)_n$ are the coagulants responsible for pollutant removal. A variety of hydroxy and oxyhydroxides may also be present, and these can contribute to contaminantremoval depending on their solubility at the governing pH range.

The pH of the medium also changes during EC and its final value depends on the initialpH (Gatsios et al., 2015; Kabdaşhli et al., 2012). The change in pH has been attributed to the production and consumption of the OH^-ions produced at the cathode (Elnakar and Buchanan,2019; Lakshamanan et al. 2009).

Current

The current applied to the EC system controls the coagulant dosage to the water (Kabdaşhli et al., 2012; Sahu et al., 2014). Based on Faraday's law, an increase in current increases the mass of Fe dissolved from the anode, and subsequently the mass of $Fe(OH)_n$ coagulants. However, an increase in current does not always promote pollution removal. Studieslike Kobya et al. (2014), Mansoorian et al. (2014), and Yavuz and Ögütveren (2018) have shown that there is an optimum current value beyond which pollution removal declines. Current also influences the size and rate of bubble production and the energy consumption of the EC setup (El-Taweel et al., 2015; Sahu et al., 2014).

Applications of Iron Electrocoagulation

EC has been applied successfully to treat wastewater from the textile industry (Espinoza- Quiñones et al., 2009; Hendaoui et al., 2020; Mahmoud et al., 2013), food processing industry (Ashanka et al., 2020; Kobya et al., 2006; Kushwaha et al., 2010), pulp and paper industry (AzadiAghdam et al., 2015; Khansorthong and Hunsom, 2009; Shankar et al., 2014), pharmaceutical industry (Yoosefian et al., 2016; Nariyan et al., 2017; Mohammed et al., 2021), petroleum refinery industry (El-Naas et al., 2009; Safari et al. 2015; Ulucan & Kurt, 2015), and wastewaters containing heavy metals (El-Taweel et al., 2015; Chou et al. 2009; Gatsios et al., 2015), among others. Table 1 provides a comparison of recent applications of Fe-EC for COD reduction from various wastewaters.

Oily Wastewater from Vegetable Oil Processing

Sontaya et al. (2013) reported that COD removal from palm oil mill wastewater ranged from 45–91.8% for initial pH 4 and 60–90% for initial pH 9. They also observed that beyond 15 minutes of electrolysis time no significant change in COD removal was achieved. Inan et al. (2004) found that 10 minutes of EC operation was enough to remove 47% COD from olive oil mill effluent at pH 9 at 12V for a Fe anode – Al cathode system. Lubis et al. (2019) applied Fe-EC to pretreated palm oil mill effluent and achieved maximum COD, TSS, and TDS reductions of 95.01%, 97.27%, and 44.11%, respectively at 20V and 45 minutes of operation. Chairunnisak et al. (2018) obtained similar COD reduction under the same parameter settings as Lubis et al., but for Fenton-assisted Fe-EC.

Table 1: Comparison of COD Removal from Various Wastewaters Using Fe-EC

Wastewater	Reference	Reactor operation mode	Electrode arrangement[1]	Parameters (optimum)[2]	Maximum/Optimum COD Removal Efficiency[3]
Palm oil mill (POM) wastewater	Darmadi et al. (2018)	Batch	MP-P (two pairs); vertical plates	U = 10 - 20 V (20 V) t = 15 – 45 min (43 min) SEc = 0 – 1.0 M (0.6)	95.05%
	Sontaya et al. (2013)	Batch	BP-S; vertical plates	d = 2.0 cm U = 6, 12, 18 V (12 V) t = 10 – 60 min (15 min) initial pH = 4, 9 (4)	89.2%
Sugar industry wastewater	Sahu & Chaudhari (2015)	Batch	MP-P (two pairs); vertical plates	d = 1.0 – 2.5 cm (2) J = 39 – 195 A/m2 (178 A/m2) pH0 = 2 – 10 (6) t = 0 – 120 min (120 min)	84%
	Thakur et al. (2009)	Batch	MP-P (two pairs); vertical plates	d = 1.0 – 2.0 cm (1) J = 39.06 – 195.31 A/m2 (146.75 A/m2) Initial pH = 3.5 – 9.5 (6.75) t = 30 – 150 min (130 min)	63.1%
Chicken processing plant wastewater	Gomes et al. (2018)	Continuous	BP-S; five plates	Electrode orientation = vertical, horizontal d = 2.1 cm J = 4 – 13 mA/cm2 (4 mA/cm2) SEt = NaCl	88.5% - horizontal electrodes at pH = 8.2 96.2% - vertical electrodes at pH = 7.9
	Kobya et al. (2006)	Batch with recirculation	MP-P (two pairs)	d = 1.1 cm J = 25 – 200 A/m2 (150 A/m2) Initial pH = 2 – 10 (2) t = 2 – 40 min (25 min)	85%

Table 1 continues on next page

Table 1: Comparison of COD Removal from Various Wastewaters Using Fe-EC (*cont'd*)

Wastewater	Reference	Reactor operation mode	Electrode arrangement[1]	Parameters (optimum)[2]	Maximum/Optimum COD Removal Efficiency[3]
Pulp and paper wastewater	Azadi Aghdam et al. (2015)	Batch with recirculation	MP-P (three pairs)	d = 2 cm U = 4 – 14V (10V) Initial pH = 3.5 – 11 (6) t = 10 – 180 min (60 min)	85%
	Katal & Pahlavanzadeh (2011)	Batch	MP-P (three pairs)	d = 2 cm J = 10 – 110 A/m2 (70 A/m2) Initial pH = 2 – 10 (7) t = 10 – 70 min (30 min)	88.4%
Automobile wastewater	Krishna et al. (2017)	Batch	Monopolar single pair; vertical plates	d = 1-3 cm (2 cm) U = 10 – 30V (30 V) t = 30 – 180 min (180 min)	71.2%
	Mohammadi et al. (2017)	Batch	Monopolar single pair; vertical plates	d = 2 cm U = 10 – 30V (30 V) Initial pH = 3, 7, 11 (3) t = 30, 60, 90 min (30 min)	94%

1. MP-P – monopolar parallel; BP-S – bipolar series 2. Optimum parameters are enclosed in brackets.
Optimal removals are listed when parameters are optimized. Maximum removals are stated with operating parameters in the absence of optimization.

The literature reviewed here demonstrates that Fe-EC has good potential for treating OW from vegetable oil processing. Typically, researchers have been able to remove over 45% ofCOD from OW, in less than 30 minutes using Fe electrodes in batch mode. The literature has alsoshown variation in characteristics for similar types of wastewaters, which may be due to differences in additives and subprocesses. Therefore, the literature findings cannot be generalized to OW generated from soybean oil processing, and local application of the ECmethod is required to verify its effectiveness.

Materials and Methodology

Oily Wastewater

OW were sourced from a vegetable oil processing factory located in Kingston. Sampleswere collected in cleaned 5L high density polyethylene bottles and transported at 30±2°C temperature. The raw samples were analyzed for COD, pH, total dissolved solids (TDS), total suspended solids (TSS), phosphates as orthophosphates, and nitrates in accordance with Standard Methods (Eaton et al., 2005). The samples were kept at ±4°C prior to EC treatment.

Chemicals

All chemicals used in the study were of reagent grade and supplied by Jamaica Laboratories and Industrial Suppliers. The supporting electrolyte was sodium chloride (NaCl).The pH of the wastewater was adjusted with either 0.1M sodium hydroxide or 0.1M hydrochloric acid. All solutions were prepared with deionized water (18.2 M cm) and doubledistilled water was used for rinsing glassware and other materials.

Electrocoagulation Reactor Setup

The EC experiments were conducted in a laboratory-scale reactor made of acrylic sheet,and measuring 10 cm in width, 15 cm in length and 15 cm in height. The reactor had a workingvolume of 1L. A pair of cylindrical iron rods were used as electrodes, which were connected in monopolar configuration to a DC power supply (Sencore PS402 Triple Output, 0-30V, 3A). The effective surface area of both electrodes was 13.36 cm^2. A wooden rail with clamps supported the electrodes

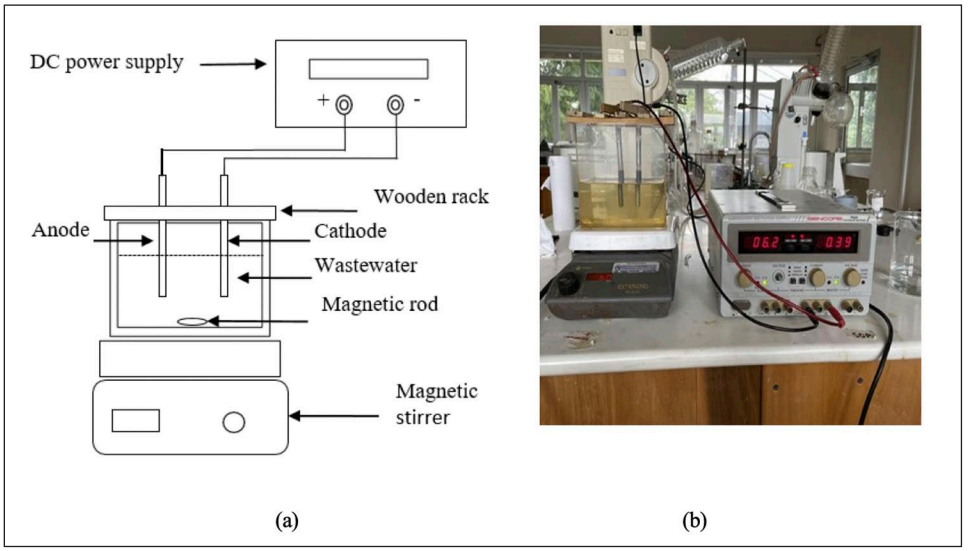

Figure 2. Lab-scale EC setup: (a) schematic diagram of the setup, and (b) actual system setup

vertically and maintained a 3-cm inter-electrode spacing. The lab-scale setup is shown in Figure 2.

Experimental procedures

A 1L mixture containing 100 mL of 1:10 diluted wastewater, 2.93g of NaCl (0.05M) anddeionized water was placed in the reactor. The initial pH of the solution was adjusted to the desired value. The electrodes were submerged into the solution and connected to the powersupply. The power was switched on, and EC was carried out under galvanostatic currents. Thereactor's content was agitated with a magnetic rod and stirrer (Corning PC-4100) at 300 rpm.

At the end of treatment time of 20 minutes, a 10 mL sample was taken, filtered and the filtrateanalyzed for COD. The final pH of the mixture was also recorded. All runs were conducted at room temperature and pressure and done in batch mode. Prior to each run, the electrodes were soaked in 1M HCl for 10 minutes, rinsed with distilled water and wiped clean with papertowel to remove all residue.

Experimental Design

The EC experiment followed a 3^2 factorial design generated by Minitab 17 software. Eachrun was done in triplicate resulting in a total of 27 runs. The parameters and their levels are shown in Table 2.

Table 2: The Range and Levels of the Investigated Parameters

Parameter	Level		
	1	2	3
Initial pH	4	7	9
Current (A)	0.1	0.2	0.4

The COD concentration was determined using HACH reagents (low and high range COD reagent vials) and a UV–VIS spectrophotometer (HACH DR 6000). The pH was measured using HACH HQ440d multi-parameter meter. The removal efficiency of COD was calculated using the following equation:

$$COD\ removal\ (\%) = \frac{COD_i - COD_t}{COD_i} \times 100\% \quad (8)$$

where COD_i and COD_t are the initial COD concentration and the COD concentration at time t (20 minutes), respectively.

Minitab 17 was used to conduct regression modelling and to assess the statistical significance of the included terms by way of an analysis of variance (ANOVA). The significant level was based on the p-value ($p \leq 0.05$), and the fitting quality of the regression model was determined by the adjusted R^2 (adj. R^2) and predicted R^2(R^2-(pred)) statistics. The software wasalso used to generate normal probability plots.

Results

Wastewater Characterization

The characteristics of the wastewater are shown in Table 3. The wastewater was foundto be alkaline with a pH of 8.71. The initial COD of OW was 3400 mg/L, which is very high compared to the effluent discharge standard of 100 mg/L.

Table 3. Characteristics of OW

Parameter	Value (mean)
COD (mg/L)	3400
pH	8.71
Phosphate (mg/L)	60
Nitrate (mg/L)	120

Table 3. Characteristics of OW (*cont'd*)

Parameter	Value (mean)
TSS (mg/L)	100
TDS (mg/L)	97
Conductivity (mS/cm)	3.16

Effect of Process parameters on COD removal

Effect of Initial pH

Relatively high COD removals were obtained at all levels of initial pH. The effect of pH onCOD removal from OW is presented in Figure 3. The mean COD removal ranged from 84.66–90.53% at initial pH 4, 87.39–89.94% at initial pH 7 and 89.8993.61% at initial pH 9. The general trend observed in Figure 3a is a rise in COD removal with an increase in initial pH. The main effects plot in Figure 3b, obtained by averaging all 9 COD removal data collected at each initial pH value, indicates a positive effect of initial pH on COD reduction with a greater reducingeffect between initial pH 7 and 9. Maximum mean COD removal of 91.72% was obtained at initial pH 9.

Table 4 shows the mean final pH values for each applied initial pH and current combination. For initial pH 4, final pH rose to circa 6.00. Initial pH 7 yielded final pH that wasclose to 7. Initial pH 9 led to a slight decrease in final pH with an overall mean of 8.66. Only acurrent of 0.4 A led to slightly higher mean final pH values at initial pH 4 and 7.

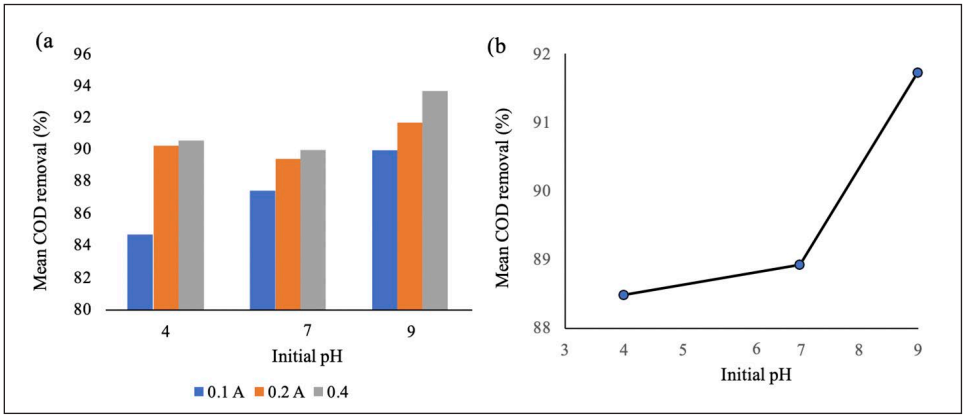

Figure 3. Effect of Initial pH of COD Removal from OW: (a) Bar Plots, and (b) Main Effect Plots

Table 4. Final pH Values for Treated OW

Final pH (mean values)					
	Current (A)				
Initial pH	**0.1**	**0.2**	**0.4**	**Mean**	**SD**
4	5.91	5.99	6.53	6.15	0.337
7	6.83	6.99	7.14	6.99	0.155
9	8.78	8.59	8.62	8.66	0.102

Effect of Applied Current

Figure 4 illustrates the results of the effect of applied current on COD removal from OW.Mean COD removal from OW ranged from 84.66–89.89% at 0.1A, 89.39–91.65% at 0.2A and 89.94–93.61% at 0.4A as shown in Figure 4a. The trend observed is an increase in COD removalwith increase in current; however, only minimal increase was obtained beyond 0.2A for initial pH 4 and 7. The main effects plot displayed in Figure 4b indicates that current had a strong andpositive effect on COD removal between 0.1 and 0.2 A. While there is a positive effect between 0.2 and 0.4A, its magnitude decreased as indicated by the less steep slope. The highest meanCOD removal of 91.36% was achieved at 0.4A.

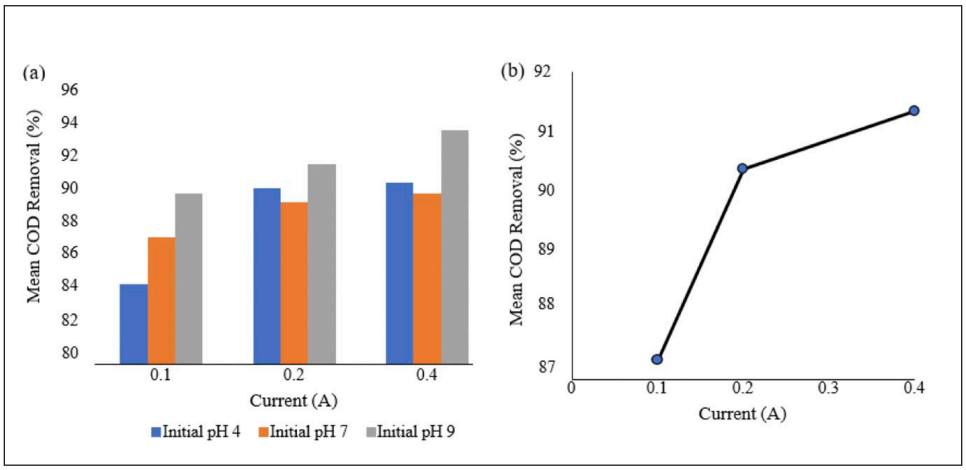

Figure 4. Effect of Current of COD Removal from OW: (a) Bar Plots, and (b) Main Effect Plots

Table 5 shows a comparison of the treatment efficiency for COD removal from oily wastewater generated from the processing of edible oils. The analysis demonstrates that the Fe-EC process utilized in this study had superior performance compared to most traditional methods, as evidenced by the COD reductions. From an operation perspective, these techniques are inferior to Fe-EC as they have several limitations, such use of chemicals, generation of large volume of sludge, high installation and operating costs, and lower efficiency in some cases (Hazikimana et al. 2017; Moussa et al. 2017).

Table 5. COD Removal Efficiency From Oily Wastewaters Using Various Techniques

Oil	Treatment method	Process Conditions	Maximum mean COD removal (%)	Reference
Palm oil	Adsorption	Absorbent type: hydrophobic, hydrophilic Particle size: 75–300 μm	79.8	Oyekanmi et al. (2019)
Olive oil	Advanced oxidation	Ultraviolet irradiation Temperature: 20oC Initial pH: 3 Time: 3 hours	22	Hodaifa et al. (2018)
Soybean	Biological treatment	Aerobic process using Trichosporon fermentans Temperature: 20, 25, 30oC Initial pH: 5, 7. 9 Inoculum concentration (%v/v): 2, 5, 8	94.7	Yu et al. (2018)
Palm oil	Coagulation- flocculation	Coagulant: Fenugreek Flocculant: Okra, Aloe vera Initial pH: 4 - 9 Coagulant dosage: 10–30 mg/L Flocculant dosage: 10–20 mL/L	34.68	Lim et al. (2022)
Soybean	Membrane technology	Ultrafiltration using nitrocellulose membrane Pressure: 2–5 bars Temperature: 25–55oC Time: = 20 min	70.0	Mousavi et al. (2010)
Soybean	Electrocoagulation	Fe electrodes Initial pH: 4, 7, 9 Current: 0.1, 0.2, 0.4 A Operating time = 20 min	89.69	This study

Regression Analysis

A multiple linear regression model based on eq. (9) was selected to predict COD removalfrom OW.

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_{12} x_1 x_2 + \varepsilon \quad (9)$$

where y represents percent COD removal, β_0, the regression constant, β_1 and β_2 are the coefficients of the linear regression, β_{12} is the coefficient of the interaction term, x_i and x_j arethe independent parameters, and ε is the error term. Tables 6 and 7 display the ANOVA resultsand summary of two models, respectively. One model includes the interaction term, while theother model does not. Both regression models had statistical significance ($p< 0.05$); however, the parameters and their coefficients were found to be statistically significant only when the interaction term was removed.

Table 6. ANOVA Results for COD Removal from OW

Source	Model with interaction		Model without interaction	
	F-Value	P-Value	F-Value	P-Value
Regression	4.33	0.015	6.55	0.005
Initial pH	2.38	0.137	5.28	0.031
Current	1.75	0.198	7.81	0.010
Initial pH*Current	0.29	0.596	-	-
Lack-of-Fit	1.12	0.387	0.98	0.467
Model statistics				
R^2	0.361		0.355	
Adj. R^2	0.277		0.299	
R^2–(pred)	0.094		0.184	

Table 7. Summary of Models

Model for COD removal (%)	Term	Coefficient	Standard Error	T-Value	P-Value
With interaction	Constant	80.97	3.99	20.29	0
	Initial pH	0.88	0.579	1.54	0.137
	Current	19.97	15.08	1.32	0.198
	Initial pH*Current	-1.16	2.16	-0.54	0.596
Without interaction	Constant	82.78	2.12	39.13	0.000
	Initial pH	0.61	0.27	2.30	0.031
	Current	12.23	12.23	2.80	0.010

Examination of the interaction plots depicted in Figure 5 revealed lines or line segments with little or no crossing, indicating that there was no meaningful interaction between the two parameters, thereby supporting the elimination of the interaction term. Based on the improvedvalues of adj. R^2, R^2-(pred) and lack-of-fit, the regression model without interaction ($F(2, 24) = 6.55$, $p = .005$, $R^2 = 0.355$, adj. $R^2 = 0.299$, R^2-(pred) = 0.184) had a better predicting power thanthe model with interaction ($F(3, 23) = 4.33$, $p = 0.015$, $R^2 = 0.361$, adj. $R^2 = 0.277$, R^2-(pred) = 0.094). In addition, the normal plot of residuals for the model without interaction shown in Figure 6 indicated a better alignment of the residuals along the diagonal line. Therefore, this model was selected as the preferred model.

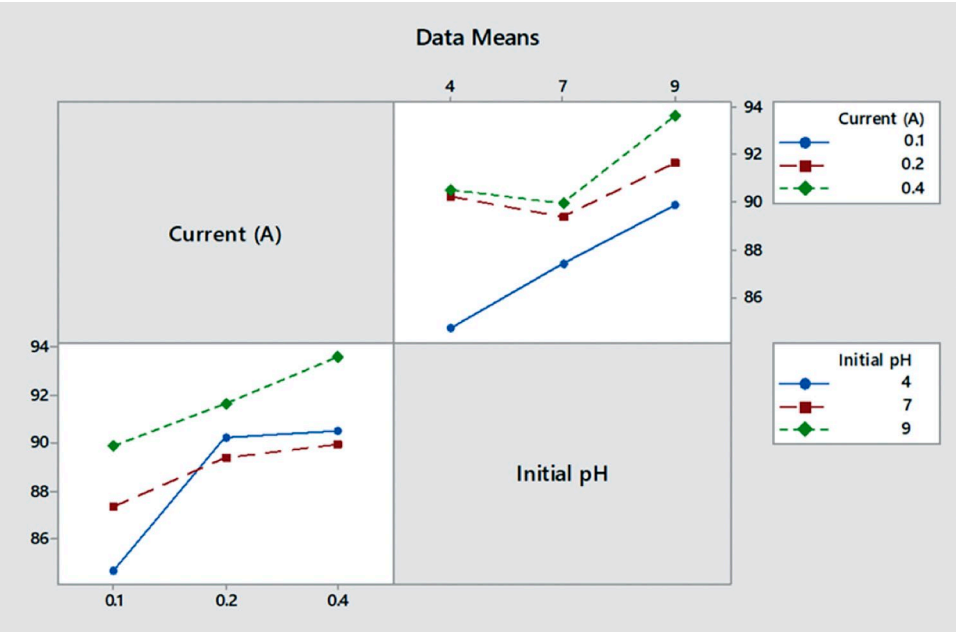

Figure 5. Interaction Plots of Initial pH and Current

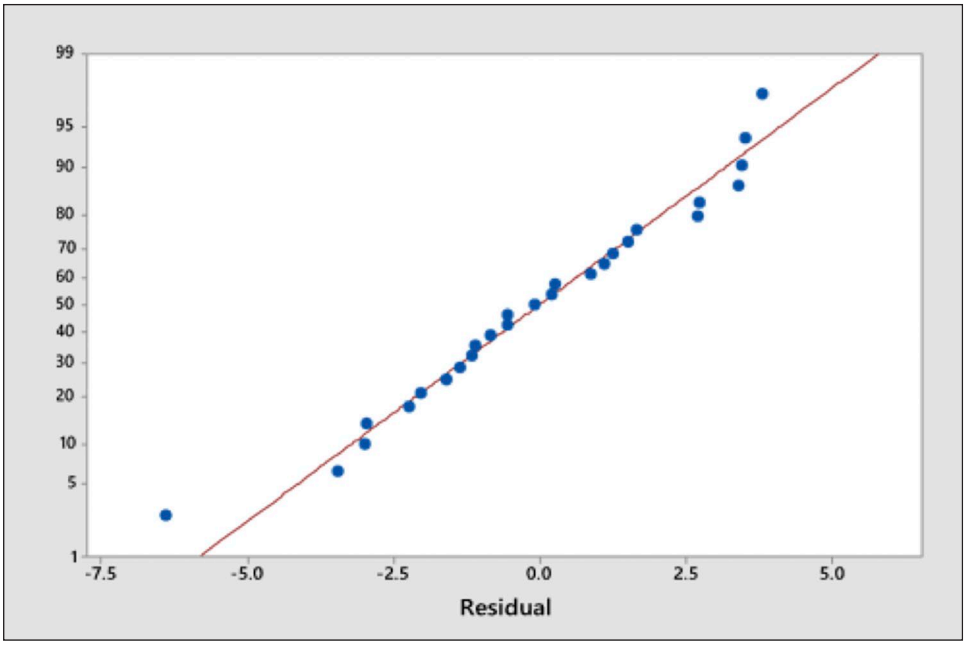

Figure 6. Normal lot of Residuals for Model Without Interaction

The model equation was:

$$\text{COD removal (\%)} = 82.78 + 0.61\ (\text{Initial pH}) + 12.23\ (\text{Current}) \quad (10)$$

Discussion

The results indicated that the highest mean COD removal from OW was 91.72% and 91.36 % at initial pH of 9 and current of 0.4, respectively. While all initial pH values led to relatively high COD removals, the highest removal at the individual currents were obtained at pH 9. Similar findings of enhanced COD removal from OW at pH 9 were reported by Sontaya et al. (2013) and Inan et al. (2004). From the literature, the pH governs the speciation of the Fe coagulant. Measuring the final pH provided the operating pH range of the Fe coagulant species.Based on the results and the Fe coagulant(s) purported to be present at alkaline pH values (Manilal et al., 2020; Ghernaout et al. 2008), $Fe(OH)_3$ is the coagulating species responsible for maximum COD removal from OW. The $Fe(OH)_3$ species is said to have high affinity for suspended and colloidal particles (Thirugnanasambandham et al., 2014); hence, its presence was beneficial to the removal of COD from OW. Regarding applied current, an increase in this parameter leads to an increase in the coagulant dosage. According to Faraday's law (eq. 2), twice the mass of Fe ions produced at 0.1A is expected at 0.2A, and four times that amount at 0.4A. Based on the results obtained for OW, COD removal increased with increased current, with maximum removal achieved at 0.4A. These results were consistent with those reported byInan et al. (2004). A higher coagulant concentration traps more pollutants, hence the positive correlation between COD elimination and mass of $Fe(OH)_3$. However, because high mean COD removals (>83%) were achieved for all initial pH and current combinations, the type and quantity of the coagulant might not be the only contributors to COD removal from OW.

The statistical analyses showed the significance of initial pH and current in the removal of COD from OW. The objective of the multiple linear regression analysis was to develop a model to predict COD removal based on the range of values of initial pH and current used in thestudy. However, not all independent variables included in a model are necessarily meaningful inexplaining the variance in the response (Montgomery, 2013). Their presence inflates the R^2 but lowers the adjusted and predicted R^2. This was the case when the interaction term, a non-significant variable, was included. While both models indicated that a moderate and collective significant effect exists between the initial pH, current, and COD

removal, elimination of the interaction term led to an increase in the adj. R^2, the R^2-(pred) and lack of fit. The model without interaction also presented a better normal plot of residuals. These findings indicate thatthe linear model without interaction was suitable for this study. Initial pH and current were statistically significant in this model, and the positive terms in the regression indicate that both parameters create a positive effect on COD removal.

Consequently, it can be stated that initial pH and current have significant effect on COD removal from OW by Fe-EC. Within the scope of the study, these parameters were crucial to theefficacy of the Fe-EC treatment of OW and resulted in an overall mean removal of 89.69% of COD.

Conclusion

In this study, the effect of initial pH and current on COD removal by Fe-EC of OW was investigated. Based on the results of the study, the following conclusion can be made:

1. Increasing initial pH leads to increased COD removal. The most effective removal wasobtained at initial pH 9.
2. COD removal from OW increases with increase in current. The highest COD removalwas obtained at 0.4 A.
3. Initial pH and current were statistically significant to the removal of COD.
4. Fe-EC can be applied in the treatment of OW as the technique can remove over 85%of COD from OW using a simple EC reactor setup and operation within an initial pH range of 4–9 and a current range of 0.1–0.4A.

Finally, this study has demonstrated the technical feasibility of EC as an effective treatment for a local high COD wastewater, and further study at the pilot scale is recommendedto determine the method's economic feasibility, and the number of stages needed to achieve treated OW that comply with a COD standard of <100 mg/L.

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JOURNAL OF ARTS SCIENCE AND TECHNOLOGY

Adopting Factorial Design of Experiments Technique to Analyse The Effects of Material Factors on The Tensile Strength of Red Mud Polymer Composites

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Abstract

Design of Experiments method was utilized to study the tensile strength of red mud polymer composites. A full 2^3 factorial design with two replications and utilising analysis of variance was used to determine the effect of the control factors, namely, red mud wt.%, pH value, and red mud particle size on the response variable, tensile strength. In addition, signal-to-noise (S/N) ratio was employed to optimize the control factors affecting the tensile strength of the composite. The red mud/HDPE composites used in the study were produced in a manually operating injection-moulding machine. The results show that the multivariable regression model, fitted for tensile strength, is adequate. At a confidence level of 95%, the intercept (mean) was the only significant source, but there were strong interactions between the amount (wt.%) and particle size and between the pH and particle size of the red mud. Tests for goodness of fit were performed and these indicated that the model has adequate prediction potential. The S/N ratio analysis showed that for maximising strength, optimum mix within the experimental level ranges was found to be 10 wt.% red mud of 7.65 pH and particle size 150 μm, giving a predicted tensile strength of 21.44 MPa with a standard error of 0.47 MPa.

Keywords: Tensile Strength, ANOVA Composites Red Mud, Polymer

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Introduction

The efficient conversion of bauxite waste (red mud) and discarded plastic materials into financially viable products has the potential to reduce pollution in the environment whilst generating an economic base for second-use products. The vast reduction in the red mud inventory through usage will also reduce high storage and waste management costs [1]. Consequently, the negative impact of its causticity on the environment will be drastically curtailed [2].

It is envisaged that products incorporating red mud will serve a wide application of use. The high-use expectation is demand-driven and includes the following: providing more housing solutions for a large number of the population in middle and low-income brackets [3]; arresting the poor and deteriorating conditions of roadways [4]; catering for the repairs and rebuilding of premises, particularly following the arrival of several hurricanes that have become frequent in recent years. These factors, coupled with the continuous rise in fuel costs, are driving the escalating expense in the procurement of construction materials. The importation of materials to meet these contingencies can exert extreme pressure on the national budget of any country, especially those in which the economy is suffering from low productivity.

Red mud generated in vast quantities has huge cost associated with the disposal, pollution effects, and general waste management, and this had led researchers to utilize it in applications. From an environmental perspective, using red mud in products reduces harmful substances such as CO, NOx, Pb, and SO_2 [2, 5, 6]. Its use has been expanded due to its unique characteristics, as it enhances mechanical and thermal resistance [7, 8], fire retardant [9], corrosion resistance [10, 11], among other properties to composites. In the construction industry, the focal use of red mud is building materials, such as bricks and blocks. Building blocks, using red mud, satisfy both environmental and economic conditions, and exhibit good properties to meet IS 15658 specification [12].

Red mud is used as a low-cost filler for polymer to develop abrasive wear resistance in composites [13, 14]. However, in another application, raw red mud incorporated in alkali-activated slags, reduces performance problems, which include unstable rheological behaviour and drying shrinkage [15].

The strength of polymer matrix composites depends on several processing factors unique to their production and is not as easily determined as is the case with monolithic materials such as steels. Filler materials increase the strength of composites; however, with increasing quantities, the inorganic material causes

the strength to deteriorate if the particle surfaces were not treated to enhance interfacial adhesion with the polymer. Otherwise, with increasing loading, the problem of interfacial de-bonding occurs due to the incompatibility between polymer matrix and the filler materials, considering the hydrophilic nature and morphology of the red mud particles [16]. However, with the addition of active functional groups and surface modification, interfacial strength is achievable in composites [17, 18].

Factorial design of experiments provides an economical and effective method of processing multiple factors to study the effect on response variable [19]. This mathematical technique is appropriate for quantitative and qualitative studies across a wide field of industrial activities. In one of the earliest applications, it provided for a quantitative study into extrusion foaming of polypropylene/wood-flour composites [20]. Subsequently, factorial design of experiments technique became extremely popular in other applications. In a particular case, its utilization resulted in the optimization of biodiesel production [21]. The spectrum of application of this technique shows that it diversified into several fields, including engineering, agriculture, medicine and life science [21].

Conventional single-factor experimentation requires the preparation of a large number of specimens, with various combinations of components, making the study lengthy and expensive. Factorial design of experiments is a dynamic statistical tool that evaluates the effect of each variable on response, treating the factors at all levels and in all combinations. The real advantage is the significant reduction in the number of experiments conducted, thus yielding a reduction in both time and experimental costs. To this end, fractional factorial of design version is utilised [22].

Currently, the findings of the literature survey revealed the following: red mud, identified as a filler material, and incorporated in polymer, produced generic composites; tensile properties of polymers are improved with modification of filler particles to enhance interfacial adhesion; and design of experiments techniques, such as factorial design, can predict the tensile strength of composites. The literature did not cover how the red mud characteristics, such as particle size and pH, and their effects on the tensile strength of composites are produced. In this study, fabricated, unreinforced red mud/ HDPE composites are tested for tensile strengths. A factorial design of experiments method will be utilized to determine the effects of input parameters on tensile strength and to assess the prediction potential of the model fitted.

Materials and Methods

Design of the Experiments

In this study, experiments were conducted using a factorial design of experiments method of the type k^n, where k represents the two levels, low and high, and n the three factors, wt.% red mud, pH, and particle size. The experimental values for each factor-level are shown in Table 1.

By utilizing the *Statistica 64* software package, the effect of the factors and their interactions on the tensile modulus of the composites was determined. The predicted response of the tensile modulus to significant factors and interactions was modelled as a first-order polynomial regression equation of the form:

$$y = a_0 + a_1 x_1 + a_2 x_2 + a_3 x_3 + a_4 x_1 x_2 + a_5 x_1 x_3 + a_6 x_2 x_3 + a_7 x_1 x_2 x_3 + \ldots\ldots + E_i \quad (1)$$

where a1, a2 and a3 are the coefficients representing the effect of each variable x1, x2 and x3, respectively; a4, a5, a6, and a7 are the interaction coefficients of the input variables; and is the error sum of the experiments. This model was first considered as linear behaviour usually occurs in physicochemical analysis of ingredients mixture [23]. The effects of the variables on the response and the adequacy of the model were analysed using analysis of variance (ANOVA), goodness of fit tests and signal/noise ratio.

Table 1. Experimental Values of the Factor-Levels

Factor		Level	Value
A	Amount of red mud (wt.%)	-1	5
		1	10
B	pH of red mud	-1	7.65
		1	9.70
C	Particle size of red mud (μm)	-1	150
		1	300

Sample Preparation

The red mud samples were obtained from both the flocculation tanks, used to store the waste prior to being discharged to the lake, and the 'red mud lake' itself, at the Kirkvine Alumina Company, Mandeville, in central Jamaica, West Indies.

Table 2 gives a summary of the physical and chemical characteristics of the "as-received" red mud utilised in the research. Chemical analysis was conducted using the spectrophotometer, X-ray Fluorescence Spectrometry (XRF) machine, X-ray Diffraction (XRD) as well as titrimetric analysis for CaO and Na2O.

The red mud was oven dried in batches of 200 g at 110 °C for 24 hours, then cooled, and ground using a crusher BICO pulveriser type U8. The pulverized dried mud was first divided into four groups: two 150-µm particle size (A1 and A2) and two 300-µm particle size (B1 and B2).

Table 2. Nominal Composition (Wt.%) of the As-Received Red Mud

Composition	wt.%
Al_2O_3	18.8
Fe_2O_3	45.3
CaO	3.1
Na_2O	1.5
SiO_2	4.3
TiO_2	6.4

The four groups of samples were first treated by adding of 50 ml of 1 molar HCl solution, and then filtered to obtain a pH of 9.7. Samples A1 and B1 were further treated by washing them with 200 ml of distilled water and filtered again until the prescribed value of pH 7.65 for the design of experiments exercise was obtained. This treatment also served to improve mechanical strength and resistance to water absorption in the composites being produced [12]. Following the treatment, the samples were dried, crushed, and sieved to their previous particle size. After the procedure, the red mud samples were stored at ambient temperature (30 °C) in moisture proof plastic bags and sealed for further use.

The HDPE samples supplied by the OMNI Industries, Jamaica, were the same used in the manufacture of water hoses, and supplied in the form of pellets, average size 3 mm and density 947 kg/m^3.

Specimen Fabrication

The mixture of red mud and HDPE were extruded into strands using a 21-mm diameter Rondol laboratory twin screw extruder with the following settings: die pressure 5 MPa, process temperature 210 ◦C, speed 180 rpm, and feed rate 1.8 g/min. The extruded strands were cooled by compressed air for quick solidification

and then fed into an attached pelletizer. The oval-shaped pelletized samples, nominally 2.5 mm in diameter and 3 mm in length, were sealed in labelled containers at 28 ± 3 °C for easy identification when needed for processing.

A manually operated injection moulding machine was used to force the samples into a mould having a dog-bone shaped cross-sectional area with a gauge dimension of 40 × 4.5 × 3.5 mm. Tensile tests were conducted on an Instron 5569 tensile testing machine with a 5-kN load cell connected to a Blue Hill 2 Software package, in accordance with ISO 294-1:1998.

Table 3 shows the design matrix for the set of experiments, where the factors are shown in coded form. The number of experimental runs for a full factorial design is 8; however, each experimental design was replicated, hence, 16 samples were fabricated.

Table 3. Design of Experiment and Results of Tensile Tests

Standard Order	Run Order	Replication	A	B	C	Tensile Strength (MPa)
2	1	1	-1	-1	-1	19.98
14	2	1	1	-1	-1	20.91
4	3	1	-1	1	-1	21.33
3	4	1	1	1	-1	20.61
1	5	1	-1	-1	1	21.81
16	6	1	1	-1	1	22.25
11	7	1	-1	1	1	20.16
7	8	1	1	1	1	20.31
6	9	2	-1	-1	-1	20.91
8	10	2	1	-1	-1	22.25
5	11	2	-1	1	-1	19.96
9	12	2	1	1	-1	21.86
12	13	2	-1	-1	1	21.33
10	14	2	1	-1	1	19.98
15	15	2	-1	1	1	20.30
13	16	2	1	1	1	19.96

Results and Discussion

The last column of Table 3 shows the experimental values of the response variable, which is the tensile strength. The initial linear regression model (using Minitab), showing the coded relationship between the predicted tensile strength (TS) and the coded factors and their interactions is:

$$TS = 20.869 + 0.147A - 0.308B - 0.107C - 0.023AB - 0.284AC - 0.272BC + 0.113ABC \quad (2)$$

In addition to the intercept (mean), the model is observed to contain the main effects, A, B, C, three two-way interactions, and one three-way interaction with their respective coefficients. The standard error of the coefficients is 0.213 and the variance inflation factor (VIF) of each term is 1.00, i.e., there is complete lack of absence of multicollinearity among the terms. Nevertheless, except for the intercept ($p = 0.000$), none of the terms was significant as their p-values exceeded 0.05.

Analysis of Variance

The Analysis of Variance (ANOVA) was used to investigate the effects of the factors and interactions, as well as their relative contribution to the performance of the model. The ANOVA was carried out on the model for a confidence level of 95% ($p \leq 0.05$).

The results of the ANOVA of the regression model for the tensile strength of the composite are presented in Table 4. Examination of the table shows that none of the factors and interactions has a significant influence on the tensile strength, as p is less than 0.05 (i.e., $\alpha = 0.05$ or 95% confidence). The last column in Table 4 shows the percentage contribution of the factors and their interactions on the tensile strength. The pH of the red mud (B), and the interactions (A*C and B*C) of the particle size with the amount of red mud and pH and are the major influences on the tensile strength. Additionally, the error contribution is 13.3%.

Table 4. ANOVA Table for Testing the Significance of Regression Model for Tensile Strength

Source	DF	Adj SS	Adj MS	F-Value	P-Value	Contribution (%)
Model	7	4.7368	0.67669	0.93	0.531	
Linear	3	2.0470	0.68232	0.94	0.466	
A	1	0.3452	0.34516	0.48	0.510	6.32
B	1	1.5191	1.51906	2.09	0.186	27.80
C	1	0.1828	0.18276	0.25	0.630	3.35
2-Way Interactions	3	2.4851	0.82837	1.14	0.390	
A*B	1	0.0086	0.00856	0.01	0.916	0.16
A*C	1	1.2939	1.29391	1.78	0.219	23.68
B*C	1	1.1827	1.18266	1.63	0.238	21.65
3-Way Interactions	1	0.2048	0.20476	0.28	0.610	
A*B*C	1	0.2048	0.20476	0.28	0.610	3.75
Error	8	5.8126	0.72658			13.30
Total	15	10.5495				
Model Summary		Standard error of estimate = 0.8524 R-sq = 44.90%; R-sq(adj) = 0; R-sq(pred) = 0				

The R^2 value, which is a measure of the proportion of the variance in the observed values that is explained by model, is recorded in Table 4. A value of 44.90% indicates that the variables are not accounting for much of the variation in the tensile strength, and which can also be caused by other variables excluded from the model. Significant among these are mould temperature, process hold-pressure, and process time. Furthermore, the R^2 value is plausible for the particle-reinforced composite used in this study, where the main ingredient (HDPE) is significantly attributing to the tensile strength, as the red mud in its present content does very little to reinforce the structure of the composite.

Estimates of Effects

The effect of a factor is the average response when the factor changes from one level to another level. In this study, the main effect of a factor is the change in the predicted outcome from the low level to the high level, and is calculated using Equation (3):

$$Effect_i = \frac{\sum y_i(H) - \sum y_i(L)}{n} \quad (3)$$

where $\Sigma y_i(H)$ and $\Sigma y_i(L)$ are the sum of the runs at the high and low level, respectively, for each factor, and *n* is the number of data collected at each level.

The estimates of the effects of the factors and their interactions were calculated using ANOVA and are presented in Table 5. It is obvious that Factor A and the interactions, A*C and B*C, are the predominant influences that affect the strength of the composite. Figure 1 presents a graphical comparison of the main effects of the three factors. Based on the limits in this study, tensile strength is improved in a composite having higher amount of red mud and lower pH and particle size. Here, for example, the mean tensile strength of the composite increases by 2.6 MPa when the red mud/HDPE wt. ratio increases from 5% (-1) to 10% (1). In contrast, the strength decreases by 0.62 MPa when the pH of the red mud is increased from 7.65 (-1) to 9.70 (+1) while maintaining the same level for the other factors. In particular, the particle size has the least effect, as the tensile strength of the composite decreases by only 0.21 MPa for the same movement in level, and this indicates that tensile strength of the composite may be insensitive to the micro-range red mud particle size used in this study.

Table 5. Effect Estimates of Factors and Interactions Resulting from Change in Level

Factor	Effect	Std. Err.	t(8)	p
Mean	20.86937	0.213099	97.93261	0.000000
A	0.29375	0.426199	0.68923	0.510169
B	-0.61625	0.426199	-1.44592	0.186211
C	-0.21375	0.426199	-0.50153	0.629508
AB	-0.04625	0.426199	-0.10852	0.916258
AC	-0.56875	0.426199	-1.33447	0.218782
BC	-0.54375	0.426199	-1.27581	0.237816
ABC	0.22625	0.426199	0.53086	0.609935
$R^2 = 0.3894$; MS Residual = 0.8051; Adj: 0				

The improved strength at the lower pH can be attributed to the method used to treat the as-received red mud, which probably allowed the binding constituents in the red mud to be in intimate contact. In an early study, Thakur and Sant [24] stated that the sodium alumina silicate in red mud is a good bonding property,

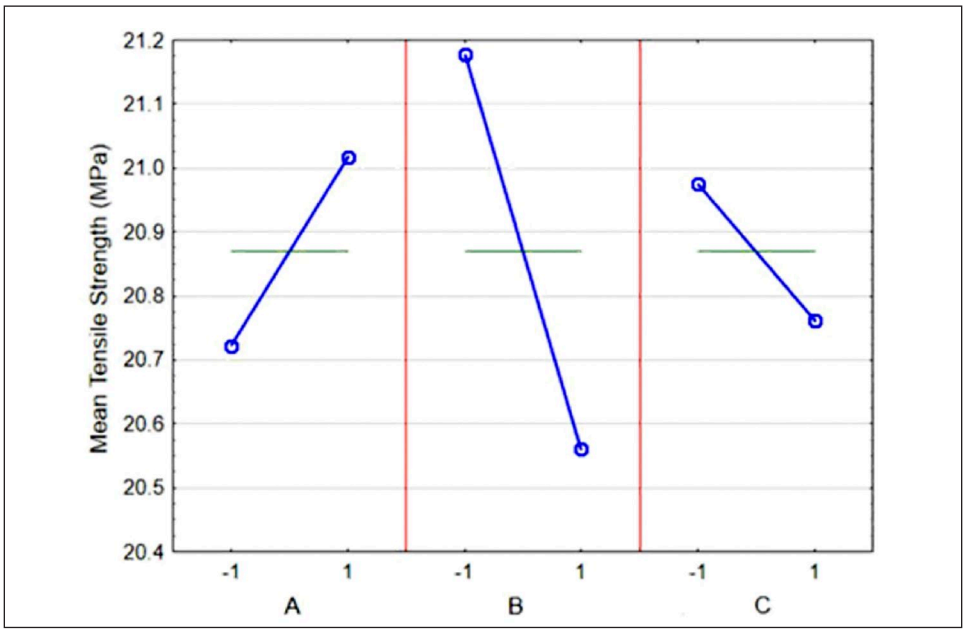

Figure 1. Main Effects Plot for Tensile Strength

and the drying of the red mud would allow the sodium alumina silicate to come together.

Although small, the increase in the mean tensile strength of the composite with smaller particle size has also been reported in other polymer/fibre composites [25, 26]. Smaller particles tend to have larger surface area than larger particles; consequently, the strength increases through increased adhesion and better stress transfer mechanism. In addition, the hydrophilic nature of both the red mud and the polymer creates bonding difficulties during fabrication [16], and this is manifested in increased voids and porosity with the larger particles that contributed to the weakening of the composite.

Figure 2 presents a graphical comparison of the effects of the three two-way interactions. Examination of the interaction plot A*B shows that the slopes are nearly parallel, indicating little interaction. This means that, on average, the effect of the increase in the amount of red mud on the tensile strength hardly changes as the pH increases. Here, the strength is reduced by 0.05 MPa. The graph, however, shows that the interactions due to A*C and B*C influence the tensile strength as their slopes cross each other.

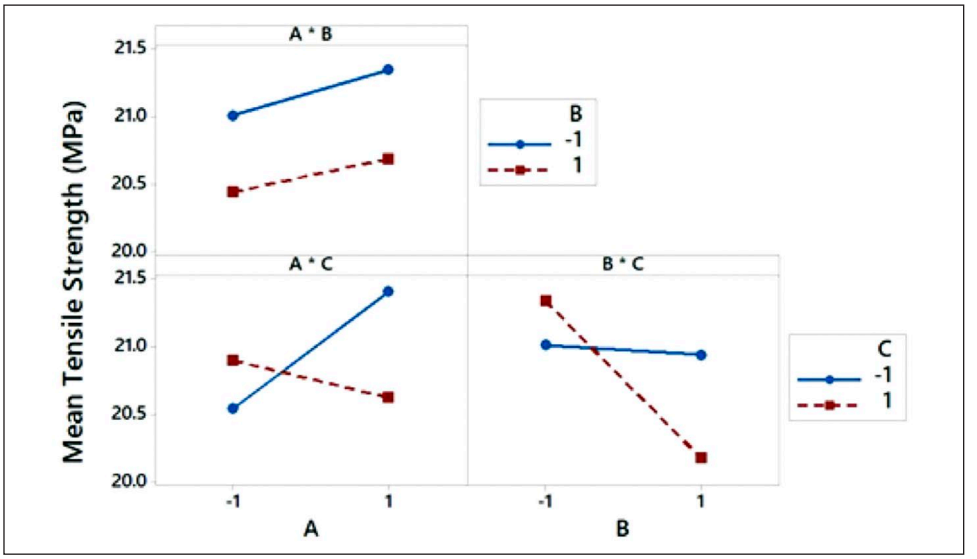

Figure 2. Two-way Interaction Plots for Tensile Strength

In the A*C plot, the average tensile strength is improved at low particle size when the amount of red mud is high. Conversely, the average tensile strength is lowered at the high particle size when the amount of red mud is low. Thus, the better scenario for high tensile strength is observed at high wt.% red mud and high particle size level.

The B*C plot shows that at low particle size the effect of pH on the tensile strength is negligible, but at the high particle size level, a moderate increase in tensile strength is achieved.

Signal-to-Noise Ratio

The average signal-to-noise (S/N) ratios for the control factors are shown in Table 6. For this study in which high tensile strength is desirable, a larger S/N ratio corresponds to a better-quality characteristic. The pH of the red mud appears to have the most influence on the tensile strength, followed by the red mud/HDPE ratio and particle size, respectively, giving optimal factor-level of A+1, B-1, and C-1. In other words, the tensile strength can be optimized when the mixture consists of 10 wt.% red mud of 7.65 pH and particle size 150 µm. Assuming additivity, the predicted optimal tensile strength, TS_P, can be calculated by adding the contribution of each variable at the optimum level to the mean tensile strength using following expression [27]:

$$Ts_p = TS_m + [(A^{+1} - TS_m) + (B^{-1} - TS_m) + (C^{-1} - TS_m)] \quad (4)$$

where TSm is the overall average tensile strength from the experimental runs, and A^{+1}, B^{-1} and C^{-1} are the maximum values of the tensile strength at their respective optimal parameter level. From Figure 1, TSm = 20.869, A^{+1} = 21.016, B^{-1} = 21.178, and C^{-1} = 20.976 MPa, giving a predicted tensile strength of 21.432 MPa. The difference between the predicted tensile strength and the average experimental result at the selected factor-levels (from Table 3) is found to be 0.15 MPa. This shows that there is strong relation between the experimental result and the predicted result at the optimal condition. Here, a confirmation test was not required as the optimal factor-levels corresponded to two of the experimental runs in the design (see Table 3).

Table 6. Response Table for Signal to Noise Ratios – Larger is Better

Level	A	B	C
-1	26.32	26.50	26.42
+1	26.43	26.25	26.33
Delta	0.11	0.25	0.09
Rank	2	1	3

Refining the Model

Since AC and BC interactions are major contributions to the initial model, the refined model needs to include the three main effects, although the highest p-value belongs to C (Table 4). Therefore, the refined model from the Minitab regression output in uncoded units is:

$$TS = 20.869 + 0.147A - 0.308B - 0.107C - 0.284AC - 0.272BC \quad (5)$$

The standard error of the coefficients is 0.194 with VIF = 1.00 for each term. Using the refined model in conjunction with the optimal factor-levels (A = +1, B = -1, C = -1, A*C = -1, and B*C = +1), the predicted tensile strength is 21.44 MPa with a standard error of 0.47 MPa. This is similar to that obtained when the optimal value is predicted using signal-to-noise ratio.

In order to determine how well the data fit the regression model, goodness of fit tests were performed; these include the analysis of the residuals and the test for lack-of-fit [28].

The ANOVA results of the regression is shown in Table 7. Again, it is observed that the values of R^2 are low, which could suggest some important factors were missing from the model; hence, the difficulty to predict with certainty the tensile strength of composites. Factors such as process conditions, particle morphology, interfacial adhesion, and particle agglomeration are likely candidates to include in the model. Nevertheless, of primary interest are the p-value (p = 0.866) for the lack-of-fit, which supports that the refined model adequately describes the experimental data for a 95% confidence level, and the contributions from B, A*C and B*C account for ~78% of the model.

Table 7. ANOVA Table for Testing the Significance of the Refined Model for Tensile Strength

Source	DF	Adj SS	Adj MS	F-Value	P-Value	Contribution (%)
Model	5	4.5235	0.9047	1.50	0.273	
A	1	0.3452	0.3452	0.57	0.467	6.73
B	1	1.5191	1.5191	2.52	0.143	29.63
C	1	0.1828	0.1828	0.25	0.630	3.57
A*C	1	1.2939	1.2939	2.15	0.174	25.24
B*C	1	1.1827	1.1827	1.96	0.191	23.07
Error	10	6.0260	0.6026			11.76
Lack-of-fit	2	0.2133	0.1067	0.15	0.866	
Pure error	8	5.8126	0.7266			
Total	15	10.5495				
Model Summary		Standard error of estimate = 0.7763 R-sq = 42.88%; R-sq(adj) = 14.32; R-sq(pred) = 0				

The normal probability plot of the refined model is shown in Figure 3. The raw residuals are the differences between the experimental values, and the expected normal value is the standardized z-values of the normal distribution. It can be seen that the residuals generally fall on a straight line, which indicate that the errors are normally distributed. Thus, it appears that the model is appropriate for the experimental data.

The observed versus predicted values plot in Figure 4 shows points that are randomly scattered around the diagonal line (the refined model), indicating that the model may be appropriate. The variability appears to be constant, although a slight curvature can be detected. The experimental design (3 factors, 2 levels full factorial with 2 replications) is a robust technique and, as such, the slight curvature observed at the higher level of the normality plot can be tolerated.

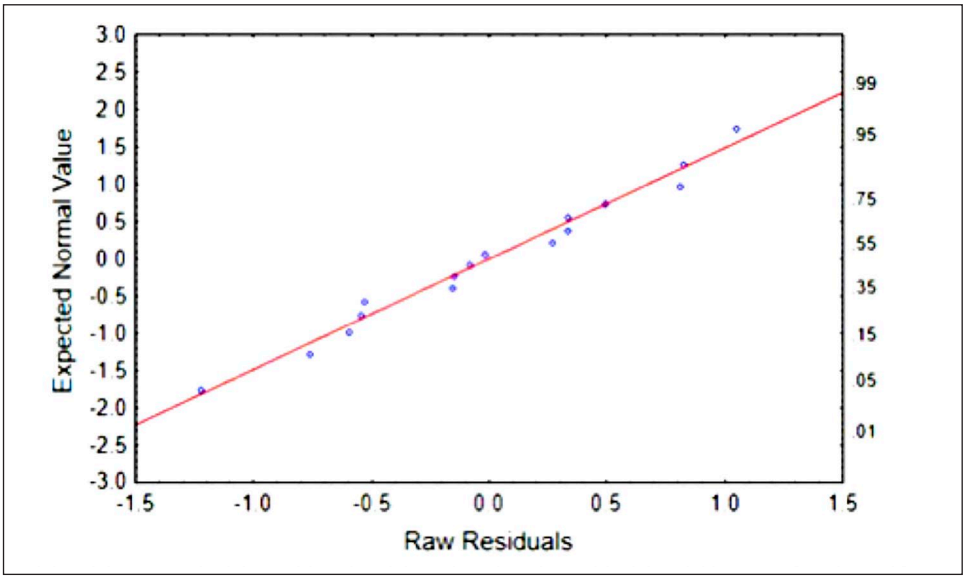

Figure 3. Normality Plot of Raw Residuals

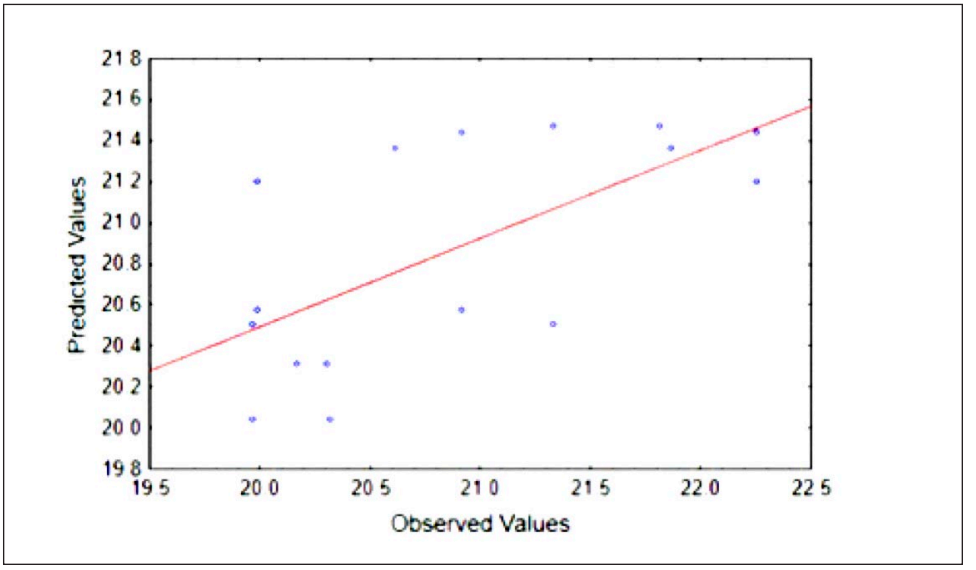

Figure 4. Plot of Observed and Predicted Values of the Tensile Strength

Conclusion

In this study, the effects of particle size, the pH of red mud, and red mud content on the tensile strength of red mud HDPE composite using a two-level factorial design of experiment, were investigated. Minitab software was used to analyse the data, and the results can be summarized as follows.

1. Using ANOVA, this work has shown that the model's intercept (mean) is the most influential term. However, the pH of the red mud, and the interactions between the red mud/HPPE ratio and particle size (A*C) and between the pH and particle size (B*C) and are the major contributory influences on the tensile strength. Thus, it is essential to consider 2-factor interaction effects of the input variables along with main factors to arrive at the model.
2. The pH and particle of the red mud were the most and least influential variables, respectively, on the tensile strength, having effects of 0.62 and 0.21 MPa, respectively.
3. The prediction of tensile strength of particle filled composites presents some difficulties. Anomalies arose if factors affecting process conditions, particle morphology, distribution, treatment, packing arrangement, etc., were not included in the model. In this study, developed model can be used to predict the tensile strength of red/mud/HPPE composites within limiting conditions. For process optimization, where the goal is to maximize the tensile strength, the optimum mix within the experimental level ranges was found to be 10 wt.% red mud of 7.65 pH and particle size 150 μm, giving a predicted tensile strength of 21.44 MPa with a standard error of 0.47 MPa.

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Exclusive Breastfeeding

Impact of Breastfeeding-Friendly Support in The Workplace

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Abstract

Supporting Exclusive Breastfeeding practices for at least six months in workplaces has been a challenge worldwide. Breastfeeding women working outside the home are less likely to breastfeed their infants exclusively. A breastfeeding-friendly support workplace could be an essential factor in the impact on a child's survival and a key strategy to increase productivity among breastfeeding women. This study aimed to ascertain the impact of breastfeeding-friendly support in the workplace and identify strategies and recommendations to continue exclusive Breastfeeding for at least six months after returning to work. The purposive sampling technique was used to select the study participants, and a cross-sectional research design was used to finalize the study. A structured questionnaire was administered face-to-face to 82 breastfeeding women employed in eight academic units on the Papine Campus of the University of Technology, Jamaica, a tertiary educational institution in the Kingston Metropolitan Region of Jamaica. The Questionnaire concerned breastfeeding employees demographics, employment characteristics, continued breastfeeding behaviours after returning to work, access to a breastfeeding-friendly environment and employee perception of implementing breastfeeding policy and supporting their newborn. Most breastfeeding women were between 18 and 49 years old; work settings were mainly cubicles (58.5%) or open floors (24.4%). Only 23.2% of the participants breastfed while at work. In the pharmacy, nursery and in their cars were the main locations the breastfeeding mothers used to express and store milk for future use. Of the participants who breastfed between one and three months (32.9%), most were

unaware of any policy (70.3%) that existed, or strategies (58.3%) implemented to improve or facilitate breastfeeding at the workplace, and 80.5% determined that the workplace was not a breastfeeding friendly environment. The findings of this study suggest that workplaces should establish dedicated hygienic rooms to improve breastfeeding among women of childbearing age. Furthermore, employers should implement a breastfeeding policy in the workplace to mitigate high levels of absenteeism and low morale for mothers to continue breastfeeding after returning to work.

Keywords: Exclusive Breastfeeding, Women of Childbearing Age, Breastfeeding-Friendly Workplace, Friendly Support Environment, Breastfeeding Policy

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Introduction

Background

According to the World Health Organisation (WHO), (2021) and Infant Nutrition Council (INC) (2003), Breastfeeding is the usual way of providing young infants with essential nutrients such as proteins, fats, carbohydrates, iron, minerals, and Vitamins A, C, and D that, is required for their healthy growth and development. Working women that are of childbearing age must adhere to the breastfeeding recommendations WHO (2023). Therefore, the factors influencing Breastfeeding are numerous and play an essential role in all societies.

Consequently, the combination of Breastfeeding women working outside the home creates considerable pressure for these working women and their infants. As a result, these women of childbearing age are less likely to breastfeed their babies than those working from home. Baxter (2008); Guendelman et al. (2009); Skafida (2012), Kaikini and Hyrkas (2014), WHO (2023) and Bai et al. (2015) have proven that Breastfeeding is vital to infants of breastfeeding age because breast milk is the optimum source of nutrition for these individuals. Oxytocin releases this living tissue, breast milk. This hormone stimulates the release of milk into the breast by the pituitary gland to secrete the hormone prolactin, which causes the women's breasts to grow and produce breast milk. The amount of breast milk a woman produces is proportional to the extent to which her baby suckles (INC, 2003).

Breastfeeding has significant health benefits for infants, such as building a robust immune system, brain development, and lowered cases of gastroenteritis, constipation, fever, colds, and other respiratory illnesses (Britton, 2017). Frequent suckling by the baby and on-demand feeding patterns are associated with maintaining adequate breast milk levels to enable exclusive Breastfeeding. In order to produce sufficient breast milk for exclusive Breastfeeding, a woman must breastfeed regularly throughout the day (NIYCF, 2014 and WHO, 2021). Therefore, working women must find creative ways to breastfeed their babies and express milk accordingly.

On the other hand, breastfeeding women who take long breaks from Breastfeeding, for example, an eight-hour break when the mother is away from the baby due to full-time work commitments, may disrupt breast milk production. Hence, workplaces should make available conducive spaces or rooms for these working women who are breastfeeding to express their milk. This lack of accommodation for breastfeeding women in the workplace could lower national productivity and growth (UNOCHA, 2022). Also, maternal or child health may affect employers through parental absenteeism if Breastfeeding is not considered a priority (Galtry, 2002 & Bai et al., 2015).

Purpose of the study

The operational definition of a breastfeeding-friendly workplace is one that makes available spaces or rooms that are private and hygienic for working women who are breastfeeding to express their milk, allow break time, and provide adequate facilities for storing their breast milk and obtaining individual and peer support from coworkers and employers.

This research sought to ascertain the impact of breastfeeding-friendly support in the workplace and identify strategies and recommendations to assist women of childbearing age to continuing breastfeeding exclusively for at least six months after returning to work. In Jamaica, the Maternity Leave Act of Jamaica (1979) gives female employees the right to take maternity leave if they have been working with the same employer for more than a year. According to Section 3 of the Act, employers must grant qualified female employees 12 weeks of maternity leave, eight weeks with pay, and the remaining four weeks without pay. Where applicable, an additional 14 weeks can be granted upon receipt of a certificate from a medical practitioner (Cameron, 2018). The Maternity Leave Act of Jamaica was updated on January 01, 2023, and allowed mothers three calendar months of paid leave from work and fathers up to three paternity leave (MFPS, 2021).

Research Objectives

To identify the:

1. Absence of Breastfeeding-facility on productivity at the workplace.
2. Existing workplace policies for Breastfeeding.
3. Challenges breastfeeding women experience while at the workplace.
4. Impact of the maternity leave/return time of breastfeeding mothers to the workplace.
5. Support strategies for breastfeeding mothers in the workplace.

Research Questions

These research questions are as follows:

1. What effect does an absent breastfeeding facility have on productivity at the workplace?
2. Do workplace policies on Breastfeeding exist?
3. What challenges do breastfeeding women experience in the workplace?
4. What is the impact of breastfeeding mothers' maternity leave/return time to the workplace?
5. What are the support strategies for Breastfeeding mothers in the workplace?

Review of the Impact of Breastfeeding-friendly Support in the Workplace

Most of the female population worldwide are women of childbearing age. Although the benefits of Breastfeeding to both the infant and mother are well established, employment is a persistent barrier to continued Breastfeeding (Cooklin et al., 2008; Skafida, 2012). The lack of break time, inadequate facilities for expressing and storing breast milk, resources that promote Breastfeeding, and limited support from employers and colleagues are among the challenges faced by employed women of childbearing age, especially those who want to continue breastfeeding by expressing their milk in the workplace (Tsai, 2013). Breastfeeding practices are essential for up to two years of life. Moreover, exclusive Breastfeeding for the first six months of a child's life can have the single most significant impact on a child's survival of all preventive interventions (Chuang et al., 2010). With that said, Breastfeeding provides unique health advantages to both the infant and mother, necessitating a breastfeeding-friendly workplace for employed women

of childbearing age. Similarly, this is conducive to increasing the initiation and duration of Breastfeeding among women of childbearing age.

The WHO (2021) recommends that women of childbearing age worldwide exclusively breastfeed their infants or children for at least the first six months to achieve optimal growth, development, and health. After that, they should be given nutritious complementary foods and continue breastfeeding for up to two years or beyond. Jamaica's Maternity Leave (MLSSJML) Act of 1979 (updated in January 2023) reflects three (3) calendar months paid from work for women of childbearing age and the biological fathers of their newborn or infant can be granted up to three paternity leave within each government organization (MFPS, 2023 and JIS, 2023).

The National Infant and Young Child Feeding Policy of Jamaica (NIYCFP, 2014) addresses the deficiencies and obstacles identified. It provides a context for developing innovative approaches for addressing the various determinants of infant and young child feeding practices. This policy sets standards for the comprehensive promotion, protection, and support of Breastfeeding or a suitable alternative. It can ensure a timely and safe transition to the appropriate introduction of complementary foods while Breastfeeding infants for up to two years and beyond (Kosmala-Anderson & Wallace, 2006).

According to Carothers and Hare (2010) and Carter (2019), Breastfeeding has lifelong benefits for both mothers and their babies. It also has tremendous benefits for employers and the economy. There was a 94.2% retention rate of employees of companies with lactation support programmes compared to the national average of 59.0%. Additionally, there was a 77.0% reduction in workplace absenteeism when lactation support programmes were in place. Likewise, employees whose companies provide breastfeeding support consistently report improved morale, job satisfaction, and higher productivity. Furthermore, there was a $13 billion annual saving for the healthcare system and taxpayers when 90% of the families exclusively breastfed for six months (UNOCHA, 2022). Therefore, for employers to support Breastfeeding in the workplace, PAHO/WHO (2019) recommends implementing policies, including paid maternity leave, paid breaks and a dedicated room for Breastfeeding in the workplace. This private, hygienic, and flexible environment helps to reduce non-working hours for breastfeeding mothers.

Some of the challenges of Breastfeeding in the workplace stem from unsuitable spacing, schedule control, work structure, and private spaces. Therefore, they use common lunchrooms, bathrooms, and old storage rooms to express breast milk. Areas such as the bathroom/restroom are a concern, especially where sanitation

is limited, storage rooms are not private, and other people can access the area. Lunchrooms are not gender-specific (Hilliard, 2016). According to Chatterjee, and Frick (2005), employment and Breastfeeding are not always incompatible, and most working mothers rely on this space to breastfeed their children. Nevertheless, some workplaces are not conducive to Breastfeeding. Breastfeeding, a critical component of child development, is a time-intensive activity that requires the mother to be with their children at every feeding stage or to express and store breast milk for later use (Ip et al., 2007).

Smith et al. (2013) surveyed 273 female employees with children aged two years or younger who had returned to work within 12 months. Among these employees, 92 (33.7%) had returned to work when the infant was six months old, and 181 (66.3%) between 7 and 12 months. Of the 92 (33. 7%) employees who returned to work within six months, and no apparent relationship existed between exclusively breastfeeding their infant and returning to work. On the other hand, comparing the participants who returned to work when their infants were 6 months old or younger and those 7 to 12 months showed that those who returned at six months or earlier reported that they had planned to breastfeed their infant as long as possible rather than specifying a duration.

In the same study, Smith et al. (2013) indicated that a lower proportion of participants reported that they had intended to breastfeed their infant for up to at least 12 months, resulting in an expected shorter duration of Breastfeeding period in comparison to those women who returned to work between 7 and 12 months. Of those returning to work at six months and or earlier, 92 (33.7%), a lower proportion than those who returned at 7–12 months, 27 (29.0%) vs 4 (45.0%) were exclusively breastfeeding at six months. Likewise, a lower proportion, 44 (48.0%) vs 50 (54.0%), continued Breastfeeding for 12 months (Smith et al., 2013).

According to the CDC (2013), the workplace policies regarding the guide to strategies to support breastfeeding mothers and babies will improve Breastfeeding. The focus should be on these policy and environmental changes designed to increase support for women who choose to breastfeed and increase the number of women who choose to breastfeed.

Ogbuanu et al. (2011) purported that the support for Breastfeeding in the workplace can include several types of employee benefits and services. The examples include the following: (a) developing corporate policies to support breastfeeding women; (b) teaching employees about Breastfeeding; (c)providing designated private space for women to breastfeed or express milk; (d) allowing flexible scheduling to support milk expression during work; (e) giving mothers options for returning

to work, such as teleworking, part-time work, or extended maternity leave; (f) providing onsite or nearby child care; (h) providing high-quality breast pumps; allowing babies at the workplace; (I) offering professional lactation management services and support.

Chatterjee & Frick (2005) concluded that organizations could establish their policies and rules regarding Breastfeeding to support lactation programmes at work. These policies can facilitate proper breastfeeding planning in the workplace, increasing the number of breastfeeding mothers returning to work. Furthermore, stakeholders can create relationships with state agencies implementing and creating workplace breastfeeding laws. Moreover, institutions can actively participate in programmes that allow them to be classified as a "baby-friendly workplace" based on their breastfeeding support practices. These efforts include creating and distributing fliers with information about Breastfeeding and organizational support services available to those intending to breastfeed. In developing these programmes, strategies regarding return-to-work and counselling services for women of childbearing age should be considered (Baxter, 2009).

Britton (2017) concurred that organizations can implement the two most common and effective methods to support breastfeeding women in the workplace. These include peer support groups and individual peer support from a peer counsellor. The goal of peer support is to encourage and support pregnant and Breastfeeding women. Interestingly, mothers from the same community who are currently breastfeeding or have done so in the past generally form the support team. As it relates to individual peer support from a peer counsellor, peer support is cost-effective. This method is an individually tailored approach and culturally competent way to promote and support Breastfeeding for women of varying socioeconomic backgrounds, especially where professional breastfeeding support is not widely available (Chapman et al., 2013).

Methodology

Research Design

This study used a cross-sectional quantitative design to finalize the research. A cross-sectional research design was used to examine one variable in different groups similar in all other characteristics such as age group that was, work category, mode of employment, Breastfeeding at the workplace and period of Breastfeeding after returning to work. Cross-sectional research is based on data

collected in different groups simultaneously. No experimental procedure was done, and as such, no variable was manipulated by the researchers.

Study Setting

According to the UTech, Jamaica, Student Handbook for Graduate and Undergraduate Students 2018/19 (2018), the University of Technology, Jamaica, originally known as the Jamaica Institute of Technology, formerly the College of Arts Science and Technology (CAST), situated on Old Hope Road, commonly called the Papine Campus started in 1958 with just over forty (40) students and four (4) programmes. There are five additional satellite campuses, two in Western Jamaica (Dome Street and Barnett Street) and the remaining three in the Kingston Metropolitan Region (Braemar Avenue, Authur, Wint Drive and Slipe Pen Road). The institution obtained University status on September 01, 1995. The institution's history is intimately connected to Jamaica's social and economic development. The University has grown to become the national University with a student population of 11,500 and offers more than 50 programmes at the undergraduate and graduate levels. The programmes include at least five Midwifery courses at the undergraduate level. The University's main campus (study site) is located within the greater Kingston Metropolitan Region in the parish of St. Andrew and occupies approximately 18.2 hectares. It lies east of the Hope Botanical Gardens, close to the Papine and Liguanea commercial centres and within walking distance of the Mona Campus of the University of the West Indies and the University Hospital.

Population

The study population included part-time and full-time women of childbearing age currently employed at the UTech, Jamaica Papine campus who are either currently breastfeeding or had breastfed in the past. Data obtained from the institution's Division of Human Resources revealed that 120 women of childbearing age are currently working on the UTech, Jamaica, Papine campus during the study period.

Inclusive criteria

Women of childbearing age currently employed at the University of Technology, Jamaica, who are currently breastfeeding or had breastfed in the past.

Exclusion criteria

Non-breastfeeding women of childbearing age currently employed at the University of Technology, Jamaica.

Sampling Procedure

The purposive sampling technique was the most suitable for this research. Therefore, individuals who met the inclusion criteria participated in the study. Participants were from all academic units (5 Faculties and 2 Colleges) on the Papine campus. They confirmed they were UTech, Jamaica's employees and worked on the Papine campus. They showed the researchers their respective identification cards as proof of employment. They covered their names for anonymity to protect their identity and prove the study's internal validity.

Sample Size

Data obtained from the UTech, Jamaica Division of Human Resources revealed that 120 women of childbearing age currently work on the UTech Papine campus. The Raosoft online sample size calculator was used to determine the sample size with a confidence level of 95%, a 5% margin of error, a population proportion of 50%, and a population size of 120. The sample size generated from the calculator was 92. However, a census approach allowed for data generalization and the necessary attempts to collect data from the 120 participants.

Data Collection Instrument

A self-developed questionnaire by the researchers consisting of 21 questions, including their demographics open and closed-ended questions covering the study's objectives, were used to collect the data.

Validity and Reliability

A pilot study was conducted. The purpose of the pilot study was to ensure that all prospective participants enrolled in the study had no ambiguity as it relates to the questions on the questionnaire. Similarly, the participants would understand the questions the same way as the other study participants and not make the respondents feel uncomfortable. It also assisted the researchers in determining the

length of time it would take each participant to complete the survey in real-time and assess the respondent's general attitude towards the questions. Additionally, preliminary data were collected before the final questionnaire was administered, and the readiness of the survey instrument for the major study to be conducted was determined.

The questionnaire was pre-tested to a similar population on another campus, and the pre-test participants were not considered part of the study. The data collected were further analyzed and measured against the research questions using the SPSS Version 25 utilizing Cronbach's Alpha to study the consistency of the questions on the survey. It determined that the tool's objectives (questionnaire) would measure what they purported to measure (validity).

Data Collection and Procedures

Face-to-face data collection was utilized, and participants had the option of 5-8 minutes to decide if they were willing to participate in the study. Participants were issued a questionnaire that matched the study's inclusion criteria. The data collection spanned over two weeks. Each participant had approximately 20 minutes to complete the questionnaire. The research team approached the participants and asked them to participate. The inclusion criteria and the purpose of the study were explained to each participant before data collection. Their agreement to participate was obtained. The participants could decide not to participate initially or during the study. Their non-participation in the study would not negatively affect them, including being discriminated against and denied services from the institution.

Data Analysis

Version 25 of the Statistical Package for Social Sciences (SPSS) was used to analyze the data. The SPSS software was chosen because it can effectively analyze and manage large amounts of data. Some statistical techniques used to analyze the data were Cronbach Alpha, p-value of ≤0.05, 95% confidence interval, Chi-square, and measures of central tendency (mean, median, and mode). Graphical illustrations and Tables represented the data set.

Ethical Approval

The study was approved by the University of Technology, Jamaica (Approval Number: 2020/04/UTech, Ja/439). All Ethical principles and standards stipulated

by this body were adhered to, including the consideration of the rights of the participants, assured anonymity, confidentiality, and privacy during and after the study. Participants did not include their names, signatures, photographs, or other identifiers.

Ethical Consideration

All questionnaires were kept in a safe with a combination lock, accessed only by the researchers and their research supervisor. An informed consent was obtained from each participant before conducting the study. The collected data was stored on a hard drive with encryption that only the researchers and their supervisors could access. Participants were not offered incentives, and their participation was voluntary – implied consent once they attempted the survey.

Results/Findings

Of the 120 expected participants, 82 (68.3%) participated in the study. The participants' ages range from 18 to 42 and over. The majority, 42 (51.2%) of the participants were between 33 and 42 years of age, followed by the 28–32 age group representing 18 (22%) (Table 1).

Table 1. Age Groups of Participants

Age Group	Women of Childbearing Age N (%)
18–22	2 (2.4)
23–27	3 (3.7)
28–32	**18 (22.0)**
33–37	**21(25.6)**
38–42	**21 (25.6)**
42 and over	17 (20.7)
Total	**82 (100.0)**

The participants were categorized into four (4) work categories with the majority representing academic staff 35 (42.7%) followed by technical staff 22 (26.9%). Among the participants, the cubicle work setting was the most used by 48 (58.5%). The open floor plan 20 (24.4%) accounted for the second largest area used by the participants (Table 2).

Table 2. Work Category and Setting

Work Category	**N (%)**
Administrative staff	18 (22. 0)
Academic staff	35 (42.7)
Ancillary staff	7 (8.5)
Technical staff	22 (26.8)
Total	**82 (100.0)**
Work Setting	**N (%)**
Open floor	20 (24.4)
Cubicle	48 (58.5)
Own office	11 (13.4)
Share office	3 (3.7)
Total	**82 (100.0)**

With the participants' primary mode of employment being full-time, 72 (87.8%), the most extensive length of service among them was 4–5 years 25 (30.5%). The second highest length of service among participants was ten years, and over 23 (28%) (Table 3).

Table 3: Mode of Employment and Length of Service

Mode of Employment	**N (%)**
Part-time	10 (12.2)
Full-time	72 (87.8)
Total	**82 (100.0)**
Length of Service	**N (%)**
< 1 year	3 (3.7)
1–3 years	16 (19.5)
4–5 years	25 (30.5)
6–9 years	15 (18.3)
10 years and over	23 (28.0)
Total	**82 (100.0)**

Among the participants, 81 (98.8%) indicated that they had breastfed. However, the most significant portion 63 (76.8%) of the population, did not work at the study site during their period of Breastfeeding. Conversely, most participants 63 (76.8%) did not breastfeed on the Job (Table 4).

Table 4. Participants who Breastfed at the Study Site and on the Job

Breast Fed	**N (%)**
Yes	81 (98.8)
No	1 (1.2)
Total	**82**
Worked at the study site during Breastfeeding	**N (%)**
Yes	19 (23.2)
No	63 (76.8)
Total	**82 (100.0)**
Breastfed Child on the Job	
Yes	19 (23.2)
No	63 (76.8)
Total	**82 (100.0)**

Of the 19 (23.2%) participants breastfed their child while on the Job. The majority, did so at the daycare centre 8 (42.0%) and in the lunchroom 6 (31.5%), respectively (Table 5).

Table 5. Location of Breastfeeding by Participants

Location of Breastfeeding	**N (%)**
Daycare	8 (42.0)
Pharmacy	1 (5.3)
Shared office space	1 (5.3)
Nursery	1 (5.3)
Workplace	1 (5.3)
Lunchroom	6 (31.5)
Car	1 (5.3)
Total	**19 (100.0)**

Among the participants who returned to work, the majority 48 (58.5%) breastfed their infants between one and six months after their maternity leave. Among those participants, the majority 27 (2.9%) only breastfed their child between one and three months. Moreover 13 (15.9%) breastfed their babies for less than one month (Table 6).

Table 6. Period Participants Breastfed After Returning to Work

Period participants breastfed after returning to work	N (%)
1–3 months	27 (32.9)
4–6 months	21 (25.6)
7–11 months	10 (12.2)
12 months and over	11 (13.4)
<1 month	13 (15.9)
Total	**82 (100.0)**

Among the participants 61 (74.4%) indicated that they expressed breast milk during the breastfeeding period of their respective infant. The home 29 (47.5%), lunchroom 9 (14.7%), and home and bathroom 6 (9.8%) accounted for the most frequent locations (Table 7).

Table 7. Participants Who Expressed Breast Milk and the Locations Used

Expressed Breast milk	N (%)
Yes	61 (74.4)
No	21 (25.6)
Total	82 (100.0)
Location for expressing Breast milk	
Home	29 (47.5)
Breakroom	2 (3.3)
Home and Nursery	4 (6.6)
Bathroom	2 (3.3)
Workspace	4 (6.6)
Car and home	3 (4.9)
Work and home	2 (3.3)
Home and bathroom	6 (9.8)
Lunchroom	9 (14.7)
Total	**61 (100.0)**

The participants indicated that the length of their maternity leave ranged from one (1) month to seven (7) months, with the majority 55 (68.7%) indicating that they had a three-month duration of maternity leave. However, a large portion 51 (62.2%) of the 82 participants indicated that the duration of their maternity leave was insufficient. Of the 52 participants who indicated that the maternity leave

was insufficient, the majority 25 (48.2%) indicated that the suggested length of time should be six (6) months (Table 8).

Table 8. Length of Maternity Leave Taken, Suggested Length and Sufficient Duration

Length of maternity leave taken by participants	**N (%)**
1 month	4 (5.0)
2 months	6 (7.4)
3 months	55 (68.7)
4 months	5 (6.3)
5 months	1 (1.3)
6 months	8 (10.0)
7 months	1 (1.3)
Total	**80 (100.0)**
Whether the duration of the maternity leave was sufficient	**N (%)**
Yes	31 (37.8)
No	51 (62.2)
Total	**82 (100.0)**
Suggested length of time for maternity leave	**N (%)**
3–4 months	3 (5.8)
12 months	4 (7.7)
6 months	25 (48.2)
9–12 months	1 (1.9)
4 months	6 (11.5)
5 months	5 (9.6)
4–6 months	1 (1.9)
3 months	5 (9.6)
8 months	1 (1.9)
7 months	1 (1.9)
Total	**52 (100.0)**

A significant amount 60 (73.2%) of the participants needed to be made aware of whether the institution had a corporate policy on Breastfeeding in the workplace. However, the majority 50 (61. 0%) of the participants indicated that the institution does not have a designated private space for Breastfeeding or expressing breast milk while on the Job (Table 9).

Table 9. Knowledge of Private Space for Breastfeeding and Corporate Policy on Breastfeeding in the Workplace

Knowledge of a corporate policy on breastfeeding in the workplace	**N (%)**
Yes	1 (1.2)
No	21 (25.6)
Not sure	60 (73.2)
Total	**82 (100.0)**
Knowledge of private space for Breastfeeding	**N (%)**
Yes	32 (39.0)
No	50 (61.0)
Total	**82 (100.0)**

Just over half 42 (51.2%) of the 82 participants indicated that they did not face challenges breastfeeding at the workplace. However, among the 40 participants who indicated that they faced challenges breastfeeding at the workplace, it was noted that unsuitable space 21 (52.5%) and no assigned private area 15 (37.5%) were the main types of challenges (Table 10).

Table 10. Whether Participants Face Any Challenges Breastfeeding at the Workplace and the Types of Challenges

Whether participants face challenges breastfeeding at the workplace	**N (%)**
Yes	40 (48.8)
No	42 (51.2)
Total	**82 (100.0)**
Types of challenges faced by breastfeeding mothers in the workplace	**N (%)**
No assigned private area	15 (37.5)
Lack of time	1 (2.5)
Unsuitable place	21 (52.5)
Inconsiderate team members	1 (2.5)
Colleagues felt that it should be outside the workplace	2 (5.0)
Total	**40 (100.0)**

A significant number 80 (97.6%) of the participants indicated that they needed to be sure 56 (68.3%) or did not know 24 (29.3%) of any strategies that were implemented in their workplace that would facilitate Breastfeeding. On the other hand, the majority of the participants indicated that the designated breastfeeding room

40 (48.8%), allocation time for Breastfeeding 8 (9.8%), private room and time 8 (9.8%), and proper safe and private space 8 (9.8%) were some of the most common ways employers could utilize to improve or facilitate Breastfeeding in the workplace (Table 11).

Table 11. Participants Knowledge of Strategies to Facilitate Breastfeeding in the Workplace and Ways Employers Could Improve Strategies.

Knowledge of strategies implemented in the workplace to facilitate Breastfeeding	**N (%)**
Yes	2 (2.4)
No	24 (29.3)
Not sure	56 (68.3)
Total	**82 (100.0)**
Ways employers could utilize to improve or facilitate Breastfeeding in the workplace	**N (%)**
Designated breastfeeding room	40 (48.8)
Allocate time for Breastfeeding	8 (9.8)
Provide a daycare centre for staff	1 (1.2)
Refrigerator space	1 (1.2)
Not sure	3 (3.6)
Private room and time	8 (9.8)
None	6 (7.3)
Private room	7 (8.5)
Proper safe and private space	8 (9.8)
Total	**82 (100.0)**

A large number, 74 (90.2%) of the participants indicated that they were aware of either an onsite or nearby childcare facility available for staff members to perform Breastfeeding or express breast milk for infant feeding. Among the 82 participants, 66,80.5% indicated that the institution was not considered a breastfeeding-friendly environment (Table 12).

Table 12. Participants' Knowledge of the Onsite Childcare Facility and Whether the Workplace was Breastfeeding-friendly

Knowledge of onsite or nearby childcare facility	**N (%)**
Yes	74 (90.2)
No	3 (3.7)
Not sure	5 (6.1)
Total	**82 (100.0)**
Whether the workplace was considered a breastfeeding-friendly environment	**N (%)**
Yes	16 (19.5)
No	66 (80.5)
Total	**82 (100.0)**

Discussion

The demographic profile of the participants reflected that a large percentage was of childbearing age (18- 49 years and over), which is consistent with the growing trend worldwide (Tsai, 2013). Although the study site was an educational institution, and most participants fell into the categories of academic, 35 (42.7%) and technical staff, 22 (26.9%), they were not working at the study site during their period of Breastfeeding. However, their current work setting at the time consisted of either a cubicle,48 (58.5%) or an open floor, 20 (24.4%).

Ip et al. (2007) confirmed that many women of childbearing age lack private spaces in the workplace, and unsuitable spacing, such as cubicles and open spaces, are challenges for breastfeeding women. Mills (2009) and Slaven-Lamothe (2014) corroborated this finding that there was no space or room, neither private nor semi-private, provided by employers included for the expression of breast milk for breastfeeding women. This study also found similar findings, whereby participants indicated that unsuitable space, 21 (52.5%) and no assigned private area were breastfeeding mothers' main challenges in the workplace. This study showed that among the 81 (98.8%) participants who breastfeed while at work, 63 (76.8%) did not breastfeed on the Job, and only 19 (23.2%) did, and they were from the study site.

Among the participants, 19 (23.2%) who breastfed on the Job and while working at UTech, Jamaica; the majority did so at daycare, 8 (42.0%) and in the lunchroom, 6 (31.5%). The participants resorted to other locations, such as the pharmacy,

Nursery, and a car. Chatterjee and Frick (2005) indicated that these less-than-ideal areas were concerning because one must consider the cleanliness of these locations and privacy. These less-than-ideal areas concern their users greatly as they are not off-limit to staff members and are not gender specific to females.

According to WHO (2023), Breastfeeding provides unique health advantages to both the infant and their mother. The majority of participants, totaling 72 (87.8%) full-time employees, had varying lengths of service at the study site, mainly falling within the 4 to 10 years and over range. These individuals encountered the task of breastfeeding in different work settings, causing disruptions not only in the production of breast milk but also having adverse effects on the infant's ability to develop a resilient immune system and optimal brain function, among other aspects.

Additionally, participants highlighted that the extended breaks from breastfeeding, coupled with the lack of suitable spaces or rooms at work and home, led to various challenges. Specifically, 29 (47.5%) mentioned challenges at home, 9 (14.7%) in the lunchroom, and 6 (9.8%) faced challenges at home and in the bathroom. These difficulties for full-time working women could potentially contribute to a decline in national productivity and growth, as outlined by UNOCHA (2022). Gielen et al. (1991) corroborated this finding that the non-accommodation of these breastfeeding mothers in the workplace could lead to poor maternal and child health, compounded by parental absenteeism, if a friendly environment were not taken into consideration at the workplace promptly. Women of childbearing age who were breastfeeding and could not do so at every feeding time or on the Job would need to express and store milk for later use (Gordon, 2006). The majority, 61 (74.4%) of the study participants indicated that they expressed breast milk during the working period.

The most considerable portion, 27 (32.9%) of the participants breastfed their babies within one (1) to three (3) months after returning to work. This activity may be directly related to the provisions made by the Maternity Leave Act of Jamaica, (1979), where a full-time or part-time (seasonal) worker is entitled to two (2) months maternity leave with pay with the option for extension without pay to three months. This Act negatively affected the exclusive six months of Breastfeeding required by WHO (2021) and Vilar-Compte (2021). As a result, the government of Jamaica, in January 2023, has gazetted an extension to the Maternity Leave Act, enabling mothers to get three calendar months maternity leave with pay. Similarly, fathers can now enjoy at least three months of paternity leave with pay (JIS, 2023). Baxter (2008) and Smith et al. (2013) concurred

that breastfeeding women who were full-time employees breastfed their infants for a shorter period, three months or less, compared to unemployed women. Interestingly, only a small 21 (25.7%) percentage of the participants in this study indicated that they continued to breastfeed their infants between seven (7) and twelve (12) months and over after returning to work.

The PAHO (2019) recommends that employers implement the necessary policies, including paid maternity leave, breaks and reduced working hours. Moreover dedicated private and hygienic rooms for Breastfeeding at the workplace. Likewise, more than a quarter, 31 (37.8%) of the participants in this study, indicated that the duration of their maternity leave was insufficient. 48.2% of the participants advocated for extending maternity leave to a duration of six (6) months.

Most participants of this study were unaware of any policy, 60 (70.3%) or any strategies, 56 (68.3%) to improve or facilitate Breastfeeding in the workplace. They did not consider the workplace a breastfeeding-friendly environment, 66 (80.5%). Chuang et al. (2010) and Ogo et al. (2016) posited that employees whose companies consistently provide breastfeeding support showed improved morale, better job satisfaction, higher productivity, greater employee loyalty to organizations, and reduced absenteeism.

Hilliard (2016) and Carter (2019) affirmed that creating breastfeeding-friendly workplaces for employees of companies with lactation support programmes had seen a 94.2% retention rate compared to 59% of the national average. This finding was consistent with our study's finding, which indicated that a large percentage, 64 (77.1%) of the participants needed to work at UTech, Jamaica, while breastfeeding their infants. Notably, the majority, 56 (68.4%) of the participants in this study adduced that employers utilize the following strategies, such as providing designated breastfeeding rooms, 40 (48.8%), allocating time for breastfeeding, 8 (9.8%), and providing proper safe and private areas, 8 (9.8%), to facilitate or improve Breastfeeding in the workplace and increase productivity. UNOCHA (2022) indicated that breast milk saves the global health system and taxpayers billions annually. Moreover, due to the increase in absenteeism among breastfeeding women and an impact on the healthcare system, global epidemiological evidence among middle-class populations in developed countries indicates strong evidence that breastfeeding decreases the incidence and severity of almost all infections, diseases and confers health benefits on their mothers, including the protection of certain cancers and the risk of osteoporosis (Galtry, 2002).

Ogo et al. (2016) concurred with these findings that the promotion of breast-

feeding among mothers in the workplace also provides benefits for employers, including greater employee loyalty to organizations as a result of gratitude and satisfaction and reduced absenteeism. This vital service results from infants of breastfeeding employees, who were less likely to become sick, and if they became sick, the sickness was less severe.

For women working full-time with infants of breastfeeding age, working outside the home and breastfeeding have been challenging. These mothers must return to work at least three months before completing the exclusive breastfeeding period of six months recommended by the Maternity Act 1979 (updated 2023, WHO, 2023). As a result, they must identify either an onsite or nearby childcare facility,74 (90.2%) available to employees to continue the critical service of Breastfeeding or extracting milk for the protection and survival of their infant.

Hence, establishing a breastfeeding policy and physical space could eliminate the issues among breastfeeding mothers in any organization who must return to the workplace full-time after the birth of a child and before the exclusive breastfeeding period of six months. These implementations could lessen and provide the necessary strategies to reduce absenteeism, reduce the burden on the healthcare system, loyalty, and increase productivity and job satisfaction in the workplace.

Therefore, some of the strategies or options for returning to work could include working from home, part-time work, extended maternity leave, onsite or nearby childcare facilities and professional lactation management services and support, and peer counselling support (Chatterjee & Frick, 2005; CDC, 2013; Chapman et al. 2013 and Vilar-Compte, 2021).

Study Limitations

Limitations of this study were:

1. The research was conducted on only one of four campuses of the University.
2. Some eligible participants did not agree to participate.
3. Restricted access to some participants during working hours.
4. Prior relevant research studies were limited.

Delimitation of Study

The study was restricted to breastfeeding women who had breastfed their children. A structured questionnaire was utilized. Sampling was done only at the main campus of one of the major tertiary educational institutions in the Kingston

Metropolitan Region. These women of childbearing age represented women who were breastfeeding and had to return to work prior to the exclusive breastfeeding period of six months. Even though the study was limited to one tertiary educational institution, the results might cause the assumption to be made that the phenomenon exists only in the region mentioned.

Conclusion

Most participants surveyed indicated that the study site was not considered a breastfeeding-friendly workplace for women of childbearing age who work full-time. They indicated that the organization needs a designation of a private breastfeeding room and the allocation of time among these employees who returned to work less than the six months of exclusive Breastfeeding recommended by WHO and the three calendar months required by the Maternity Act, Jamaica 1979 updated 2023.

While the majority, 63 (76.8%) of the participants were not employed at UTech, Jamaica during the period of Breastfeeding, on average, 48 (58.5%) who breastfed their babies between one and six months went on to breastfeed their babies an additional six to twelve months, 34, (41.5%) after returning to work. The shift in common challenges faced by women of childbearing age, particularly those employed full-time, encompasses issues like the absence of appropriate work environments, insufficient time off, and a lack of privacy. These women often resort to utilizing unconventional spaces such as homes, lunchrooms, bathrooms, and workspaces for expressing breast milk. These challenges could lead to poor maternal and child health due to parental absenteeism, lowering national productivity and growth.

The participants confirmed that the necessary establishment of a breastfeeding policy and the breastfeeding-friendly environment by UTech, Jamaica, could mitigate/ remove issues such as reduced absenteeism, low morale, reduced productivity and increase job satisfaction, and loyalty to the organization among breastfeeding women who must return to the workplace full-time shortly (1–5 months) after the birth of a child. Moreover, the policy should include options for returning to work, including working from home, part-time work, extended maternity leave, onsite or nearby childcare facilities, and professional lactation management services and support.

Recommendations

1. Creation of a designated room/space and a suitable environment for the expression of breast milk and Breastfeeding.
2. The required Training of all levels of staff on the importance of exclusively breastfeeding for at least six (6) months and its implications is critical.
3. Implementation of lactating support groups and peer counsellors for pregnant and Breastfeeding women.
4. Extension of the maternity leave to at least six (6) months.
5. Implementation of the flexible work week for lactating and breasting feeding women.

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TVET Integration in Jamaica's Secondary High Schools and Attitudes of School Leadership

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Abstract

Many countries, inclusive of Jamaica, are integrating Technical Vocational Education and Training (TVET) in secondary schools as a policy to develop their human capital and to facilitate responsiveness to global ecological and economic development trends. This thrust is consistent with the objectives of international organisations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Labour Organisation (ILO) and European Centre for the Development of Vocational Training (CEDEFoP). This study examined TVET integration in the secondary school system in Jamaica and school leaders' attitude towards the process towards facilitating students' learning, particularly within a context of policies and frameworks that have been advanced by the Government of Jamaica. A sample of secondary high schools in Jamaica (principals and vice principals), specifically within the Kingston and St. Andrew region was targeted. Purposive, non-probability sampling was used to select participants, while structured interviews and document reviews were undertaken to collect the data. The main findings of the study indicate that despite the Government's commitment to institutionalise TVET in secondary educational institutions, there are underlying challenges that continue to negatively impact its progress. These include inadequate buy-in/support for TVET from some school principals, inconsistent approach by school leaders in the planning and implementation of TVET in secondary schools, the need for increased capacity-building for school leaders, and an urgent need for the Ministry of Education and Youth (MOEY) to review its strategies towards making a greater impact in integrating TVET within the secondary school system.

Keywords: Technical Vocational Education and Training (TVET), TVET Integration, Human Capital Development, Secondary High Schools, School Leadership.

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Introduction

In recent times the integration of Technical Vocational Education and Training (TVET) in secondary schools has been employed as a key strategy by the Government of Jamaica to strengthen the education system, thereby advancing the country's human capital to positively impact the economy (Thwaites, 2013). This thrust is consistent with the objectives of the United Nations Educational, Scientific and Cultural Organization (UNESCO) to promote TVET globally towards the development of human capital.

TVET has been consistently plagued, however, with negative perceptions which has been inherited from the colonial period and consequently faces a level of resistance in its implementation (particularly in countries that are former British colonies). For example, Psacharopoulos (1987 as cited in Joo, 2008) argued that developing countries should concentrate their educational investments on general education because the rate of return is higher in general education than in vocational education. A study conducted in Jordan revealed that the implementation of TVET was negatively impacted by a host of problems including poorly prepared teachers, the lack of facilities required for the delivery of TVET activities, lack of administrative support for TVET, and negative attitudes of teachers, students, administrators, and parents demonstrated towards TVET (Jawarneh, 2013).

Despite the foregoing challenges, organisations such as UNESCO, the International Labour Organisation (ILO) and European Centre for the Development of Vocational Training (CEDEFoP) have been proactive and strategic in driving the TVET agenda globally. Consequently, a number of countries and regions have been taking a more strategic approach in implementing TVET towards the development of human capital, building a highly skilled workforce and reducing poverty (UNESCO, 2009, European Centre for the Development of Vocational Training, 2011).

In Jamaica, technical vocational education was introduced during the 1800s through the establishment of Kingston Technical High School in 1896, and the subsequent establishment of 13 similar institutions. However, until 1995 no serious consideration was given to the integration of TVET with general education to

facilitate the development of skills and competencies to support the workforce (Ministry of Education, 2014). This was evidenced first by the mainstreaming of TVET in schools through the Technical High School Development Project and later by the implementation of the Career Advancement Programme (CAP) in 2009, among others (Human Employment and Resource Training Trust/National Training Agency, 2014; Morris & Powell, 2013).

However, irrespective of the various initiatives that have been implemented to advance TVET integration, there is evidence that underlying challenges continue to negatively impact its progress. Contributory factors as indicated in the Human Employment and Resource Training Trust/National Training Agency (HEART Trust/NTA) reports (2013 & 2014) include administrative and leadership issues, poor infrastructure within the schools to adequately facilitate TVET, and poor understanding of the wider benefits of TVET. Notably also, during the pilot phase of TVET integration in secondary schools in Jamaica, observations of a number of school principals were disappointing, in that they demonstrated very little commitment and did not readily embrace the process (Morris & Powell, 2013).

Purpose and Significance of the Study

This paper seeks to investigate issues surrounding TVET integration in Jamaican secondary high schools and attitudes of school leadership as they navigate and strategize to facilitate students' learning within a context of policies and frameworks that have been advanced by the Government of Jamaica.

Research Questions

The following research questions guided the study:

1. What are school leaders' attitudes to TVET and TVET integration at the secondary level?
2. How does the behaviour of school leaders' impact TVET integration?

Literature Review

The following definition of TVET has been established by UNESCO and the ILO since 2001: TVET is used as a comprehensive term referring to those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, atti-

tudes, understanding and knowledge relating to occupation in various sectors of economic and social life (UNESCO, 2001, p.7). In 2015, a revised definition was advanced by UNESCO: "Education, training and development relating to a wide range of occupational fields, production, services and livelihoods" (UNESCO, 2015, Annexe II, p. 2).

Historically TVET has been mainly restricted to practical training that has always been considered inferior to academic education (Ntshoe & Holzbaur, 2012; Oketch, 2007). Despite efforts by many countries to advance TVET programmes towards strengthening of their education systems and economies, research shows that technical and vocational education has historically been considered a path for students who fail to meet the mark for more 'intellectual' learning. This attitude has been observed among several stakeholder groups, inclusive of school leaders, teachers, parents and students (Kingombe, 2011; Morris & Powell, 2013; Tomlinson, 2009; Vaz, 2012).

In addition to the foregoing, challenges such as the need to have a highly skilled and competent workforce and a competitive economy brought about a necessity to consider the integration of technical and practically oriented education into academic education

Further, a number of researchers and practitioners have argued that TVET is now seen as a global imperative for the 21st Century (Jacinto, 2011; Lauglo & Maclean, 2005; Tomlinson, 2009; UNESCO, 2000; The International Centre for Technical and Vocational Education and Training of UNESCO, 2014; Vaz 2012; Yasin, 2014).

In the Caribbean region, Subran (2013) called for a renewed focus on TVET to facilitate Caribbean development. He argued that there is an urgent need for curriculum planners to recognize that societies have changed to become more demanding and discerning and hence, TVET curricula must be reformed "to focus on achieving the image of a new type of worker for this new age, in which the societal values and expectations are being drastically changed" (p.94). Reforms proposed by Subran included the development of higher-order skills, empowering future workers to be autonomous decision makers, and recognizing students' needs and aspirations through initiatives for their personal development. He further advanced that such reform must also emphasize greater integration of the academics with worker preparation and the deliberate development of employability skills, ensuring also that TVET programmes adequately prepare students for the world of work including self-employment and entry into small businesses.

Jamaica's Perspective on TVET Integration in Secondary Schools

In an effort to develop a globally competitive workforce, Jamaica has been giving priority to its human capital development strategies. From the 1990s to the present time the MOEY has been implementing national initiatives to integrate TVET into the school system (Ministry of Education, 2014; Morris & Powell, 2013). Such initiatives include the Technical High School Development Project which was launched in 1995; the TVET Rationalization in Secondary Schools which was piloted in 1998; the Career Advancement Programme (CAP) (an extension of the TVET rationalization in schools programme, and features a 'Senior School', with grades 12 and 13, as extensions of the existing secondary/high school system) which was launched in 2009 and the implementation of the National Standard Curriculum (NSC) in 2017.

School Leadership Defined

The term 'school leadership' encompasses the roles of principals, assistant principals and other executive-level staff members, which suggests that leadership can be distributed within schools and among staff (Smith & Riley, 2012). Smith and Riley advanced the notion that school leadership is viewed as a strategic, forward-looking process that involves the development and communication of a strong vision and attendant goals or objectives, along with a relevant plan for implementation, monitoring and review. Leithwood (2008) found that the vast majority of successful school leaders draw on the same concepts of basic leadership practices. These include building vision and setting directions, understanding and developing people, redesigning the organisation, and managing the teaching and learning programme. Leithwood contended that while such practices have been identified as necessary for leaders who wish to improve student learning in their schools, they are rarely sufficient by themselves. Other policies and strategies must be established to ensure effective school leadership. These include data management, more strategic focus on teaching quality, strategic resource management and collaboration with external partners. Earley (2013) argued that:

> Of the many leadership approaches found in the literature two were found to be effective in schools when combined. First, *transformational leadership* which included building a clear vision, establishing commitment to agreed goals, encouraging high expectation and offering support, while developing a conception of leadership that was neither linked to status nor embodied in the

> actions of any single individual, but rather dispersed or shared throughout the school. The second approach, termed learning–centred or pedagogical leadership is one which focuses strongly on teaching and learning and enhancing student outcomes. (pp. 7–8)

School Leadership within the Context of TVET Integration

Several leadership issues emerged from the literature pertaining to TVET integration in schools (Dike, 2013; Dinbi et al., 2009; Greenwood, 2013; Ministry of Education, 2013; Morris & Powell, 2013). Arguably, the extent to which school leaders positively embrace the underpinning principles of TVET integration is the extent to which the process will achieve a successful outcome (Morris & Powell, 2013; Tomlinson, 2009).

Coordination, leadership, and management of TVET often take place through complex mechanisms to facilitate delivery, assessment and certification. Therefore, the potential for administrative problems is high due to possible misunderstandings stemming from school leaders having differing perception of and attitude to TVET, and approach to leadership. The foregoing oftentimes leads to clash of cultures due to differing levels of commitment to TVET/TVET integration in schools (Dike, 2013; Ministry of Education, 2013; Hutton & Dixon, 2016; Morris & Powell, 2013). According to Morris and Powell (2013) a number of traditional high schools demonstrated resistance towards the notion of TVET integration during the 1998 pilot phase of TVET integration in secondary schools in Jamaica; and some school principals even took the decision to opt out of the pilot process due to perception and attitude towards TVET (Morris & Powell, 2013). In a later study, Hutton and Dixon (2016) found that this challenge of resisting TVET persisted among educational leaders in Jamaica while efforts were being made by the University of the West Indies (UWI) to implement a TVET leadership programme to capacitate school leaders for the education system. Dike (2013) supported the notion of poor perception and negative attitude among school leaders regarding TVET integration. He found that, in Nigeria for example, there is a general poor perception of many key stakeholders, including school leaders, that TVET is meant for individuals who are either not intelligent enough to gain admission into regular academic institutions or are incapable of withstanding the rigors of formal academic programmes. Dike further advanced that school leaders' negative attitude towards TVET led to poor implementation of TVET integration in the secondary school curriculum in Nigeria.

Additionally, a study conducted by UNESCO (2016) found that most developing countries lag far behind with regard to the development of effective school leadership, despite the intentions of policy documents and discussions. Morris and Powell (2013) recommended the advancement of educational programmes, not just for school leaders, but for all stakeholders to facilitate greater understanding (and better utilisation of funds) in implementing TVET integration in schools.

Methodology

Study Design

This study utilized the generic qualitative design (Merriam, 2009). Structured interviews, combined with document review were used to examine how TVET integration is implemented in Jamaica's high schools, and the attitudes/behaviour of school leadership, in particular principals and vice principals.

Sampling

A combination of two purposive sampling strategies was used for the selection of sites and participants: 1) The maximum variation sampling was used to select the research sites, a mix of public secondary high schools (traditional high, upgraded high, technical high; co-educational and single sex) which are led by the principals and vice principals in relation to the implementation of TVET integration. According to Etikan, Musa & Alkassim (2016), maximum variation sampling strategy is a purposeful sampling strategy in which the researcher looks at a subject from all available angles, thereby achieving a greater understanding. 2) The expert sampling strategy was utilised for the selection of participants (principals and vice principals with the responsibility of advancing TVET integration across the secondary school system) as subjects for the study. Patton (2002) argues that expert sampling is a type of purposive sampling technique that is used when a research needs to glean knowledge from individuals that have particular knowledge, expertise or professional judgement in the area of focus.

A representative sample of eight (out of 40 high schools located in Kingston and St. Andrew) were targeted for participation in the study, broken down as follows:

1. Five traditional high, of which three were single sex (two girls' single sex and one boy's single sex); and two were co-educational high schools

2. Two upgraded high schools (both co-educational)
3. One technical high school (co-educational).

A total of 16 school leaders participated in the study, comprising one principal and one vice principal per school.

Data Collection Method

In keeping with the qualitative nature of this study data was collected via interviews and document review. Interviews were conducted with both principals and vice principals at each participating school. The documents reviewed included school improvement plans, National Education Inspectorate (NEI) reports and curriculum documents with listing of TVET subjects offered and copies of e-mails regarding implementation of TVET.

Data Analysis

Thematic analysis was used to analyse the data gathered using Berg (2004) six step approach in identifying, analysing, organizing, describing, and reporting themes found within a data set.

Ethical considerations

Ethical clearance was obtained from the Research Ethics Committee of the University of Technology, Jamaica. The researcher obtained permission from the principals of the schools before the data was collected. Participants were invited to be a part of the study. Those who agreed to participate were asked to sign an informed consent form. The researcher ensured that participants' right to privacy was respected, and each participant was assigned a fictitious name in order to maintain confidentiality and anonymity (Babbie, 2010). All data collected were stored in a safe place and accessible only by the researcher. The researcher collected and analysed the data and reported the findings in an honest manner.

Findings and Discussion

The findings are presented according to research questions.

Research Question 1. What are school leaders' attitudes to TVET and TVET integration at the secondary level?

The results show varying attitudes among school leaders which are grouped under two themes:

1. School leaders have bought into the process of TVET integration at the secondary level.
2. School leaders are tentative towards the process of TVET integration at the secondary level.

School Leaders have Bought into the Process of TVET Integration at the Secondary Level

Some participants, more than others, showed a greater level of awareness, appreciation and evidence of endorsement and actual implementation. Such participants indicated that their level of awareness and endorsement of TVET are based on 1) communication from the Ministry regarding policy direction and TVET integration through seminars, written information and meetings with education officers; and 2) Their schools have always had a general focus on a mix of skill-based and academic subjects. In this regard, school principal Annette said, ". . . communication comes from the Ministry of Education re schools to implement TVET subjects" and principal Mark noted, "I have attended a number of seminars that have been put on by the Ministry; I have been sensitized to the importance of incorporating Tech Voc courses into the curriculum." School principal, Michael supported the point regarding the general focus of his schools on TVET integration and stated, "I have been at this school for the past 25 years and it has always been part of our mission to focus on technical vocational education."

School Leaders Tentative Towards the Process of TVET Integration at the Secondary Level

The participants indicated that while they are aware of the policy and the Ministry's thrust towards TVET integration at the secondary level, they did not demonstrate any urgency towards its implementation. Vice Principal, Andrea stated:

> The Education Officer visited the school and spoke to us re: Policy on TVET integration. I think the school is on board, but no real follow-up has been done and not much planning has taken place for TVET. The EO is to get back to the school re certain things: training and certification of teachers, resources for TVET, extra remuneration for teachers (as the teachers see this as additional work), and planning issues, such as timetabling.

Principal, Heather also indicated, "I see the relevance, but not much planning takes place for TVET at our school; we do not wholesale offer/encourage students to take up a mix of subjects. We are not there as yet; we need to re-visit this approach".

Principal, Arlene's perspectives were also noted:

> Over the years our education system has adopted a grammar school system approach to education, which is a legacy of the British system. We have always tended to educate our children to do the traditional profession such as, law, medicine and teaching for many years. Now that we have seen the relevance and importance of integrating TVET into the curriculum, we have made a conscious decision to offer a few of these courses. We can't go wholesale as we have to be mindful of the tradition of the school.

The foregoing suggests that despite the existence of a National Qualifications Framework of Jamaica (NQF-J) and a National TVET Policy, not all school principals are making the appropriate strategic shift mentally or otherwise to support the Ministry's policy and frameworks, and to ensure TVET integration is implemented into the secondary school system.

Arguably, despite the Ministry's efforts, it would appear that the principals primarily from the traditional high schools do not have an attitude of urgency or enthusiasm for TVET and have not fully bought into the process of TVET integration in secondary schools. This attitude, therefore, has the potential to derail the Government's efforts in reforming the education system and by extension, not fully achieving its objectives with the TVET integration process.

Consistently, the literature also suggests that despite best efforts to strategically advance TVET through policy, sometimes key stakeholders (at the policy and implementation levels) do not necessarily support the process (Dinbi et al. 2009; Morris & Powell, 2013). Dinbi et al. (2009) argued that oftentimes, serious lobbying of doubting politicians (and other key stakeholders) is required, supported by significant success stories from other areas where TVET integration has borne fruit.

Research Question 2. How does the behaviour of school leaders' impact TVET integration?

Two themes emerged from the data in relation to question 2:

1. TVET integration is impacted through leadership styles.
2. Positive attitude to professional development activities (to support TVET integration).

TVET Integration Impacted by Leadership Styles

During the discussions on leadership, the interviewer tuned in to the attitude of the principals (based on their own perspectives as well as from vice principals) regarding TVET integration.

Principal, Mark who described himself as a situational leader, and appears to be passionate about TVET integration indicated:

> . . . so, my leadership is designed in such a way so as to enhance the teaching and learning process and to help students to fulfil their academic goals… I have bought into the approach of the Government of Jamaica that we need to ensure that students graduate with a skill, because the skill will enable them to be more employable, and once we get our young men and women employed, it is going to ease the burden on the society and economy.

Consistent with his perceived leadership style, principal, Mark also explained how he introduced a particular TVET subject, Cosmetology in his school:

> I went to great lengths in introducing Cosmetology in the school. I encouraged the teacher (who is a past student) to join the staff here; and I have identified a little area that I am going to renovate; I already bought my hair dryers and other equipment. I want to give the students options, and that's what they like.

Principal Annette who describes herself as an instructional leader and 'walks the school grounds frequently' shares her views:

> While my role as a top-level leader of the school is to provide the framework, I really think that the people who are going to implement policy and implement curriculum need to be convinced by themselves; and if they are exploring, and they find that information, they must perfect it. For me, it is a slow process, but it I think it is an effective one.

Principal Arlene who sees herself as an educational leader, always learning,

and being able to influence her colleagues with what is new, available and good for the school shared an example of how she has been navigating the integration of TVET in her school:

> Humanities is less attractive to the modern student, but Business is extremely attractive. So, when I heard that Entrepreneurship was available as a CAP subject it gave me the courage to push it as a 3rd form subject. It enables the students to form businesses in the classroom – everybody wants to start a business (TVET approach).
>
> So, we have jumped in fully…, the students are extremely excited about it.

An analysis of copies of letters that were obtained from the school supported the foregoing and showed evidence of a number of events that were held where the participation of the entrepreneurship students featured strongly. These included a ***Third Form Business Fair*** and a ***Jamaica Stock Market Challenge*** that were held during 2018.

Principal, Heather who described herself as a transformational leader indicated during the discussion: "We are very open to the concept of TVET integration, but it is not a major priority in the current school improvement plan or school operations…" An analysis of the school's SIP also gave an insight into principal Heather's leadership style, which appears different to how she described herself. In response to ***Self-evaluation and school improvement planning*** the following is stated:

> A School Improvement Plan (SIP) . . . is in place. The SIP outlines priorities relative to students' attendance and their behaviours; the quality of teaching; and performance management. However, this plan has not been owned by the middle leadership and teachers in the school and as such, there is not a deep commitment to the priorities. Action plans are done in most departments, but these are not always informed by and linked with the improvement priorities and targets that are laid out in the SIP. (p. 6)

Principal Donovon (who also appears to be a firm supporter of TVET integration) describes his leadership style as participative/distributive. He stated:

> As principal, I have to have hard discussions with the teachers and challenge certain traditional views; I share the bigger picture as it relates to TVET integration and relate it to policy issues that are now driving school operations; I have to change the direction a little; give timelines and hold persons accountable.

Documents obtained from principal Donovon showed how the school, under

his leadership, organises TVET in the school curriculum. TVET courses offered include home economics, automotive technology, mechanical engineering, electrical technology, building technology and business. All are delivered and assessed through the Caribbean Vocational Qualifications (CVQ) framework for skill competence. In addition to the TVET subjects, principal Donovon emphasized that the students are also required to pursue Mathematics, English and related Sciences. Donovon stated the following regarding related Sciences: "If students are doing auto mechanic or electrical, related Science would be Physics. If they are doing home economics, the related science would be Biology." Vice principal, Joan indicated that her principal is "Always seeking to be creative and resourceful despite the limited resources."

Positive Attitude to Professional Development Activities (to Support TVET Integration)

The matter of professional development as a key support mechanism for TVET integration emerged during the data gathering process. The data pointed to principals' attitude and approach to their own professional development, and for instructional staff members. Participants who spoke on the topic highlighted that they make a point of embracing learning initiatives so that they are kept abreast of current issues in education, and also to demonstrate to instructional staff (i.e., leading by example) that continuous learning is important. Principal Arlene shared her view that, "As the school leader, I try to keep learning. I make them know that I am learning." Principal, Donovon gave an example regarding his approach to professional development and 'leading from the front': ". . . I make sure that I take upgrading initiatives every year; I have my certificates to show. I have to lead from the front." Principal, Mark also shared his approach:

> As principal I have to be informed by the knowledge that is available out there – I have attended a number of seminars that have been put on by the MOE; I have to keep abreast of the emerging issues pertaining to Tech Voc and the curriculum.

Most participants appeared to have a strong appreciation for professional development for teachers. Additionally, those participants who appeared to be firm supporters of TVET integration in secondary schools were most vocal regarding the importance of teacher development/upgrading, particularly in the area of TVET. Principals Bryan and Michael gave their perspectives on teacher development and approach taken at their schools. ". . . As principal, I have to push for these teachers to upgrade through STEM initiatives, online courses (planning for learning) linked to the new performance appraisal system – they have to do

upgrading/professional in-service training . . ." (Bryan). "I know the teachers are doing the Assessor Training now so we have teachers on that programme. All tech voc teachers should do the Assessor Training progamme and be exposed to the CBET methodology as it is important for effective TVET integration" (Michael).

Several participants provided indication that they have been encouraging their teachers to pursue training at the Vocational Training Development Institute (VTDI) and or the University of Technology (UTech), Jamaica. Principal John gave an example of actual training that teachers have been pursuing to support TVET integration: "VTDI has been doing training of teachers in AutoCAD. A number of our teachers are being trained. This is part of the reform process to facilitate TVET integration." Principal Arlene (one of the participants who appeared to be taking incremental steps to TVET integration in her school) also shared an actual example of professional development that teachers have attended to support the process: "Three teachers attended VTDI's Assessor Training programme recently. They were enlightened – new ways to assess – CBET." Analysis of training documents at the VTDI were undertaken for the NVQJ Level 4 in Assessment programme (which facilitates teachers to understand and apply competency-based delivery and assessment methodologies) and Computer Aided Drafting (which facilitates teachers at the secondary level to gain competencies in AutoCAD, and to equip them to deliver the new CSEC curriculum in Technical Drawing).

The analysis confirmed the following: At the time of the interview, three teachers from principal Michael's school were pursuing the Assessment Training programme; three teachers from principal, Arlene's school had successfully completed training during the summer period of 2018; and two teachers from principal, John's school had successfully completed training in Computer Aided Drafting during the summer of 2018.

Vice principal Joan shared her perspective regarding professional development for teachers and TVET integration:

> When the teachers prepare the students for assessment, it is the CBET methodology that they use to assess them, so it is important that they are trained properly to use the methodology . . . We are getting there in terms of having most, if not all teachers exposed to the training at the VTDI.

Vice Principal Donnelle indicated that "The good thing is most of our technical teachers have been trained at the VTDI and UTech." Vice principal Yvonne also shared the strategy utilised at her school to ensure teachers are appropriately prepared for the delivery of TVET subjects. She indicated, "The teachers at my

school are encouraged to attend the Assessor Training programme offered by the VTDI."

The findings point to a number of school principals who are strategically advancing TVET in their schools, despite the various constraints such as financial, infrastructure and resistance from stakeholders. The findings show that such Principals not only demonstrate instructional and distributive leadership styles, but also characteristics of the ***transformational leader***. A transformational leader is one who is exceptionally proactive; he/she identifies the need for change, creates a vision to guide the change through inspiration and executes the change with the commitment from members of the group which he/she is charged with leading (Earley, 2013; Northouse, 2013; Yukl, 2010). Characteristics of these principals observed include high level of confidence, energetic, enthusiastic, competent, inspiring and a firm willingness to help others along the 'change journey' through educating themselves and strategically facilitating instructional staff members to engage in ongoing professional development (Seashore-Louis et al., 2010; Yukl, 2010). Yukl (2010) argued that transformational leaders, through insight and enthusiasm, can obtain commitment from followers, raise their consciousness about issues, and mobilize their energy and resources to facilitate effective change. In relation to relevance to the school context, Seashore-Louis et al. (2010) found that a number of studies have demonstrated positive relationships between transformational leadership and excellent school leadership.

The study found that the majority of participants who appeared to be firm supporters of TVET integration in secondary schools are very aggressive regarding professional development for themselves and for teachers, particularly in the area of TVET. Consistent with literature, leadership is found to be central to the effectiveness of educational institutions (Cloud, 2010; Gentry, Eckert, Munuamy, Stawiski & Martin, 2014; Huber, 2008; Muijs, Harris, Lumby, Morrison & Sood, 2006). Muijs et al. (2006) argued that there is evidence to suggest that there is a positive relationship between leadership and organisational improvement. The principals who do not view TVET integration as priority for their schools, the evidence shows a number of contributory factors. Chief among them include leadership issues such as: poor attitude to TVET and TVET integration translating into low level of support for the curriculum reform process; not totally convinced of the benefits of combining traditional academic and TVET subjects; grappling with the constraints in establishing TVET in their schools (stakeholders' resistance, lack of resources – finance and physical, negative perception of TVET, lack of substantial support from the MOEY); and lack of key leadership competencies

that are required for the education sector, for example, despite the MOEY's thrust, there is evidence of lack of vision for TVET, non-inclusion of TVET in the School Improvement Plan, and lack of effort pertaining to networking/forming alliances and partnerships to facilitate the advancement of TVET (Dike, 2013; Greenwood, 2013; Ministry of Education, 2013; Morris & Powell, 2013; Newman 2013). In his study, Dike (2013) observed that one of the major causes of poor investment in Nigeria's TVET system, is that most of the leaders lack leadership competencies. Morris and Powell (2013) also referenced leadership challenges as a key inhibitor for effective TVET integration in Jamaica's secondary schools as observed during the 1998 pilot process. Dinbi et al. (2009) underscored this point, noting that it is important that designated/appointed leaders within the education and training system are appropriately qualified and understand how to employ efficient and effective management systems to ensure success. A noteworthy argument put forward by Newman (2013) indicated that effective school leadership within Jamaica's school system could prove challenging due to Jamaica's context, inclusive of history, culture, the many new policies that are sometimes not in alignment with each other and not fully understood by all, ongoing curriculum reform initiatives and lack of requisite resources.

Given the findings, for example, different levels of commitment by school leadership to the advancement of TVET integration in secondary schools, underpinned by differing leadership styles, there is an urgent need for the MOEY to take a more strategic/or different approach to educating the school principals, and establish more effective systems of monitoring and accountability for TVET integration to ensure greater consistency/standardisation and compliance with policy across the secondary school system (Woldetsadik, 2016). Woldetsadik argued that legal frameworks supported by robust monitoring and evaluation systems should be established to ensure effective implementation and sustainability of TVET. The evidence also points to the need for training entities such as the Vocational Training Development Institute (VTDI), University of Technology, Jamaica and National College for Educational Leadership (NCEL) to review existing training programmes for school leadership towards facilitating effective capacity building interventions with a focus on TVET in the school system (Greenwood, 2013).

A number of researchers support the view that for TVET to be taken seriously, it must be given national priority and firmly supported by policy (Greenwood, 2013; Vaz, 2012; Winch, 2013). Greenwood (2013) posited that governments should seek to empower stakeholders by helping them to build capacity through strengthening technical knowledge and providing necessary resources which

would facilitate more efficient and effective implementation of TVET. Greenwood further advanced that if countries want to make genuine transformation of the TVET landscape, it can only be accomplished effectively through system change; and that this can only be manifested through different activities at the strategic, policy and action levels.

Conclusion

This qualitative study sought to examine TVET integration in the secondary school system in Jamaica and the attitudes of school leadership. The findings confirmed that despite the Government's commitment to institutionalise TVET in secondary educational institutions, there are underlying challenges that continue to negatively impact its progress. These include a mix of positive and negative attitude of school leaders towards TVET and TVET integration in secondary schools; and most critical, varying leadership styles among school principals, some of which do not readily support the Government's thrust towards integrating TVET to facilitate human capital development. The study also showed, however, that despite the shortcomings, a number of secondary school principals exhibit transformational leadership characteristics; are cognizant of the global and national issues surrounding TVET integration, inclusive of the benefits to students and Jamaica's economy, and consequently show full support for the process.

While it is recognised that the MOEY is advancing strategies to support the TVET integration process, key recommendations should be noted. These include improved engagement of key stakeholders of the secondary education system to facilitate greater understanding and buy-in of TVET integration in the secondary schools. Stakeholders should include school leadership (principals, vice principals and other key administrative personnel who influence school leadership), school board, teachers, parents and community representatives. Greater collaboration by the MOEY with key training entities should be pursued to ensure capacity building programmes that are being implemented for school leaders are current, relevant and are in alignment with the Ministry's policies, inclusive of TVET integration. Finally, the Ministry should either establish a new accountability framework or strengthen what currently exist to facilitate effective monitoring and evaluation of the advancement of TVET integration in secondary schools and ensure school principals are held to account if evidence continues to show that TVET is not being satisfactorily integrated into the school curriculum consistent with the policy.

Consistent with international trends, the strategy to advance TVET integration in Jamaica's secondary high schools is important. It firmly supports the process of widening access, facilitating articulation for learners and provides employment opportunities, including self-employment. It is, therefore, important that the policy makers take urgent steps to implement the recommendations made in this study to ensure the various policies and frameworks are appropriately embedded in the education system, and more school principals implement strategies in their schools to advance TVET integration. Finally, it is anticipated that this study will contribute to, and enhance the existing research literature pertaining to TVET.

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A Systematic Literature Review of The State of TVET Research in The Caribbean Over The Past Quarter Century (1996–2021)

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Abstract

The importance of technical and vocational education and training (TVET) in developing a skilled labour force capable of functioning in a highly competitive global world, has been largely acknowledged. This is particularly so in the Caribbean, where stakeholders generally agree that TVET offers unique opportunities for countries to develop their human capital and advance their economic development. This research paper utilizes a systematic literature review (SLR) to evaluate relevant literature on TVET in the Caribbean over the past quarter-century, from 1996 to 2021. The study aims to analyze and present the state of research in the region to identify gaps and recommend some focus for future research directions/agenda. This gap hopefully will help stakeholders (practitioners, scholars, and policymakers) develop appropriate strategies to address future challenges relating to TVET in the Caribbean. We discovered 93 relevant papers in the review, which were reduced to 45 documents after applying our inclusion/exclusion and quality assurance criteria. The 45 selected papers were examined, and the findings revealed a concerning decline in the level of research over the past few years. Based on the review, after a surge in publications in the first half of the last decade, there has been a sharp decline in TVET research in the Caribbean in the second half of the decade. This occurred at a time when many TVET challenges remain to be explored and addressed. Several contemporary areas that will require additional attention in the future. These include TVET delivery during a pandemic, remote learning for TVET,

and TVET challenges in the digital era as well as the level of TVET readiness to prepare the workforce of the Caribbean for the 4th industrial revolution.

Keywords: Education, Technical, Training, Vocational, TVET, Systematic Literature Review

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Introduction

Technical vocational education and training (TVET) is increasingly being viewed as an important tool for developing a competently skilled workforce capable of operating in a competitive environment (Anderson, 2009). Because of its emphasis on skills for the labour market, TVET has been recognized by governments around the world as being particularly crucial to economic development (Guthrie et al. 2009). Governments view it as a social policy tool, helping those from certain vulnerable groups, such as those lacking in employable skills (Basu, 1997). The removal of trading barriers, the crucial role of technology and the increasingly global nature of competitions are just a few of the factors that are redefining the approaches to technical and vocational training being undertaken by many countries. In this scenario, many countries have been taking a closer look at TVET with the intention of assigning a greater role to it in their overall educational and training programmes (Bhattarai, 2020).

As noted by Morris (2008), there has been a greater acceptance and recognition of TVET within the Caribbean over the past decades (Morris, 2008; Hutton, 2009). This point was underscored by Hutton (2009) who noted that strides have been made in integrating it into the educational system of most countries in the Caribbean (Subran, 2013). This integration has even extended to the tertiary level alongside an increase in the number of post-secondary institutions that are now offering TVET curricula (Hutton & Dixon, 2016). Local agencies such as the Human Employment & Resources Training Institute/National Training Agency (Heart/NTA) in Jamaica have been lauded for the pioneering role they have played in developing TVET in the country (Cowell & Gregory, 2019). Regionally, institutions such as the Caribbean Examination Council through the Caribbean Secondary Examination Certificate (CSEC) and the Caribbean Advance Proficiency Examination (CAPE) have established curricula and increased the number of subjects through which students can matriculate from high schools. Standards to

ensure quality and consistency in TVET delivery have been established in some countries and steps have been taken to align these standards regionally through certification such as the Caribbean Vocational Qualification (CVQ) (Jules, 2015). The formation of the Caribbean Single Market and Economy (CSME) has also served as a catalyst for policymakers to harmonize these standards even further (Keevy & Authority, 2011).

Technical vocational education and training have made significant strides in the Caribbean (Morris, 2015). At the individual level, it can assist students in gaining the requisite skills needed for employment and social mobility. This can open up possibilities for self-employment, entrepreneurship, or job creation. At the societal level, it is widely acknowledged that a nation's economic prosperity and the abilities and competency of its workers are strongly correlated with TVET (Pavlova, 2014).

However, the TVET sector in the Caribbean current mode of operation makes it difficult for it to deal with new challenges such as the recent COVID-19 pandemic that ravaged the world. Other contemporary phenomena such as the digital revolution and the pernicious social issue of high levels of unemployment among young people are forcing many to reevaluate the role TVET should play in the future (Hassan et al. 2021). This examination is necessary in order to provide a set of actions to refocus the TVET sector to deal with the new challenges. Thus, a diagnostic assessment of the major problems and issues inherent in the TVET sector is required.

The study aims to commence that process of introspection with this review by taking a look at what has been done and identify gaps that will need to be addressed in the coming years. Specifically, we will seek to review the level and type of research on TVET in the Caribbean over the past twenty yeras and highlight what has been the focus, themes, and methodology that were used in these studies.

The study will also seek to identify other pertinent gaps in the literature on TVET in the Caribbean and suggest some focus for future research endeavours. The rest of this paper is arranged as follows. First, we outlined the research objectives and questions that we are seeking to answer. Second, we explain the methodology used in our review. Third, we present the results and findings. Fourth, we discuss the key highlights of the findings, and lastly, we provide our conclusion, limitations and recommendations for future studies.

Research Objective and Questions

The objective of this systematic literature review was to determine, analyze and describe the nature and focus of TVET research in the English Caribbean over the past 25 years during the period 1996–2021. The goal was to describe the research that has been undertaken, identify gaps and recommend some directions for future research focus. As such the study was guided by the following research questions:

***RQ1*:** In what forms were the research papers published?

***RQ2*:** What was the frequency of publication of the studies during the period under review?

***RQ3*:** Which countries were highlighted in the research papers?

***RQ4*:** What research methodologies were utilized in the studies?

***RQ5*:** What were the professional designations of the persons who conducted the different studies?

***RQ6*:** What were the dominant themes highlighted in the studies?

Methodology

Search Strategy

The study was conducted using a systematic literature review along with a qualitative content analysis of the relevant papers. A systematic literature review provides researchers with a guideline to examine relevant literature in a thorough, methodical, and objective manner (Noordzij et al. 2009). The decision to choose this approach was considered suitable as the method is extensively used by researchers from a wide cross-section of disciplines as a basis for undertaking qualitative analysis of information collected for review (Xiao & Watson, 2019).

The review primarily focused on studies that were conducted and published over the past twenty-five years from 1996 to 2021 and which were accessible from opened accessed databases. The focus centred on studies that dealt with TVET in the English Caribbean. The twenty-five-year period was selected to provide a large pool of papers on the subject. The review adopted the protocols recommended in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses

(PRISMA) principles proposed by Moher et al. (2009). The PRISMA rules were used to decide on the eligibility criteria that were used, the sources from which the information was sourced and the data collection process that was utilized to retrieve the papers that were reviewed (Fleming et al. 2014).

Database Search and Search Terms

In order to access as many publicly available information on TVET studies undertaken in the Caribbean, the search was conducted among several databases, including Web of Science, Scopus, Google Scholars, National Centre for Vocational Education Research (NCVER), as swell as within the online libraries of the University of the West Indies and the University of Technology, Jamaica. Following the recommendation of Alias and Suradi (2008), this approach was undertaken to expand the pool of available papers for the period of the review (Alias & Suradi, 2008). The keywords and search terms used were Technical and Vocational Education & Training AND Caribbean OR TVET in the Caribbean.

Inclusion and Exclusion Criteria

In order to select relevant papers for inclusion in the review, we examined the titles and abstracts of the papers and decided on their inclusion based on four primary inclusion criteria. Thus, for papers to be included, they had to fulfil the following criteria: (1) dealt with TVET in the Caribbean, (2) was published between 1996 and 2021, (3) covered all or some aspects of TVET across all the English Caribbean region or in one or more English Caribbean countries. Finally, all papers had to be published in the english language. Papers which did not meet any of the stated criteria were excluded from the review.

The Selection Process

The initial search of the different databases generated a total of 93 papers. From this total, 5 papers were omitted due to duplication. The remaining 88 papers underwent a thorough evaluation to determine which were relevant and should be included in accordance with the inclusion criteria that were established for scrutinizing the titles and abstracts. This process led to the exclusion of an additional 38 papers. Full copies of the remaining 50 papers were downloaded, and the same inclusion criteria were used for a more thorough second screening. For this screening, each paper underwent at least two evaluations to see if it satisfied

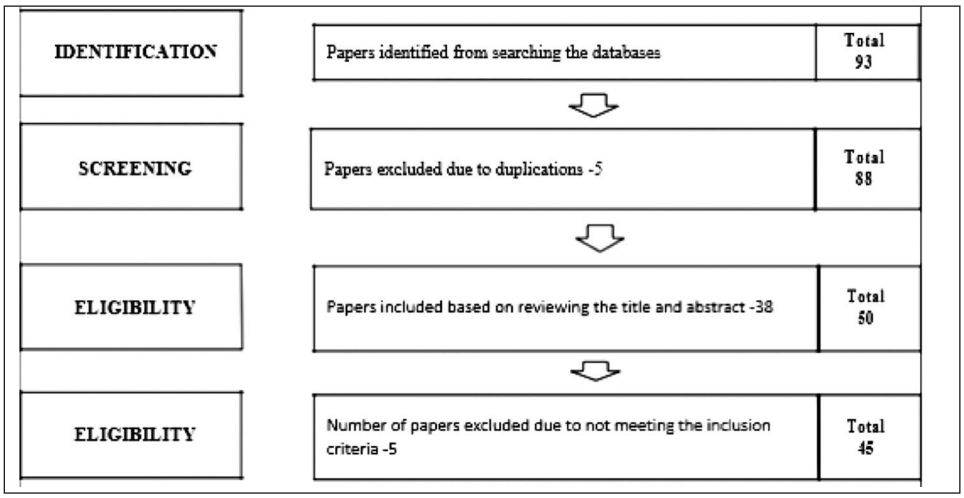

Figure 1: PRISMA Literature Review/Approach

Inclusion /exclusion criteria	Detailed explanation
1. Subject focus	The paper dealt with TVET in the Caribbean dealt with TVET in the Caribbean
2. Publication date	The was published between 1996 and 2021
3. Area of coverage	The paper covered all or some aspects of TVET across all of the English Caribbean or in one or more member countries
4. English language	English language is the main research language of educational research. Plus, it use allows for an easier comparison of the results obtained
Any paper not meeting any of the stated criteria was excluded from the final review.	

Figure 2: Inclusion/Exclusion Criteria

the requirements. Following a review of the entire manuscript in this second screening, another 5 papers were eliminated, leaving a total of 45 papers. The PRISMA steps utilized to guide the entire process are outlined in Figure 1, while the inclusion/ exclusion criteria that were followed are depicted in Figure 2. The final information was collated and arranged in a spreadsheet for the subsequent detailed examination.

Findings

RQ1: In what forms were the research papers published?

In analyzing the review papers, it was found that 42% of them were published as journal articles. This represented the majority of the review papers. Those published as reports constituted the second type of research paper most commonly found. These papaers represented reports that were either conducted or funded by a number of regional and international organizations including The United Nation Educational and Scientific Organization (UNESCO), The International Labour Organization (ILO) and various national governments within the Caribbean (See Table 1).

Table 1: Form of Publication

Forms of Publication	No	%
Policy paper	1	2%
Conceptual paper	1	2%
Conference proceeding	1	2%
Books	3	7%
Thesis or dissertations	7	16%
Reports	13	29%
Journal articles	19	42%
Total	**45**	**100%**

RQ2: What was the frequency of publication of the studies during the period under review?

Over the review period, the most productive window when studies were published was between 2011–2016, during which 42% of the papaers reviewed were published. The next most productive period was from 2017–2021, when only 7% of the reviewed papers were published. It is possible that this slowdown in the publication could be explained by the COVID-19 pandemic, which effectively curtailed most research activities. It could have also stemmed from the natural lag time that publications take to be digitized and indexed in the databases that were accessed. (See Table 2).

Table 2: Publication frequency

Years	No	%
1996–2000	8	18%
2001–2006	10	22%
2007–2010	5	11%
2011–2016	19	42%
2017–2021	3	7%
Total	**45**	**100%**

RQ3: Which countries were highlighted in the research papers?

Most of the papers reviewed showed that most of the TVET research focused on all the Caribbean countries as a combined region. This was the case in 22 of the 45 papers, which accounted for the 4% of all the papers reviewed. Trinidad was featured in 2% of the papers, while Jamaica was a distant third, featuringing only 9% of the papers. (See Table 3).

Table 3: Countries featured in the reviewed papers

Countries	No	%
Guyana	1	2%
Barbados	2	4%
OECS	3	7%
Jamaica	4	9%
Trinidad	13	29%
Entire Caribbean region	22	49%
Total	**45**	**100%**

RQ4: What research methodologies were utilized in the studies?

In the review, it was found that 26 of the45 papers used a qualitative approach (Table 4). This represented 58% of the papers and was the most preferred research methodologyused by researchers. The quantitative approach came next and was utilized in 31% of the reviewed papers. A combined or mixed research approach incorporating both a qualitative and quantitative methods accounted for the remaining 11% of research methods that were used.

Table 4: Research methodology

Methodology	No	%
Quantitative	5	11%
Mixed	14	31%
Qualitative	26	58%
Total	**45**	**100%**

RQ5: What were the professional designations of the persons who conducted the different studies?

We found that 26 of the 45 papers were authored by persons who can be classified as either academics, researchers or practitioners involved in some way with TVET. This number represented 58% of the reviewed papers. Professionals and consultants authored the second largest category of papers, which may not be surprising since we had previously alluded to thefact that a number of the reviewedpapers were commissioned by a number of international and regional organizations. Interestingly, students authored the remaining 16% of papers. Again, this came as no surprise since master's thesis and doctoral dissertations featured prominently among the papers that we found (See Table 5).

Table 5: Authors of the research

Authors by professional designation	No	%
Students	7	16%
Professionals	12	27%
Academics, researchers, practitioners	26	58%
Total	**45**	**100%**

RQ6: What were the dominant themes highlighted in the research papers?

TVET has come a far way in the Caribbean. Initially viewed as an alternative for individuals who weren't academically inclined, it is now largely viewed as a way to equip workers with the skills needed to be productive as well as problem solvers (Morris, 2013). Not surprisingly, the review identified 8 different thematic focuses in the papers that were reviewed (Table 6). The benefits of TVET and how to implement it was the theme featured in 42% of the papers. This was the dominant theme featured in the majority of the studies that were undertaken

as many Caribbean countries sought to integrate TVET into their educational offers. Best practices in TVET was the second-largest category with 20%, while stakeholder's views on TVET was the third category that was identified in the review. Issues relating to using TVET to lessen skill shortage, enhance career development, quality control and standard and mainstreaming TVET within the curriculum all tied for the fourth most frequently mentioned themes in 7% of the papers reviewed.

Table 6: Themes highlighted in the research

Themes of the research	No	%
Alignment of TVET and STEM	2	4%
Constraints to TVET (Finance, structures etc.)	2	4%
Enhancing TVET within the curriculum	3	7%
Quality control, assessments and standards in TVET	3	7%
Skill shortage, career development, competencies	3	7%
Stakeholders views on TVET	4	9%
Best practices in TVET	9	20%
Implementing and the benefits of TVET	19	42%
Total	**45**	**100%**

Discussion

The approach taken in this study was to execute a systematic literature review to locate relevant research papers dealing with TVET within the Caribbean. We initially located 93 papers from 7 databases and libraries for the time period spanning from 1996 to 2021. After applying several inclusion and exclusion criteria we settled on 45 papers which were thoroughly reviewed to ensure quality assurance for the study. Based on our findings, we can conclude with a few general insights that were gleaned from the review: These are discussed as followed:

1. The pace of TVET research studies within the Caribbean seemed to have declined within the past few years. While the COVID-19 pandemic could have undoubtedly contributed to this, the slowdown in output actually started in 2017 which was 3 years before the onset of the pandemic in 2020, so this raises questions about the reason for the decline. Will this decline continue, or will there be an uptick in scholarly inquisition now that the region is recovering from the pandemic?

2. While 42% of the papers reviewed were journal articles, another 29% were actually reports commissioned by a number of regional and international organizations. This would suggest that there is room for scholars, researchers and those in the academia to increase the level of scholarly inquisition to provide practitioners and policymakers with more evidence-based solutions for TVET.
3. Jamaica is the largest country in the English Caribbean and one of those countries often cited for the strides it has made in TVET (Morris & Powell, 2013, Cowen & Gregory, 2019). Yet, based on the review, it was not ranked as the leading country from which the most studies emanated. While there is no metric equating country size with research output, this revelation may appear surprising to some.
4. Forty-two percent (42%) of papers reviewed dealt with issues relating to the mechanics of TVET. Approximately half of this number focused on what are the benefits of TVET and discussed approaches for implementing it from a policy and institutional standpoint. But there seemed to be a paucity of studies addressing vocational pedagogy, which is a crucial component of any overarching TVET strategy (Paryono, 2015). Similarly, there seemed to have been limited focus on areas such as the teaching/learning environment needed to foster faster TVET integration into the educational system and generate better results.
5. One notable finding in the reviewed papers was the almost total absence of a theoretical lens on which the research papers were grounded. According to Tikly (2013), TVET plays a crucial role in human development which is a field of study supported by many theoretical lenses (Tikly, 2013). Gage (1989) argued that research in education should go beyond its narrow concern for technical and design issues (Gage, 1989). Pring (2000) suggested that education should seek to address a wider range of issues such as social and political inequalities (Pring, 2000). Therefore, it would be helpful to investigate how different learning theories might optimize the motivation, involvement, and career prospects of learners as a way to decrease social exclusion, alienation, and unemployment, whilst lessening the perceived polarization that exists between professional and non-professionals (Tuijnman & Belanger, 1997; Magro, 2009).
6. Finally, of the 45 papers reviewed, none was discovered that addressed themes such as remote learning, virtual or blended learning in TVET given the experience coming out of the COVID-19 pandemic. These issues were either ignored or given no focus by researchers.

Conclusion

Although the study has given some insights into the state of TVET scholarship in the Caribbean by answering the research questions we raised in the introduction, it does point to a need for more research on the construct across a wider thematic span. If governments and policymakers in the Caribbean are to fully embrace TVET, then more evidence-based studies will be needed to tell the story. Similarly, if critical stakeholders such as learners and the business sector are to be sold on the idea that TVET offers workers more than just the technical skills needed to function effectively in the workplace, then researchers, practitioners, and scholars will need to show the impact of TVET with more empirical studies.

This would include conducting more longitudinal and cross-country studies involving countries in the Caribbean as well as with other developing and developed countries.

Practical Contribution

This systematic literature review has analyzed the state of TVET research in the Caribbean. As such, there are a few practical implications emanating from this review for those TVET stakeholders inclusive of policymakers, scholars and practitioners who are working towards improving and strengthening the quality and delivery of TVET throughout the Caribbean. It is the hope of the author that this review will be able to accomplish the following. First, spur more scholarly investigation among researchers, academics, and policymakers into the many dimensions of TVET scholarships in the Caribbean. Second, motivate more international and regional organizations, along with Caribbean governments to fund more studies into TVET. Finally, given the gaps that we highlighted in the literature, promote and foster greater collaboration between researchers and policymakers to take a more pragmatic approach to identity, analyze and apply solutions to the challenges in TVET that are firmly grounded in the scientific inquisition.

Future Research Focus

Based on the state of TVET research globally and some of the gaps that we have highlighted, we believe the research focus in the Caribbean should be around the following themes in TVET;

1. **The impact of COVID-19 on TVET in the Caribbean**. The world is emerging from COVID-19 which has had one of the most disruptive impacts on the education sector worldwide in the past century (Schleicher, 2020; Lamey et al. 2021). Many researchers have commented that the pandemic has brought into question, the readiness of TVET stakeholders to adjust to new norms of learning (Hoftijzer et al. 2020; Lie et al. 2020). None of the papers that we reviewed addressed the impact of COVID-19 on the delivery of TVET within the Caribbean. This must clearly be on top of the list for any future study.
2. **Delivery of TVET lessons remotely**. One of the consequences of the COVID-19 pandemic was the shift to online and remote learning. Researchers like Ali (2020) and Oyedotun (2020) have asserted that online and remote learning have become a necessity for educational institutions in the era of COVID-19 (Ali, 2020; Oyedotun, 2020). However, some have questioned the readiness of educational institutions to make this shift (Carpenter & Dunn, 2020). It is certainly of interest to hear the views of TVET stakeholders in the Caribbean on the state of their readiness for another pandemic with such a disruptive power.
3. **Integration of TVET and STEM**. Many countries are searching for ways to fuse TVET and Science, Technology, engineering, and mathematics (STEM) into one seamless process to propel their economy higher up the technology ladder (Martin-Paez et al. 2019). As noted by Chan and Mohammad (2019), TVET should be a crucial component of this quest, but many practitioners are unsure how to create this fusion (Chan & Mohammad, 2019). Our review found one paper authored by Hutton and Dixon (2016) which presented a framework for achieving this integration in the Caribbean (Hutton & Dixon, 2016). But, this was a conceptual paper whose recommendations now need to be tested through empirical studies.
4. **The role of TVET in a digital world**. Douse et al. (2019), noted that digitization is profoundly changing how we work and the type of skills we will need to have to master these jobs (Douse et al. 2019). This will require TVET practitioners to equip learners with new skills to handle big data, deal with artificial intelligence and work within the 4th industrial revolution that is now at hand (Kanwar et al. 2019; Subrahmanyam, 2019). None of the papers that we reviewed addressed any of these emerging phenomena. This we believe is yet another understudied area warranting more investigation.

Limitations

In this study, there were a few limitations that we wish to highlight. These include: (1) The review focused only on databases that were accessible online, so it is likely that other studies might have been available, but only as hard copies and therefore couldn't be accessed remotely. (2) The review made no distinction between papers that were peer-reviewed and non-peer-reviewed papers, so the author has made no comments on the quality of the research papers that were published. (3) Since the review was limited to publications within the English Caribbean, papers from the wider, non-English Caribbean were excluded.

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Insiders' Perspective on Higher Education Leadership Development

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Abstract

Leadership development is a continuous, long-term, integral aspect of Higher Education Institutions' (HEI) sustainability, improvement, and effectiveness. Leaders may be rotated or changed within an HEI; however, the Administrative Support staff (Insiders) tend to remain and serve the new leaders during their tenure. Insiders have observed the leadership skills, styles, strengths, and challenges faced by HEI leaders over time. This study aimed to determine the leadership competencies perceived as important by Insiders, for leaders at various levels in an HEI as well as the perceived leadership training and development needs of HEI leaders. Fourteen leadership competencies were identified: Action Oriented, Building Team Spirit, Command Skills, Ethics and Integrity, Interpersonal Savvy, Managing Vision and Purpose, Motivating and Inspiring Others, Problem Solving and Decision Quality, Results Orientation, Fostering Innovation, Humility, Learning Agility, Maintaining Established Standards, and Strategic Agility. Fifty-three Insiders were surveyed using an online platform. Five categories of leaders (total 14) were interviewed to determine their perceived leadership training and development needs. In an HEI setting where collegiality is highly valued, three competencies appear to be the essence of leadership in the Higher Education environment: Building Team Spirit, Ethics, Integrity and Accountability, and Problem-solving and Decision quality. The Human Resource and Administration (HR&A) Division is integral to the preparation of HEI leaders and a Higher Education Leadership Development Centre is proposed as a vehicle to develop the important competencies that are desirable for HEI leaders.

Keywords: Leadership Training and Development, Leadership Competencies, Leadership Strengths and Challenges

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Introduction

Leaders are expected to adapt to environments and situations that are unpredictable, ever changing, and challenging to the future of an institution and its internal and external community. Leadership development is a continuous, long term and integral aspect of institutional sustainability, improvement and effectiveness. It can be an expensive endeavour that involves investment in training of current and potential leaders without guarantees, as leaders may be effective in given situations and not in others.

For over 60 years, University X, a publicly owned, institutionally accredited higher education institution, has been preparing work-ready graduates for the main economic sectors of the Jamaican economy. Governed by a Council and an Academic Board, the university offers over 100 programmes in the Arts, Sciences, Technology and Engineering, through its 8 academic faculties and 23 schools. Approximately 11,000 students receive a top-quality education and services from about 1,300 dedicated staff members.

The majority of leadership positions at University X are rotated in two-to-five-year cycles leaving little time for new leaders to build experience and expertise in the role before their tenure ends. There is hardly any transition period for hand-over from the outgoing to the incoming appointee, which leads to loss of institutional knowledge, and impairment of continuity; the incoming officer is left to navigate a steep learning curve. In contrast, the Administrative Support staff to the leadership posts tend to retain their positions and serve new leaders during their tenure. They therefore gain insight into the leadership skills, styles, strengths, and challenges faced by the leaders they have served and observed over time. The Administrative Support staff were the "Insiders", whose perspective was primarily considered in this study. However, to get a more fulsome picture of the realities of leadership within University X, this study also explored the issue from the perspective of the leaders themselves. Wolcott (1973), as cited in Miller (2018) posited that there is much benefit to be gained from capturing the accounts of what school leaders do and what they experience during their duties, versus

what it is felt school leaders should do. This understanding enables policymakers to come to grips with the realities that school leaders face on a day-to-day basis.

An appreciation of leadership competencies required to lead at various levels in an HEI from both the perspective of the leaders and those they lead, would help Human Resources Departments and HEI senior management to plan, organise, and prepare current and future leaders for their roles. This insight may also influence search and interview criteria that would ensure that those appointed are most suited for the role.

The overarching aim of this research was to identify and describe what the Insiders as well as leaders at various levels perceive to be effective leadership within University X and what training needs exist to address gaps in leadership competencies/behaviours.

Two questions were the focus of the study:

1. What characteristics, skills, and attributes do Administrative Support staff and Academic Leaders perceive as important for leaders at various levels in a university?
2. What leadership training and development needs do leaders have within University X as perceived by the leaders themselves and their Administrative Support staff?

Literature Review

The topic of leadership is among the most explored of all times. Many theories have been developed about the subject as researchers seek to determine the most effective way to improve the practice of leadership. Yet, there is still much to be unearthed as situations change and inevitably require a shift in approaches to leadership. It is important that we begin with a definition of leadership. Lunenburg and Ornstein (2012, p. 100) define leadership as "the process whereby one individual influences other group members toward the attainment of defined or organisational goals." Therefore, for one to be designated a leader, one must influence one's followers towards attaining the goals of the organisation.

In a comparative study of adaptive versus transactional leadership in current higher education, Khan (2017) describes the transactional leadership style as one which places emphasis on the leader-follower relationship and the exchange of rewards based on established performance goals. On the other hand, adaptive leadership is described as taking into consideration not only leader-follower relationship, but also, factors within the environment and how to prepare for

and adjust to address these successfully. Both styles were measured against their ability to withstand changes within the environment, handle complex situations and to motivate followers. Khan argued that the complex environment within which higher education institutions operate requires a leadership strategy that is flexible and supportive. This Khan believes will reduce the negative impact of external factors such as new technologies for teaching and learning, globalisation and changing student demographics. Khan posits that whereas neither form of leadership can provide a total response to changes in the environment, an adaptive leadership style is more advantageous as it allows for flexibility and orientation toward change in the face of impending paradigm shifts in the operation of HEIs.

Bass and Avolio (1993) believe that for an organisation to be effective, the leaders must utilise tactical and strategic thinking and be able to transform the culture into one that embraces change. They argue that transformational leaders are effective because they first try to understand the existing culture of their organisations and then realign it to reflect the new vision and direction. This they do by integrating creative insight, tenaciousness and energy along with intuition and sensitivity to the needs of their followers. Simsek (2013) argues that "An incremental and adaptive mode of change requires maintenance or transactional leadership skills, whereas dramatic and dis-continuous organisational change demand transformational leadership skills" (p. 2). The question is, what is the intrinsic nature of HEIs and to what extent are they impacted by environmental conditions? Simsek feels that "educational and school systems in the world are the most regularized" (p. 5). Therefore, educational institutions are expected to deliver what is common, accessible, normal and pedagogically correct. This therefore raises another question, is it reasonable to expect higher education leaders to be transformational in their approach? Given the current global environment characterised by advancement in technology, social, political, and economic unsettledness along with health challenges, it might be reasonable to expect that leaders can to a certain degree, be "norm-setters" as well as "norm-breakers". For example, as norm-setters, they would construct new realities as they strive to ensure their institution's economic viability in the global marketplace. Meanwhile, as "norm-breakers", they could "teach their organisations to unlearn habitual, traditional ways of doing and seeing things" (p.4).

More recent research has identified humility as a key component to success at leadership. Wang, Zhang, & Jai (2017) argue that leader humility is critical if an organisation is to be effective under both normal circumstances and during periods of crisis. They postulate that humility among leaders emerges from willing

self-scrutiny, recognition of the strengths and contributions of others and openness to feedback and new ideas from others. They posit that these qualities are integral to employee creativity, which is important if organisations are to survive in "highly turbulent and uncertain environments" (p. 6). Feder and Sahibzada (2014) add yet another dimension, by arguing that humility among leaders offers a competitive advantage as employees feel more engaged and are less likely to quit. They referenced a study conducted at the University of Washington, Foster School of Business, which concluded that the most effective leaders are generally humble people, who usually perform optimally as individuals and within teams.

In identifying critical leadership paradigms for the 21st Century, Thompson (2017) sought to determine the extent to which the quality of leadership within schools is important for consideration and the leadership qualities that teachers expect to see their principals/leaders display. Thompson's research found that from the teachers' perspective, the appropriate approach to effective educational leadership requires that school leaders recognize the commitment and effort of their staff as well as the need for their continued professional development. The study went further to indicate that teachers wanted their principals to create opportunities and structures to facilitate a culture of participatory or shared leadership in the decision-making process and resolve conflicts through influence rather than through power. They also expected that their leaders would embrace diversity and acknowledge the multiplicity of talents and gifts possessed by various members of the institution and demonstrate openness to criticism and acceptance of the views of others.

Thompson's study focused on the instructional leadership of principals in the secondary school system. However, the situation is somewhat different within HEIs where there are Executive and Academic Administrative positions that have no equivalent at the secondary level.

Watson (1998) of The Institute of Leadership Dynamics noted that most leaders in business, government, and non-profit organisations need to possess some combination of leadership competencies to excel. The ten competencies Watson identified were Action Oriented, Building Team Spirit, Command Skills, Ethics and Integrity, Interpersonal Savvy, Managing Vision and Purpose, Motivating and Inspiring Others, Problem Solving and Decision Quality, Results Orientation, and Strategic Agility.

Interestingly, the core values of University X bear a striking similarity to the 10 competencies identified by Watson. However, there exist two values, namely, Accountability and Innovation, which were not addressed in Watson's list, which

are also worthy of consideration. Other authors have identified Humility (Wang et al., 2017), Learning Agility (Benna, 2015) and Maintaining Established Standards (Simsek, 2013) as critical competencies for leaders within HEIs. Table 1 below defines the 14 leadership competencies considered in this study.

Table 1. Fourteen Leadership Competencies Considered in the Study

Leadership Competencies	Description
Action Oriented	A [disposition] towards action. Uses experience and knowledge to capitalize on opportunities and challenges. (Watson, 1998)
Building Team Spirit	Creates an atmosphere where individuals from diverse cultures and perspectives can work together in pursuit of a common mission. Creates an esprit de corps within the group by promoting wins and successes and encouraging open dialogue. (Watson, 1998)
Command Skills	Takes charge in challenging, difficult and/ or ambiguous situations. (Watson, 1998)
Ethics, Integrity and Accountability	Modelling and reinforcing the organization's key values in the pursuit of the organizational goals; highly credible and trustworthy. (Watson, 1998)
Fostering Innovation	Focuses on taking the institution to the next level, in light of ever-increasing competition.
Humility	Demonstrates a relaxed posture in relation to power, accepts limitations and takes criticism well. Listens to and shows respect for the views of others. (Wang, et al, 2017)
Interpersonal Savvy	Establishes and maintains productive relationship with appropriate people at all levels within and outside the organization. Builds and effectively uses a network of relationships. (Watson, 1998)
Learning agility	Takes the initiative in finding new opportunities to learn and experiments with new approaches and techniques. (Benna, 2015)
Managing vision and Purpose	Creates and communicates a compelling vision of the future. Translates the vision into clear and meaningful strategies and specific priorities, which help others to focus their efforts. (Watson, 1998)
Maintaining established standards	Where necessary, adheres to established regulations, and follows protocol and policies. (Simsek, 2013)
Motivating and Inspiring Others	Provides strong leadership and finds ways to get maximum results from others. (Watson, 1998)
Problem-solving and decision quality	Identifies both overt and underlying issues. Makes sound and timely decisions in accordance with the organization's vision, mission, core purpose, and strategic thrusts. (Watson, 1998)
Results Orientation	Drives execution of the organization's strategies and goals to reach objectives. Produces results consistent with the organization's vision and mission. (Watson, 1998)
Strategic Agility	Translates business vision into clear strategies and specific priorities to help others focus their efforts for business success. Has broad knowledge and perspective and can anticipate and adapt to future consequences and trends accurately. (Watson, 1998)

The poor performance of the Jamaican public education system and of students at the CXC examinations have been linked to the quality of leadership provided by principals (Hutton, 2013). Several attempts have been made to address the deficiencies. These include:

1. the Task Force on Education Reform of 2004 which stipulated that all principals must engage in continuous leadership training,
2. a training programme for school leaders conducted by a local university, and
3. the Ministry of Education's establishment of the National College for Educational Leadership in 2011 to equip school principals with the requisite leadership skills for the secondary, primary and early childhood levels.

There is yet to be an established response to the issues faced by academic and administrative leaders in HEIs.

With reference to Higher Education Indian Institutions (HEII), Dwivedi & Joshi (2020) stated ". . . effective Academic and Administrative Leadership at all levels . . . is the need of 21st century HEIIs" (p. 141). Further, in consideration of faculty and administrative staff, Dweivedi & Joshi concluded "recruitment to promotion and long-term retention should base [sic] on quality, character, true learning and not on mere educational qualifications. They must compulsorily be well facilitated for continuous periodic training before and during tenure for global standard performance" (p.141).

Khalid (2019) noted that HEIs often struggle with finding the right people for many academic leadership positions, and the academic subject experts when assigned as academic leaders, they are overwhelmed by the robust expectations and multi-dimensions of the role. Khalid further stated, "there is a sheer need to develop such talent from within the organizations so that HEIs become self-sufficient to cater to the future competency needs" (p.45).

As argued by Abdulla et al (2023), the HEI landscape is highly competitive and the recruitment of leaders who have extensive and wide-ranging skills such as research, student services, business management practices, and academic administration is a strategic imperative for the survival and growth of the institution in order to meet the needs of society, Government and stakeholders.

Methodology

The research design is a convergent mixed methods design where the qualitative and quantitative data are collected concurrently, and the results are merged and

compared for interpretation (Creswell & Plano Clarke, 2018) cited in Hastings (2022). The Administrative Support staff serving Programme Directors, Heads of School and the Executive Assistants to Deans, Vice Presidents and President were identified from University X's telephone and email directories. A questionnaire was developed by the authors and pilot tested with a sample from the population. After considering written feedback from the pilot test, adjustments were made to improve the instrument. Ethical clearance was obtained from the University X's Ethics Committee before invitation emails were sent out via an online survey platform (SurveyMonkey). On the first page, the aim and intent of the survey was presented to the participants, who had to click on a link to indicate their informed consent before proceeding. There was no compulsion or compensation for the respondents to participate, other than their willingness to support the objectives and aims of the survey.

To ensure confidentiality, candid responses, and anonymity, the respondents were not required to give their names, gender, specific office, unit, division, faculty, or the name of their supervisor/leader. There was therefore little possibility to triangulate the identity of any respondent.

All 175 Administrative Support staff including Faculty Administrators and Executive Assistants were invited by email to participate in the survey. The instrument was designed to obtain their position and length of tenure. From the list of 14 Leadership competencies, respondents were asked to select the top five competencies that they considered important for the leadership post for which they gave support. Through open-ended questions, respondents were asked to provide advice to newly appointed leaders regarding what qualities and competencies they would need to succeed in their new role. They were also asked to provide suggestions to the Human Resources and Administration (HR&A) Division regarding possible training initiatives to improve the Administrative Support staff's capacity to foster the Leader's success. The responses to the open-ended questions were analysed for common themes.

The Academic and Administrative leaders were grouped into five categories:

1. Executive/University Officers,
2. Directors/Senior Directors/Managers/Administrators,
3. Deans/Vice Deans/Associate Deans,
4. Heads of School/Associate Heads of School, and
5. Programme Directors, Course Leaders.

Fourteen randomly selected current leaders representing Academic and Administrative/Executive Management were interviewed to a) capture their leadership journey, and b) determine their perceived leadership training and development needs. Additionally, they were asked to identify the top five attributes perceived as important for leaders in the posts they occupy. After agreeing to participate, the questions for the interview were circulated ahead of time. The interviews were conducted in-person and recorded where permission was given. Interview transcripts were analysed for common themes and further compared with the data collected from the Administrative Support staff.

Results

Of the 175 Administrative Support staff, Faculty Administrators and Executive Assistants invited to participate, 53 completed the survey yielding a response rate of 30.3%. Informal feedback suggested that participants had difficulty navigating the SurveyMonkey platform due to their browsing software. The window of time to generate interest in the survey was also a factor in the response rate.

Research Question 1: What characteristics, skills, and attributes do Administrative Support staff and Academic Leaders perceive as important for leaders at various levels in a university?

From the list of 14 leadership competencies, respondents were asked to select the top five that they considered important for the leadership post for which they gave support. Overall, the top five leadership competencies that were identified by Administrative Support staff in rank order are shown in Table 2.

From Table 2, most Administrative Support staff members selected Building Team Spirit (77%) as a required leadership competency for leaders in University X. This was followed by Ethics, Integrity and Accountability (66%), Problem-Solving and Decision quality (47%), Motivating and Inspiring Others (45 %) and Results Orientation (38 %) as the top five leadership competencies.

The top five leadership competencies as perceived by Administrative Support staff when differentiated by type and level of leadership is shown in Table 3 and Figure 1.

The leadmership levels indicated are Executive/University Officers (Exec. Officer), Senior Directors/Directors/Managers /Administrator (Sen. Directors), Deans/Vice Deans/Associate Deans (Deans), Heads of School/Associate Heads of School (HOS), and Programme Directors/Course Leasers (PDs).

Table 2. Tally and Ranking of Top five Leadership competencies of Leaders as perceived by Administrative Support staff

Leadership Competencies	f	Rank	%
Building Team Spirit	41	1	77
Ethics, Integrity and Accountability	35	2	66
Problem-solving and Decision quality	25	3	47
Motivating and Inspiring Others	24	4	45
Results Orientation	20	5	38
Action Oriented	18	6	34
Humility	16	7	30
Managing Vision and Purpose	15	8	28
Strategic Agility	15	8	28
Interpersonal Savvy	14	10	26
Maintaining established standards	13	11	25
Learning Agility	12	12	23
Command Skills	11	13	21
Fostering Innovation	9	14	17

N= 53

Table 3. Tally and Percentages of Top five Leadership competencies as perceived by Administrative Support staff of various Administrative and Academic Leaders

	ADMINISTRATIVE LEADERS				ACADEMIC LEADERS				
Leadership Competencies	Exec. Officers	Sen. Directors	Total	%	Deans	HOS	PDs	Total	%
	n = 10	n = 11	n = 21		n = 10	n = 6	n =16	n = 32	
	f	f	f		f	f	f	f	
Building Team Spirit	8	9	17	80.95%	8	6	10	24	75.00%
Ethics, Integrity and Accountability	7	7	14	66.67%	6	6	9	21	65.63%
Problem-solving and decision quality	4	5	9	42.86%	4	3	9	16	50.00%
Motivating and Inspiring Others	6	4	10	47.62%	4	3	7	14	43.75%

Action Oriented	4	3	7	33.33%	3	1	7	11	34.38%
Maintaining established standards	1	2	3	14.29%	2	2	6	10	31.25%
Learning agility	3	1	4	19.05%	2	0	6	8	25.00%
Results Orientation	6	4	10	47.62%	1	3	6	10	31.25%
Command Skills	2	1	3	14.29%	1	1	6	8	25.00%
Humility	2	4	6	28.57%	4	1	5	10	31.25%
Strategic Agility	2	3	5	23.81%	4	2	4	10	31.25%
Fostering Innovation	3	1	4	19.05%	2	0	3	5	15.63%
Managing Vision and Purpose	4	4	8	38.10%	5	0	2	7	21.88%
Interpersonal Savvy	4	4	8	38.10%	2	2	2	6	18.75%

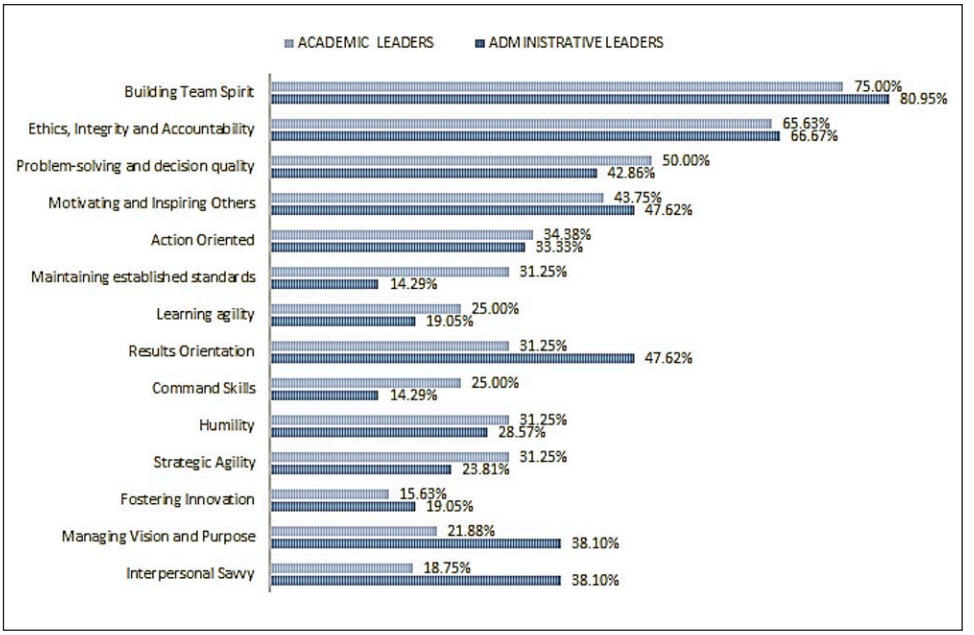

Figure 1. Top five ranking of leadership competencies as perceived by Administrative Support staff for Administrative and Academic Leaders

From Table 3 and Figure 1, there are differences in perception of leadership competencies between the Administrative Support staff for Administrative leaders and those for Academic Leaders. Maintaining established standards, Strategic Agility, Command Skills, and Problem-solving and Decision quality appear to be more important for Academic leaders, while Results Orientation, Managing

Vision and Purpose, and Interpersonal Savvy were considered more important competencies for the Administrative Leaders. The other competencies were not perceived as contrastingly different.

From the 14 interviews conducted, Administrative Leaders (Executive/University Officers/ Senior Directors/Directors/Managers /Administrator) and Academic Leaders (Deans/Vice Deans/Associate Deans, Heads of School/Associate Heads of School, and Programme Directors, Course Leaders) provided their top five leadership competencies for their respective roles. The responses were tallied and ranked as shown in Table 4.

Table 4. Tally of Administrative and Academic Leaders' Perceived Ranking of their Top five Leadership Competencies.

Leadership Competencies	ADMINISTRATIVE LEADERS		ACADEMIC LEADERS			Total	Rank
	Executive Officers n=3	Senior Directors n=3	Deans n=2	HOS n=3	PDs n=3		
Ethics, Integrity and Accountability	2	3	2	2	3	12	1
Building Team Spirit	1	2	2	3	3	11	2
Problem-solving and decision quality	2	2	0	1	2	7	3
Interpersonal Savvy	1	2	1	1	1	6	4
Command Skills	2	0	0	2	1	5	5
Motivating and Inspiring Others	2	1	1	1	0	5	5
Humility	3	0	0	1	1	5	5
Managing Vision and Purpose	0	1	2	0	1	4	8
Strategic Agility	1	0	1	2	0	4	8
Maintaining established standards	1	1	0	0	2	4	8
Action Oriented	1	2	0	1	0	4	8
Results Orientation	0	2	0	0	1	3	12
Fostering Innovation	0	2	1	0	0	3	12
Learning agility	0	0	1	1	0	2	14

Key: HOS = Head of School, PD = Programme Director

From the interview of Administrative and Academic leaders, the top five ranked competencies identified were nearly identical to the Administrative Support staff's top five ranking.

Of the 14 leaders, 12 identified Ethics, Integrity and Accountability, 11 identified Building Team Spirit, seven selected Problem Solving and decision quality, while six chose Interpersonal Savvy. Three competencies were tied in 5th place, namely Command Skills, Motivating and Inspiring Others, and Humility. Results Orientation was only considered as a top five competency by three leaders. The competencies of Interpersonal Savvy and Command Skills were ranked more highly by Administrative and Academic leaders (6 of 14 and 5 of 14 respectively) than by Administrative Staff (26% and 21% respectively).

At the other end of the spectrum, the least selected competencies identified by Administrative Support staff in descending order were Interpersonal Savvy (26%), Maintaining Established Standards (25 %), Learning Agility (23 %), Command Skills (21 %), and Fostering Innovation (17 %).

The competencies Action Oriented, Maintaining Established Standards, Strategic Agility, and Managing Vision and Purpose were selected equally by 4 of 14 Administrative and Academic leaders. The least selected competencies by Administrative and Academic leaders were Results Orientation and Fostering Innovation (both 3 of 14), and Learning Agility (2 of 14).

The Administrative Support staff were divided into two groups – those supporting Academic Managers and Leaders (Deans, Heads of School, Programme Directors) and those supporting Administrative Managers and Leaders (Executives, and Directors). This categorisation was to determine if the perceived leadership competencies by Administrative Support staff were differentiated across academic and administration/executive functions.

A higher proportion (81%) of Administrative Support staff for Administrative/Executive Leaders than Administrative Support staff for Academic Leaders (75%) perceived Building Team Spirit as an important competency. Ethics, Integrity and Accountability were almost identical (67% and 66%).

Managing Vision and Purpose (38%) and Interpersonal Savvy (38%) were rated as competencies that are more important for Administrative Leaders when compared to the Academic Leaders (22% and 19% respectively). By contrast, Strategic Agility (31%) and Maintaining Established Standards (31%) were rated as more important competencies for Academic Leaders when compared to the Executive Leaders (24% and 14% respectively). Innovation is one of University X's core values and so it was interesting that only 18% of Administrative Support staff and 3 of

14 Leaders (14%) believed Fostering Innovation was a priority leadership competency. This finding warrants further research into the reason for this perception.

Research Question 2: What leadership training and development needs do leaders have within University X as perceived by the leaders themselves and their Administrative Support staff?

To unearth the leadership training and development needs within University X, the perspectives of the 53 Administrative Support staff who responded to the questionnaire as well as 14 leaders at various levels within the university were explored. The following question was posed to the Administrative Support staff: What advice would you give to the HR&A Division to prepare an incoming officer/leader for the job ahead?

In the main, the respondents felt that incoming leaders should be trained to handle the day-to-day functions of their job. It was felt that they should undergo rigorous training in handling systems such as the Integrative Student Administrative System and strategies to deal with issues such as students' withdrawal from courses, and grade forgiveness among others. It was suggested that the HR&A Division should ensure that the incoming leaders understand University X's policies and procedures, the goals and responsibilities associated with their positions as well as how their roles impact University X at large.

The need for leaders to receive training in leadership and management was unequivocal from the responses of the Administrative Support staff. Various suggestions were given regarding how the HR&A Division could administer leadership training. These included preparing operational manuals, facilitating workshops, seminars and robust orientation sessions, and instituting a system of mentorship and shadowing of existing leaders. One respondent urged the HR&A Division to steer the incoming officer towards adopting a transformational leadership style that will assist their subordinates in achieving organisational and personal goals.

Interestingly, a small group of respondents felt that one way that the HR&A Division can address the gap in leadership training and development is by engaging in a more deliberate selection of leaders for the posts. It was felt that the HR&A Division should carry out background checks and ensure that the incoming leader already has at least some of the requisite skills for the position, is knowledgeable about the area, knows how to supervise/lead, effectively utilise the performance appraisal instrument, deal with conflicts, and manage a team. The selected leader should have already proven that s/he is goal-oriented, an effective communicator, is approachable, can inspire teamwork, has a keen eye for detail, is customer-cen-

tric, follows protocol and proactively responds to challenges. It is also important that the individual has demonstrated a willingness to retool and to continue acquiring knowledge in good governance and leadership.

To further ascertain the leadership development training needs, the 14 leaders, who were randomly selected from five levels across University X, were asked what preparation they undertook before commencing the office they currently hold. It is of interest to note that more than two-thirds of them undertook rigorous self-preparation for the task that lay ahead.

The steps they took included seeking advice from relevant stakeholders including their Administrative Support staff, reading extensively in order to understand the history of the institution and its culture, perusing ordinances and policies governing their operations, and engaging in fact-finding exercises in which they reviewed self-studies and University Council of Jamaica (UCJ) reports to determine the strengths and weaknesses of their units. The others reported that they had acquired much experience while engaged in previous employment. None of the interviewees pointed to a meaningful, deliberate attempt on the part of the HR&A Division to prepare them for the roles they were to assume.

Notwithstanding that, the HR&A Division was commended for having facilitated opportunities for some of them to serve in various leadership capacities and attend conferences, which in part, prepared them for their current roles. One interviewee reported that after serving as a head of a unit for twenty years, he had since been promoted twice. Throughout his tenures, he drew on the strengths of others whose examples he could emulate and learn about educational leadership. Another respondent shared that he had served as a Subject Leader, Programme Director, Unit Coordinator, Examination Coordinator and Warden, the latter giving him ample opportunities to interface with students and issues related to their welfare.

When the leaders were asked what they thought the HR&A Division should do to support the leadership preparation for new and incumbent leaders, there was an overwhelming call for more deliberate attention to orientation and training. The specific areas of needed training were quite similar to those identified by the Administrative Support staff. The leaders also spoke about the need for on-going training in leadership in the form of manuals, workshops and seminars. Several lamented the absence of an effective system of mentorship and succession planning. One interviewee called for an official handing over process to be made mandatory, while another suggested that leadership training programmes be certified and attract professional development credits.

Discussion and Conclusion

Competencies Essential for Leadership

Getting the Insiders (Administrative Support staff) to identify what they perceived as the strengths required for a leadership post proved somewhat challenging as they sometimes seized this as an opportunity to highlight their leaders' weaknesses. Nevertheless, it was possible to glean that the competencies they perceived as important were largely similar to the 14 identified from the literature (Table 1). In an HEI setting where collegiality is highly valued, it was not surprising that Administrative Support staff considered Building Team Spirit as a required competency for leaders. This was regarded as almost as important as Ethics, Integrity and Accountability, and Problem-solving and Decision quality. These three competencies appear to be the essence of leadership in an HEI environment such as University X as perceived by both the Administrative Support staff and the leaders themselves.

Watson (1998) ascribes three levels of competence attainment: learning, performing, and excelling. The degree to which each competency is achieved or required would depend on the individual, and the nature of the leadership context. For example, a Marketing and Promotions Department may consider Interpersonal Savvy more critical to its success, while the Planning Department may rate Strategic Agility as primary. Although ideal, no one is expected to perform equally and excel in all leadership competencies. This therefore presents an opportunity for leadership growth and development for everyone involved in or contemplating leadership.

It must be noted that the ranking of competencies by the participants in this study is relevant only within the context of University X. As perceptions change over time, further research is required to explore the reasons for the low ranking of some leadership competencies, the possible implications, and direction for leadership preparation and development.

Leadership Training Development Needs

Administrative leaders within University X tend to be recruited from outside the institution directly into posts due to their technical skill set. Their leadership preparation is generally external to the institution, and therefore the onboarding process has to be deliberate on the part of the HR&A Division. It cannot be

assumed that a new hire is conversant with all the leadership requirements of the job and can easily, and without guidance, assimilate the culture of University X. Conversely, it should not be taken for granted that academic staff that move up through the ranks will automatically be able to handle the administrative and leadership aspects of the job as noted by Khalid (2019). Therefore, all leaders and aspirants should be included in activities designed to build leadership competencies.

Additionally, all leaders need support to function properly or at an optimum. The Administrative Support staff play a key role in orienting the new leader to the operations of the office, as they possess institutional memory – a valuable resource for context and continuity. The extent to which Administrative Support staff are empowered to contribute to the success of the leader is somewhat tied to the value placed by the institution on the potential of the staff to influence the training of the leaders.

Given the complexities of leadership within HEIs, there is a need for persons to develop the required competencies to ensure that they are capable of building team spirit, ethical behaviour, integrity, accountability, and excellence in problem-solving and decision quality. Self-preparation is not sufficient to achieve this goal as conveyed by two-thirds of the leaders who were interviewed. Such practice contributes to inconsistency in leadership development and stifles the long-term development of the institution. Self-preparation is therefore not a recipe for sustainability nor continuity of HEI leadership, and this reality begs for a programmatic intervention.

The Leadership Training and Development Model (See Figure 2) would facilitate the screening, assessment, training, and certification of academic and administrative leaders for the higher education sector. Central to the model is a Higher Education Leadership Centre (HELC) where a Personal Leadership Development Plan is prepared for each participant after having engaged in a leadership inventory and evaluation process. Activities and programmes (workshops, coaching, mentoring, action projects, shadowing, journaling, etc.) (Johnstal, 2013; Gigliotti & Ruben, 2017; Gordon et al., 2016) would be customised for individuals, units, and institutions.

The HELC would ensure that a pool of qualified potential leaders is prepared and available to apply for appointments to leadership positions and provide continuous leadership development for incumbents and the newly appointed leaders. This initiative could be incorporated within the HR&A Division of an HEI such as University X. For the internal staff member who shows an interest,

the leadership training and development begins with a process of screening. An application would be required which includes recommendations and a statement of intent from the applicant. For those who are directly employed in leadership positions, the training and development process forms a part of their onboarding and is therefore mandatory. The goal of the HELC is leadership capacity building and the programme will vary for each participant and is not a guarantee of a leadership role upon completion.

Building Team Spirit, Ethics, Integrity and Accountability, and Problem-solving and Decision quality were identified as required competencies for leaders in an HEI environment such as University X. The identification of key leadership competencies as a foundation for leadership development is an imperative for the sustainability and continuity of HEIs. The perceived and actual competencies are both critical in the formulation of deliberate, customised intervention strategies within a leadership training and development framework such as the HELC. They should cater for all levels of leadership within HEIs and function as a resource for continuous leadership development for existing and new members within the HEI community.

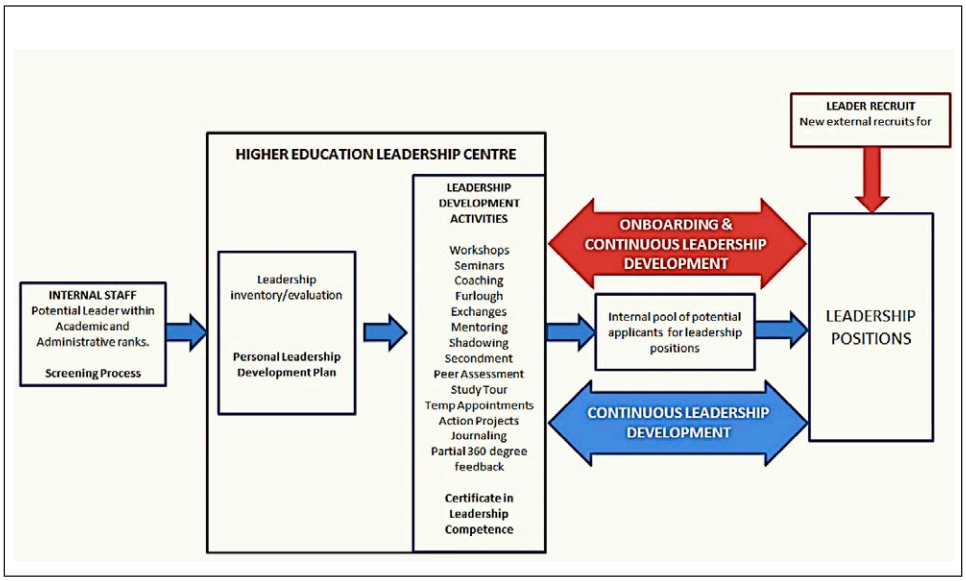

Figure 2. Proposed Leadership Training and Development Model

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Globalisation

Building Research Management Capacity and Enhancing Curriculum Development at Jamaica's Leading Public University Through Cross-Border Collaborative Partnerships

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Abstract

Globalisation refers to the growing interdependence of the world's economies, cultures, and populations, brought about by cross-border trade in goods and services, technology, and flows of investment, people, and information. Relatedly, the European Union and other organizations involved in funding research on a global scale have recognized, articulated, and adopted the posture that, to effectively tackle global challenges, humanity needs to be able to harness creative solutions from all over the world, and that an effective way to do this is through collaborative research and other types of partnerships. In the case of Jamaica's leading public university - the University of Technology, Jamaica (UTech, Jamaica) –"Partnering with other universities and tertiary institutions to develop new research (and other) opportunities" is one of its strategic initiatives. In this paper, the authors use a retrospective analytical approach to describe and discuss examples of how UTech, Jamaica has engaged in cross-border collaborative partnerships, to build institutional research management capacity and enhance curriculum development to address important challenges ranging from climate change to sustainable energy. In addition, the authors also discuss learning and other benefits that accrue from these cross-border partnerships. From their retrospective analysis, the authors conclude that through intentional global collaboration UTech, Jamaica developed an innovative master of science programme aimed at addressing the critical areas of sustainable energy and

climate change and has also benefitted from capacity-building of the staff in its research management office to perform their functions more effectively as research and innovation managers.

Keywords: Globalisation, Collaborative Partnerships, Curriculum Development, Capacity-Building, Research Management.

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Introduction

The engagement in cross-border collaborative partnerships by personnel in universities is one aspect of globalization, which refers to the growing interdependence of the world's economies, cultures, and populations, brought about by cross-border trade in goods and services, technology, and flows of investment, people, and information (International Monetary Fund, 2000; James & Steger, 2014). From this definition flows the notion that the world has been rendered 'borderless'.

Collaboration amongst higher education institutions (HEIs), research centres, and industry has long been practiced among more mature organisations, but for the UTech, Jamaica this was a deliberate strategy embarked upon in 2011 in furtherance of its mission.

Huang (2014) defined research collaboration as "joint work between researchers in achieving research objectives" (p.92) and he used the lens of social network theory to argue that research collaboration networks are a form of research capacity at the interpersonal level, which is complementary to capacity building at individual, organizational, and inter-organizational levels.

Additionally, several factors are the driving forces behind what may be regarded as a renewed focus on collaborative partnerships; these are donor agendas, researcher agendas, and local national, and international development agendas (Research Global, 2013; Huang, 2014).

Concerning donor agendas, the European Union and other organizations involved in funding research on a global scale have recognized, articulated, and adopted the position that, to effectively tackle global challenges, humanity needs to be able to harness creative solutions from all over the world, and an effective way to do so is through collaborative research and other partnerships (Research Global, 2013).

Regarding research agendas, they provide impetus for collaborative partner-

ships because many researchers are aware that a lot of the world's significant challenges need trans-disciplinary solutions that are agnostic of geographical, cultural, and other boundaries, and which also take account of new approaches to knowledge generation. In addition, within this context, as would be expected, many researchers are naturally inclined to forge collaborative partnerships with trailblazers, leading scholars, and thought leaders in their field, regardless of where they work (Research Global, 2013).

In relation to benefits that accrue from collaborative partnerships, a 2011 report entitled 'Knowledge, Networks, and Nations: Global Scientific Collaboration in the 21st Century' emphasizes that collaboration often enhances the quality, efficiency, and effectiveness of research (The Royal Society, 2011). There are, of course, different modalities of collaborative partnerships, but the expected benefits are essentially the same: synergistic enhancement of knowledge, increased dissemination of that knowledge, the sharing of resources and time commitments, and the expansion of social networks.

Notwithstanding the benefits that may accrue from collaborative partnerships, critical success factors have been identified. Among the critical ingredients necessary for successful collaborative partnerships are effective institutional frameworks for assessing the feasibility of international collaborations; alignment of objectives; trust and openness; mutual confidence; cooperation; cultural knowledge and sensitivity; absorption capacity and ability to learn from best practice; and communication (European Commission, 2005; Schofield, 2013; and Wilson, 2013).

Additionally, the Swiss Commission for Research Partnerships with Developing Countries (KPFE) listed the following as 'added value' that may be derived from collaborative partnerships: findings; results; changed perspectives, technologies and methodologies, capacities and career opportunities, exposure (e.g., to broader research communities and contextual and institutional access) (KPFE, 2018). Furthermore, while cautioning that they may have to be applied selectively depending on the particular partnership, the KPFE also identified eleven key principles of good partnership practice, which are: Set the agenda together; Interact with stakeholders; Clarify responsibilities; Account to beneficiaries; Promote mutual learning; Enhance capacities; Share data and networks; Disseminate results; Pool profits and merits; Apply results; and Secure outcomes. The KPFE also identified seven important questions that must be given consideration: Why work in partnership?; How to ensure cohesion?; What form of collaboration?; Which foci and priorities?; Who to involve?; Where to create relevance?; and When to consolidate outcomes? (KPFE, 2018).

We now come to the case of the University of Technology, Jamaica (UTech, Jamaica), the country's oldest publicly owned University. The institution was established by 'The University of Technology, Jamaica Act (Act 27 of 1999) of the Jamaican Parliament; this was an upgrading to university status of the College of Arts Science and Technology (CAST) which had been operating since 1958 as a polytechnic-type training institution. The "objects" of the new university are to: "(a) advance education and development of technology through a variety of patterns, levels, and modes of study and by a diversity of means by encouraging and developing learning and creativity for sustainable development for the benefit of the people of Jamaica, the Caribbean and elsewhere; (b) preserve, advance and disseminate knowledge and culture through teaching, scholarship, and research; (c) make available the results of such research and service; and (d) promote wisdom and understanding by the example and influence of corporate life" (University of Technology, Jamaica Act, 1999).

"Partnering with other universities and tertiary institutions to develop new research (and other) opportunities" is one of the strategic initiatives articulated in the University of Technology, Jamaica's Strategic Plan (University of Technology, Jamaica Strategic Plan, 2008–2015). Institutional arrangements at the University established to pursue this strategic initiative include the School of Graduate Studies, Research and Entrepreneurship (SGSRE), and the Office of International and Institutional Linkages (OIIL), which facilitate participation in partnerships or consortia with other HEIs, or other organizations. The number of Memoranda of Understanding (MOU) UTech, Jamaica has signed and the collaborative projects involving international partners are proxy indicators of the extent to which the institution has pursued the aforementioned strategic initiative. So, for example, for Academic Year 2017–2018, the institution signed twenty-two (22) MOUs with local and international partners. Notably, "Collaboration on research" is one of the clauses in these MOUs.

Examples

We will now cite below two examples that illustrate how UTech, Jamaica has pursued the aforementioned strategic initiative by engaging in cross-border collaborative partnerships, to build institutional research capacity and enhance curriculum development to address important challenges ranging from climate change to sustainable energy. In addition, we also discuss learning and other benefits that accrue from these cross-border partnerships.

The examples are:

1. 'The Improvement of Research & Innovation Management Capacity in Africa and the Caribbean for the Successful Stimulation and Dissemination of Research Results (RIMI4AC)' Project
2. Development of the master's degree in Sustainable Energy and Climate Change (MSECC)

'The Improvement of Research & Innovation Management Capacity in Africa and the Caribbean for the Successful Stimulation and Dissemination of Research Results (RIMI4AC)' Project

The University of Technology, Jamaica was the Caribbean partner on the European Union (EU)/African Caribbean and Pacific (ACP) funded Science and Technology project, 'The Improvement of Research & Innovation Management Capacity in Africa and the Caribbean for the Successful Stimulation and Dissemination of Research Results (RIMI4AC)'. This project was funded in the amount of €2.6 million under the Science and Technology Programme of the ACP with support from the European Union. The specific objective of this project was to strengthen the capacity of research institutions in the regions for sustainability, to effectively manage research and innovation activities, and to improve dialogue between researchers and policymakers, to inform evidence-based national and regional policies feeding into the regional sustainable development agendas of the five regions from which project partners were drawn (Dyason, 2014; Streete et. al., 2014).

The nine partners on the RIMI4AC project were: the Association of Commonwealth Universities (ACU, UK-based); Research Africa (RA, South Africa); Research and Innovation Management Services (RIMS, Belgium); Southern African Research and Innovation Management Association (SARIMA, South Africa); Stellenbosch University (SU, South Africa); University of Technology, Jamaica (UTech, Ja.); University of Botswana (UB); University of Brea (UB, Cameroon); University of Dar es Salaam (USDM, Tanzania) (Dyason, 2014; Streete et. al., 2014).

Within the framework of the RIMI4AC project, a series of capacity-building workshops and short courses were conducted, and resources were developed for research managers of the partner institutions. Additionally, a major outcome for Caribbean partners was the establishment and launch of the Caribbean Research & Innovation Management Association (CabRIMA), in October 2010 (Henry, 2011; Dyason, 2014; Streete et. al., 2014).

The mission of CabRIMA is "to support systematic improvement in the effectiveness of research and innovation management systems, structures, and processes in regional research and innovation institutions through capacity building and effective networking." And its objectives are to:

- Professionalize the research and innovation management profession in the region, raise the profile of regional Research and innovation Managers, identify training needs, and provide opportunities for continuous professional development.
- Provide a forum for networking, collaborative actions, and the transfer of know-how among Research & Innovation Managers of the region.
- Develop mechanisms for Research and innovation Managers of the region to benchmark their activities against best practices in the profession.
- Stimulate research and innovation, and support the translation of research results into policies, practices, and products beneficial to end-users.
- Influence national and regional policies that will foster the regional sustainable development agenda of CARICOM member states.
- Link regional Research & Innovation Managers with the Global Research Management Network (Henry, 2011).

The Secretariat for CabRIMA is the School of Graduate Studies, Research & Entrepreneurship, at the University of Technology, Jamaica. Since its establishment, CabRIMA's membership reflects the major higher education institutions and research organizations in Jamaica; for reasons of the geographical realities of the Caribbean islands, pan-Caribbean membership has been restricted to members from The University of the West Indies. However, to address this challenge, CabRIMA has leveraged the power of the Internet to interact with its members.

Consistent with its mission and objectives, CabRIMA has spearheaded activities aimed at building the capacity of its members to perform their functions more effectively as research and innovation managers (Henry, 2011).

In addition to their participation in the RIMI4AC project, research managers at UTech, Jamaica also engaged with the Global Research Management Network (GRMN) by participating (attending and making presentations) in congresses of the International Network of Research Management Societies (INORMS). These engagements have resulted in benefits accruing to the institution (Henry, 2011; Ivey et. al., 2014; Ivey & Henry, 2015)

The second example is the development of an innovative master's degree.

Development of the Master's Degree in Sustainable Energy and Climate Change (MSSECC)

The Caribbean Sustainable Energy and Innovation Institute (CSEII), UTech, Jamaica pioneered a Master of Science course of study in Sustainable Energy and Climate Change with the technical and financial support of the German Society for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) through CARICOM following two years of developmental work led by the university's Associate Vice President, Sustainable Energy. The concept for this specialist degree programme was premised on UTech, Jamaica's thrust to advance training in sustainable energy and climate change management throughout the Caribbean Region with a focus on innovation and entrepreneurship. Jamaica, like most of its CARICOM partners, has been overly dependent on imported fossil fuels to meet its energy needs. This energy poverty has negatively impacted these nations in realising their economic, social, and political objectives or to meet the Global Goals for Sustainable Development. The time had come for an acceleration in looking beyond petroleum to renewable energy development in the Region even as the world was facing predictions of the dire impacts of climate change especially on Small Island Developing States. In 2009, Jamaica developed its National Energy Policy 2009–2030 with its vision for a modern, efficient, diversified, and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security and supported by informed public behavior on energy issues and an appropriate policy, regulatory and institutional framework (Ministry of Energy and Mining, 2009; Potopsingh & Alcock, 2022). The development of seven sub-policies subsequently further created the opportunity for capacity building. The need for capacity was supported by the Ministry of Labour and Social Security publication on Labour Market Trends and Prospects for Employment Opportunities (2015). Research in the wider Caribbean conducted on the Technical and Professional Baseline Analysis under an Inter-American Development Bank-funded project showed the need for similar capacity building within the Caribbean region (Rademaekers et. al., 2014). New approaches would be necessary to address the nexus between energy and climate change and to create new strategies and programmes for young scientists to offer innovative solutions. The philosophy of this Master's programme would take an innovation-driven, problem-solving approach, preparing students who are responsive to the global drivers for green business development linked to climate change and sustainable energy. The Deutsche Gesellschaft

für Internationale Zusammenarbeit (GIZ), CARICOM, and CSEII conducted a Cross-Faculty Workshop in July 2015, to build the internal synergies required for the proposed programme. This was followed by dialogue with industry stakeholders to ensure the relevance of the programme to industry (Potopsingh, 2015; Potopsingh & Muir, 2019).

Understanding the Global Agenda

To gain international support for the degree, there had to be an understanding of the global agenda and particularly an alignment of the agenda and values of the countries rendering that support to the degree. Of relevance in this regard, the German Government has been at the forefront of renewable energy and has demonstrated this through its energy transformation programme *Energiewend*e (German for 'energy turnaround') (Smil, 2020).

For the Caribbean, a low-carbon emissions development strategy has been articulated by CARICOM which necessitates the training of a cadre of professionals to fulfill this strategic objective. In this respect, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)/CARICOM Renewable Energy Efficiency Technical Assistance (REETA) programme committed to capacity building in universities of which UTech, Jamaica was one of the main beneficiaries; a Memorandum of Understanding (MOU) was signed with CARICOM/GIZ REETA Project in September 2014. This cooperation focused on the following:

- Implementation of short courses at UTech, Jamaica which can articulate with the Master's Degree in Sustainable Energy and Climate Change
- Curricula development
- Linkage with other Universities and Professors for joint collaboration
- Exploration of scholarship options
- Establishment of cooperation with Industry and Private Sector
- Investigation of education material and research facilities
- Creating a guideline for future cooperation and program exchange with other institutions

Other Realties

There have been a lot of discussions on sustainable development, but insufficient focus on providing training at the tertiary level to support a sustainable future linking energy systems, climate change, urban and regional planning, building

design, natural resources management, human health or policy in a teaching environment that gears towards entrepreneurship and the development of green business out of these ideas discussed at the university in an interdisciplinary approach. Therefore, to implement the concepts and ideas of sustainable development there was an urgent need for innovation and entrepreneurship to drive green business development in the region.

Issues about renewable energy, energy efficiency, climate change management, and linking energy and climate change at the policy, regulatory, technical, environmental, socioeconomic, and political levels, are crucial for the sustainable growth and development of the Caribbean region. UTech, Jamaica, as the leading national university and a leading academic institution in the Caribbean Region, must provide the capacity building in these areas. The International Renewable Energy Agency (IRENA) (2015), an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy in its publication 'Rethinking Energy: Renewable Energy and Climate Change' highlighted some key issues which will influence international policy. These are:

- Renewable energy offers an immediate means to decarbonise the global energy mix.
- Renewable energy deployment brings economic growth and sustainable development.
- Transition to a sustainable energy future by 2030 is technically feasible and economically viable.
- Effective action against climate change calls for scaling up investments in renewable energy.

These issues are important to the crafting of new curriculum or updating existing syllabi to make learning more relevant for application.

Jamaica's Labour Force

The demographics of the Jamaican workforce show that the unemployed workforce falls between the ages of 19 and 24 (Statistical Institute of Jamaica, 2018). Training in relevant skills that will empower the youth is important, especially in an environment where traditional jobs will be hard to find and where entre-

preneurship is finding its place globally and regionally. The capacity building by tertiary institutions must take into account the potential for self-employment and the creation of new jobs. UTech, Jamaica has set the standard for entrepreneurship in its curricula. The MSSECC has a strong focus on innovation and entrepreneurship in the areas of renewable energy, climate change, and sustainability. Through collaboration with the University of Leipzig, Germany, students and lecturers in the master's programme have been exposed to the essentials of business start-ups and the opportunities in universities to realise the vast income potential from student/university generated business. The Caribbean region has not yet begun to explore such possibilities, but the foundations are being laid through this programme.

The key is to keep pushing until there is more shared knowledge on the subject and to expand the networks to look at different models. Cooperation requires an understanding of cultural differences but even as culture is considered there is now a levelling of norms and business practices which transcend borders. The understanding of business practice is becoming universal. Students need to understand the norms and mores of business practice. Speaking the same technical and business language is important to ensuring cutting-edge developments are transferable in whole or in part.

Globalisation of Curricula and Joint Research

Globalisation of curricula is becoming more common, especially in areas such as sustainable energy and climate change; another approach to achieving this is through joint research.

The research programmes at UTech, Jamaica have in the past focused on the biological sciences, but there are endless possibilities for energy, climate change, and entrepreneurship. The multi-disciplinary team approach is proving to be an effective one in universities in Northern Europe where innovation is being driven by the universities working in close collaboration with industry (Felce, 2011). Cross-faculty and cross-academic collaboration are therefore useful in the consideration of research activities. The MSECC is delivered through a collaboration agreement between the Caribbean Sustainable Energy & Innovation Institute (CSEII) and the Faculty of The Built Environment.

Innovative Approaches in Developing the Degree

In developing the master's programme, to ensure that stakeholders in the local

environment were included, a stakeholder mapping exercise was done to have strong interaction between syllabus writers, local and international partners, local government and private sector agents, and across faculties. This was done through face-to-face meetings with members across faculties and a one-day workshop which included staff from various faculties who gave their input in refining the syllabus outlines. This was another layer to ensure there was necessary engagement top down and bottom up.

Considering that many of the faculty members in attendance had an interest in the subject matters and would likely be engaged in the delivery of the modules, it was important to bridge any gaps between the European model and what exists in UTech, Jamaica. The engagement continues and steps are taken to ensure that participants especially in the workshop are kept informed through activities such as attending lectures being delivered by international experts as well as engagement in student projects and presentations.

It should be noted that international engagement continues through new contacts and networks. This has proven very fruitful as through another EU-funded project "Knowledge transfer capacity building for enhanced energy access and efficiency in the Caribbean (CAP4INNO)" on which UTech, Jamaica was a partner, new alliances were formed with the Chalmers University of Technology (Sweden) and through this collaborative project, the master's programme was further strengthened. In particular, through the application of Action Learning as the teaching and learning methodology that was introduced and reinforced via multiple local and international capacity building interactions.

Cho and Egan (2013), citing Marquardt and Banks (2010), stated that Action Learning (AL) is a process and tool that enables individuals and groups to learn while solving problems and implementing actions. Cho and Egan (2013) also identified the two central themes of Action Learning as being: "real, work-based issues" and "team learning." In the master's degree in Sustainable Energy and Climate Change that was developed and is now being delivered at UTech, Jamaica, the Action Learning approach to teaching and learning is proving to be successful from various vantage points. Student engagement and performance are assured and those who are trainers are now applying Action Learning in their praxis.

The programme has sought to differentiate itself in many ways from the traditional teacher-centric approach, and so the art and science of andragogy are deployed in interactions between students and teachers. Teacher-centricity has dogged the Caribbean region over centuries. Students are recognized as equals and are so treated. This barrier has not been fully removed but there is a better

understanding among the key actors of the dynamics which the programme seeks to achieve. In addition, support mechanisms through engagement with UTech, Jamaica faculty, international, and local partners are part of the model to build confidence in this new approach.

Core Modules in the Master's Degree

The MSSECC has been carefully designed to ensure synergism of multi-disciplinarity. The eight core modules that ensure this are:

- Sustainability of Energy Systems
- Climate Change and Sustainable Lifestyles
- Energy and Environmental Policies, Regulations and Economics
- Green Business and Green Growth
- Green Entrepreneurship and Innovation
- Bio-Based Economy
- Climate Change and Sustainable Planning
- Energy and Environmental Data Management

Research Project

The research component of a master's degree is typically a thesis. However, in this programme, the research component seeks to have students apply their learning from all the core modules and an internship experience to develop an innovative business idea linked to energy, climate change, or resource management. The project is based on sound academic investigation, ethics, and research analysis, and draws on learned skills and content. The output is a feasibility plan relevant to green business and entrepreneurship. Supervision is by strong academics with specialist knowledge in the fields of study and supported by industry authorities. The intention is that some Research projects will lead to the creation of new businesses in energy and climate resilience.

Alignment of the Degree with the Sustainable Development Goals (SDGs)

The United Nation's global goals are the key drivers for a unified global development path. The MSECC addresses all the seventeen sustainable development goals. Energy is without doubt a crucial element to achieving all the goals and since clean energy is linked to climate change mitigation, this mix will be as relevant in three decades as it is today. There are established principles defining

sustainability/sustainable development that apply to curriculum development and management (Brundtland Report, 1987).

Discussion

In a dynamic and increasingly 'borderless' world, universities and other institutions of higher learning have the opportunity to shape public policy, reform old thinking, and create new solutions to significant global challenges facing contemporary society. Engaging in collaborative partnerships to achieve these ends has been shown to have much utility. This is an approach deliberately pursued by the University of Technology, Jamaica.

Research Managers at the University of Technology, Jamaica has self-reported gaining meaningful exposure, experience, and overall building of their research management capacity from their participation in the RIMI4AC project – a capacity-building project that involved a consortium of nine partners drawn from Belgium, Europe, South Africa, Central Africa, Eastern Africa, and the Caribbean. The Research Managers have also self-reported the expansion of their professional networks internationally through engagement with the Global Research Management Network (a community of practice), in particular their attendance and participation in congresses of the International Network of Research Management Societies (INORMS).

Research Management at the University of Technology, Jamaica is a structured activity that is contributing to a growing research culture at the institution that is reflected in increased research output in the form of publications and the undertaking of research projects that have the potential to impact public policy, yield commercializable results, lead to improvement in the quality of life, and enhance human capital. In other words, UTech, Jamaica's Research Managers, and by extension, the university, have benefitted from involvement in international ('borderless') collaborative partnerships. Concerning experiences at The University of the West Indies, Rampersad (2014) reported there is growing recognition that collaboration, especially through research and mobility programmes, can advance institutional capacity building and successful knowledge transfer.

As is the case with its research agenda, UTech, Jamaica also enhanced it academic offering through international collaborative partnerships. The Master's degree in Sustainable Energy and Climate Change (MSECC) was not a mere experiment. Rather, it was deliberately designed to provide solutions to the needs of the society which may be replicated in other Small Island Developing States

and emerging economies. Other interventions in academic cooperation provide support systems to strengthen outcomes. Each environment will be different, but the principles will be the same – principles such as alignment to a global agenda for sustainability, inclusion through stakeholder action, mutual respect between student and teacher, North-South dialogue, and continuous refinement and adjustments.

Working with partners across international borders and regions can be simultaneously both exciting and daunting. Differing cultures, languages, terminologies, methodologies, and resources all affect partnerships, and present a range of complex challenges for participants and their institutions (Research Africa, 2013; Bammer, 2008); critical success factors for collaborative partnerships are trust, cooperation, and communication (European Commission, 2005; Wilson, 2013). Whenever they are effectively undertaken, the benefits (value added) of international ('borderless') collaborative partnerships include synergistic enhancement of knowledge, increased dissemination of that knowledge, the sharing of resources, and the expansion of networks.

Conclusion

The two examples cited in this paper are real-world examples of how cross-border collaborative partnerships, as a strategic initiative of UTech, Jamaica, were intentionally effectively leveraged to (a) develop an innovative Master of Science programme aimed at addressing the critical areas of sustainable energy and climate change, and (b) build the capacity of staff in its research office to more effectively perform their functions as research and innovation managers. The outcomes of these two examples have led to other collaborative partnerships and the university continues to build its capacity from them.

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Impact of Self-Reported Learning Styles Among Doctoral Students in an Online-Mediated Health Sciences Program

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Abstract

Over the past two decades, and before the COVID-19 pandemic, online delivery in higher education has increased significantly. However, if accommodated by educators, students identified self-reported learning styles can improve attitudes towards learning and increase their critical thinking skills, academic achievement, and creativity. This study aimed to identify common learning styles among students in an online doctoral program and determine their effectiveness in a distance-learning environment. It also investigated whether age groups and gender correlated with learning styles among the study respondents. The quantitative descriptive cross-sectional research design was used to conduct the study using an anonymous electronic survey consisting of 16 adapted questions from the Index of Learning Styles by Felder & Solomon (1991). Forty-nine (49) respondents aged 25 and over 61 enrolled in the online winter term of the 2014 Doctor of Health Science Program in the College of Health Care Science at Nova Southeastern University (NSU) were surveyed using purposive sampling. This study found that most respondents were self-reported verbal learners, and the older respondents indicated that their predominant learning style had changed. Compared to the self-reported visual learners, these verbal learners were 3.7 times and 1.6 times more likely to solve problems and solve them in a group, respectively. The study purported that students who enter online programs will, over time, have more than one predominant learning style. The findings of this study suggest that understanding students' learning styles can assist all stake-

holders in identifying and using the most appropriate online learning strategies to add the most value to online learners' learning experience and promote the continuous quality of online higher education.

Keywords: Online Learning, Self-Reported Learning Styles, Higher Education, Online Learning Experience, Online-Mediated Doctoral Programs

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Introduction

After the COVID-19 pandemic, the growth of online delivery in higher education has significantly increased exponentially. However, an increasing trend among online students needing to complete their courses of study on time compared to face-to-face learners continues to escalate (Shaw et al. 2016 and Riger et al. 2017). Online students encounter many disadvantages, including navigating different teaching and learning styles (Denman et al., 2018). Learning styles are cognitive, emotional, characteristic, and physiological factors that are stable indicators of how a learner perceives, interacts with, and responds to the learning environment (Yang et al., 2011). If accommodated, a student's learning style can improve attitudes toward learning and increase their thinking skills, academic achievement, and creativity (Thomas & Teras, 2014). The following factors contribute to lower online persistence rates: (a) varying degrees of mismatch between the difficulties of online courses, (b) students' academic preparation, (c) family, and (d) peer influences. Moreover, a high degree students' of self-directedness, students' adaptation to computer-mediated communication, economic factors, lack of employer and technical support, varied experience levels, and skills of faculty members in teaching online courses are some additional disadvantages affecting online students(Alarbi et al., 2018; Ames et al., 2018).

The idea that people learn differently is venerable and originated with the ancient Greeks (Bernard et al., 2009). Educators have long noticed that some students prefer specific learning methods compared to others. They have suggested that one of the first things educators can do to aid the learning process is to be aware that student populations have diverse learning styles. While educators cannot accommodate each student's learning needs, several learning opportunities must be available. Moreover, when the learning is effective for students, an increased level of user acceptance of the information will result.

Additionally, research scholars agree that learning style is a good predictor of an individual's preferred learning behaviour (Brill et al., 2014; Denman et al., 2018; Gray et al., 2015) and identified that a match between learning and teaching styles increases student achievement and satisfaction.

Therefore, online programs are structured to allow for increase user flexibility rather than many opportunities for connection and collaboration. This flexible modality can result in online doctoral students not having the opportunity to collaborate with faculty members and their peers, which can lead to the feeling of isolation, which is compounded by not having the opportunity for informal interactions which occur naturally among doctoral students who pursue their course in a face-to-face modality, thus limiting their ability to build relations. This need for more connection between students and their peers and the identification of their learning styles needs to be revised. It has been identified among scholars that social integration and belongingness are critical factors in student retention and persistence (Rovai, 2003; Pyhalto et al., 2012; Rockinson-Szapkiw, 2014 and Litalien & Guya, 2015); Shaw et al., 2016. Because of the natural isolation of online learning and the lack of seriousness in identifying students' learning styles, institutions must be proactive and intentional in supporting online learners to become socially connected to peers (Fraenza & Rye, 2021).

An advantage of this educational approach is that instructors can serve students as faculty, advisors, facilitators, and mentors (Terrell, 2002). However, these students in online learning programs may experience isolation and alienation from the institution because of their physical separation from the institution and its services and other students (Collings et al., 2014). Students' poor academic and social integration into institutional life may contribute to these feelings of alienation (Hunter & Devine, 2016). Therefore, it is imperative to reduce online students' many disadvantages, including navigating different teaching and learning approaches continuously introduced daily (Koole & Stack,2016). As a result, understanding students' learning styles can be an advantage for online students (Shaw et al., 2016).

Literature Review

Face-to-face, online, and blended approaches are the most common teaching methodologies. In the last three to four decades, several educators have proposed that teaching would be more effective if faculty members considered the differences in students' learning styles (Butler & Pinto-Zipp, 2005; Cole et al.,

2019; Carnwell, 2000; Doey & Kincaid, 2012; Felder& Silverman, 2002; Gee, 1990; Terrell, 2002 & Zacharis, 2011). The standard methods by which students learn over the years include the following: seeing and hearing, reflecting and acting, reasoning logically and intuitively, memorizing and visualizing, drawing analogies and building mathematical models (Heagney & Benson, 2017; Lenz et al., 2006).

However, the delivery format in the various educational settings was no longer constant, and the number of delivery methodologies increased exponentially, especially among graduate programs. Demonstration, discussion, emphasis on memory and the focus on principles and other applications are some strategies educators continue to use to assist students in learning (Felder, 2010; Yang et al., 2011). Therefore, it was imperative to determine how much each student learns and whether or not the teaching environment was conducive to face-to-face or online methodologies or a combination of both modalities (Felder, 2010). Students' success depends on their ability, prior experience, and preparation. However, the compatibility of the students' and instructors' learning styles plays a critical role in the outcome of the students' successes (Yang et al., 2011).

Litzinger (2007) defined learning styles as alternative ways of taking in and processing information. The concept of learning styles arose with the work of Kolb theory more than two decades ago. This learning style instrument (LSI) is credited by much research as the first to be created in the US (Cole et al ., 2019; Felder, 2002; Gee, 1990; Yang et al., 2011). Kolb's LSI measures students' learning style preferences in two bipolar dimensions. Over time, learners prefer concrete experiences when learning or engaging in abstract or conceptual analyses when acquiring skills and knowledge (Bergsteiner et al., 2010). They also may have emphasized interests in turning theory into practice, such as active experimentation, or they may have preferred to engage in reflective thinking about their experiences (Rovai, 2003).

According to Butler & Pinto-Zipp (2005) and Terrell (2002), Kolb's LSI is a cognitive learning style mode. Lakhal et al. (2020) also defined learning styles as a set of cognitive, emotional, and physiological characteristics which affect the learner's learning environment, confirmed this. Therefore, accommodating students' learning styles may improve attitudes toward learning and increase thinking skills, academic achievement, and creativity (Butler & Pinto-Zipp, 2005; Carnwell, 2000 &Terrell, 2002). Learning styles from a student's unique learning preference can aid instructors in planning small group and individualized instructions (Lakhal et al., 2020). However, Dawson (2006) suggested that educators could aid the learning process through awareness of the diverse

learning styles in the student population. Cognitive processes include storing and retrieving information in the brain, representing the learner's ways of perceiving, thinking, remembering, and problem-solving (Carnwell, 2000). Rovai (2003) showed this by using Kolb's LSI to identify predictors of high risk among community college students.

Theoretical Frameworks

At the turn of the century, experiential learning pedagogy became commonplace in developing graduate students' attributes and educational aims in many countries (deJong, 2006). This type of learning can be defined as actual learning by experience and is among the prime importance for individuals' survival in any society (Chan, 2012). Face-to-face learning and experiential learning are complementary to each other. Face-to-face learning generates theoretical knowledge inside the classroom, whereas experiential learning enables individualized experiences and skills to be developed outside the classroom (Bernard et al., 2009).

The nature of the experience was continuous and indicated that the experiential learning process was one of deep-seated importance and adult development overall (Lerners et al., 2007).

From these philosophers, Kolb, who developed the learning theory more than two decades ago, defines experiential learning as that process whereby knowledge is created through the transformation of experience, and this experience is continuous (Bergsteiner et al., 2010). Kolb's theory depicts a four-stage learning cycle: concrete experience, reflective observation, abstract conceptualization, and active experimentation (Baasanjav, 2013). The theory required the learner to experience, reflect, think, and act in a recurring process in response to the learning situation and what was learnt (Felder, 2010). When the learner actively experiences and performs, concrete experience is achieved. Through reflective observation, the learner consciously reflected and concluded from their experience (Lenz et al., 2006). Based on these implications, in the third stage of abstract conceptualization, the learner conceptualized a theory and utilized these generalizations to engage in further action and experiment with different scenarios in the final cycle of active experimentation (Dawson, 2006). The learning theory cycle is ongoing, and it involves both concrete and conceptual components, which require a variety of cognitive and affective behaviours (Carnwell, 2000).

According to Butler and Pinto-Zipp (2005), for one's learning to be fully transformed into one's understanding, the learner must engage with the components

of the learning cycle; however, the learning cycle can begin at any one of the four points as stated by Kolb, cited in Bergsteiner et al. (2010). Drawing from Kolb's learning theory, the philosopher has established the conversational learning approach, whereby learners construct meaning and transform experiences into knowledge through conversations (Felder, 2010).

The Myers-Briggs type indicator (MBTI) is another popular learning style instrument similar to Kolb's theory. This instrument measures the psychological preferences in how people perceive the world and make decisions (Rovai, 2003). The learning style theorized that there are four principal psychological functions by which individuals experience sensation, intuition, feeling, and thinking. Notably, among individuals, one of these four functions is dominant most of the time (Platisidou & Metallidou, 2008). The 1999 Felder and Solomon ILS questionnaire was widely used and accepted by educational researchers worldwide (Rovai &Wighting, 2005). This self-administered online questionnaire elicits information about how online students learn best.

The instrument promotes understanding of learning styles in a broad context, spanning the following four main categories: active, visual, verbal, or sequential learning. A (a) visual learner can be summarized as someone who prefers visual representations of presented material, such as pictures, diagrams, and flow charts. The individuals identified as (b) verbal learners preferred written and spoken explanations compared to those classified as (c) active learners. These active learners learn best by trying things out and enjoying working in groups. Individuals who utilize a linear thinking process and learn in incremental steps are considered to be (d) sequential learners (Baasanjav, 2013; Lakhal et al., 2020; Sapp & Simon, 2005; Terrell, 2002; Yang et al., 2011).

Each of the components outlined has parallels in other learning style theories; however, the combination of the components was unique to Kolb's learning styles. According to Zacharis (2011), the active component is analogous to the active component in Kolb's learning theory. Although the verbal component of ILS is aligned with the concrete component in Kolb's learning theory, the visual component is reflective and sequential to the abstract component. Successful students had lower scores on their preferences for concrete experiences than unsuccessful students (Bergsteiner et al., 2012). Individuals with higher scores on concrete experience tend to exhibit a greater sensitivity to feelings and expect to require more interactions with peers and their instructors (Dawson, 2006). Successful students also preferred to look for abstract concepts to help explain concrete experiences associated with their learning (Song, 2013). They wanted to

know "why" certain things happened in conceptual or theoretical terms (Lenz et al., 2006).

The increasing prevalence of distance educational programs calls for studying the underlying factors promoting student effort in online courses and potential differences from face-to-face teaching modality (Zacharis, 2010). The impact of learning style variables in a live teleconference distance education showed that both distance and on-campus groups were taught simultaneously by the same instructor, received identical course content, and both groups met weekly (Wang et al., 2007). The outcome showed that the influences of students' learning style preference were in the following areas: course content, course completion rates, and attitudes about learning (Lenz et al., 2006). Students in the distance learning classes who possessed a more independent and conceptual learning style had the highest average scores in all of the student achievement areas (Lakhal,2020; Heagney & Benson,2017; Baasanjav, 2013; Pigliapoca & Bogliolo, 2008).

In a distance learning program, individuals with the lowest scores in student achievement had a more social and conceptual learning style (Baasanjav, 2013; Bergsteiner et al., 2010; Yang et al., 2011). Students with social and applied learning styles performed much better in the on-campus class (Cole et al., 2019). The outcomes of the Gee (1990) study suggested that successful distance education students favour an independent learning environment, although successful on-campus students prefer working with others (Carnwell, 2000; Gee, 1990).

The correlation analysis of several online and face-to-face studies revealed that on-campus students displayed collaborative tendencies that were positively related to their needs to be competitive and to be good class citizens (Cole et al., 2019; Dawson, 2006; Pigliapoco & Bogliolo, 2008; Wang & Woo, 2007, & Zacharis, 2010). Thus, on-campus students favour collaborative styles to the extent that they help them obtain the rewards of the class. In contrast, online students were willing and able to embrace collaborative teaching styles if the instructor clarified that this was expected and gave specific instructions and guidance for meeting this expectation (Carnwell, 2000 & Zacharis, 2011). Online students were driven more by intrinsic motives and not by the reward structure of the class (Sapp & Simon, 2005; Terrell, 2002).

Research conducted by Pigliapoco and Bogliolo (2008), examined the sense of community perceived by students enrolled in different course delivery formats indicated that of the two groups (online versus traditional face-to-face courses), online students reported engaging in fewer interactions with other classmates, devoted less time to studying and expended less study effort. In the comparison

of asynchronous online and face-to-face course discussions, they found that although online students perceived the class atmosphere to be more favourable for participation by all respondents, responses often required more time to finish (Wang & Woo, 2007). In contrast, face-to-face discussions were more spontaneous and engaging, allowing multiple instant comments to co-occur (Sapp & Simon, 2005). In a similar study by Cole et al. (2019), a disproportionately higher percentage of students failed to complete the course online due to instructional ineffectiveness and a lack of belonging.

Faculty members offering traditional courses online should consider administering a learning style inventory to both their distance and traditional students before the start of each course. Knowledge of student learning preferences can aid faculty members in class preparation, designing class delivery methods, choosing appropriate technologies, and developing sensitivity to differing student learning preferences within the distance education environment (Lenz et al., 2006). Although instructors know that different learning styles exist, applying this knowledge is often inconsequential (Bergsteiner et al., 2010; Bernard et al., 2009).

Some instructors utilize various teaching activities, hoping to cover most student learning preferences. This method, though expedient, may not be the most effective or systematic way to address student-learning preferences in the classroom (Zacharis, 2010). Many instructors thought the same effective teaching methods in their traditional classroom would also work in distance learning settings (Baasanjav, 2013; Dawson, 2006; Felder, 2010). The underlying assumption is that students who enrol in distance education classes will have the same learning preferences as those in traditional classes. According to Lenz et al. (2006), teaching styles and accompanying classroom processes are like a master key and thus appropriate for any setting.

Methodology

This study utilized a quantitative descriptive cross-sectional study in an anonymous electronic survey consisting of 16 adapted questions from the Index of Learning Styles by Felder & Solomon (1991). The study respondents were graduate students enrolled in an online winter term health science doctoral program in the College of Health Care Science at NovaSoutheastern University (NSU), a private research university in the USA. The study design used was appropriate; it has been used extensively worldwide to explore students' learning styles in online

programs similar to the respondents. The research risk was minimal because it utilized a reliable, anonymous electronic survey.

Data Sources

The target study population for the research included 227 enrolled students in an online winter term of a health science doctoral program at NSU in the USA. The study population consisted of males and females between the ages of 25 and over 61 years. Graduate online students not currently registered in the winter term of the Doctor of Health Science program were excluded from participating in this study. The respondents were solicited using the purposive (non-probability) sampling technique. This technique benefited the study because all individuals enrolled in the winter term of the online program at NSU matched the inclusion criteria and had an equal probability of being a part of the final sample studied. Written permission was sought from the Director of the online health science doctoral program to place the invitation and survey's URL in the program's Student Center for all students enrolled in the winter term to participate.

Immediately following the Institutional Review Board's (IRB) approval, the Director sent an anonymous electronic invitation to each student currently enrolled in the winter term through the Program's Student Center via e-mail.

The electronic invitation contained the IRB protocol number and the anonymous electronic survey questionnaire URL. It was hosted through a secured Google Drive platform managed by the University of Technology, Jamaica's IT department, outside the country (USA) of the study site. Before the administration of the questionnaire, the increased risk of losing respondents' confidentiality moved from minimal to severe due to the respondents being required to register on UTech, Jamaica's Moodle Platform, for access to the survey questionnaire. The survey's URL was amended and resubmitted to the IRB Committee. The amended approval was granted. Forty-nine (49) respondents accessed the questionnaire by clicking on the survey's link. The electronic survey was open for ten days, allowing eligible online health science doctoral students to participate in the study. Confidentiality was maintained throughout the research process, and all information was protected with privacy and anonymity. The Google Drive that hosts the URL link for the anonymous survey stored the responses from respondents prior to coding and uploading to the statistical software for analysis. During data collection, the data's confidentiality was maintained by each student's anonymous questionnaire completion. The researcher took no

part in administering the survey link. The raw data of respondents' responses were kept in a locked drawer and computer with keys and password protected, respectively. Only the researcher had access to this information.

Data Analysis

The statistical analysis of the data was done using the SPSS 19.0 software. The results are represented using descriptive and inferential analyses to establish relationships between variables and test items. The test-retest correlation coefficient, Cronbach's alpha, and Pearson correlation coefficients were the chief statistical processes used to obtain the results that show

the reliability and validity of the ILS model used to identify the learning patterns of individuals worldwide. The instrument was evaluated for validity using Cronbach's alpha reliability scale, which revealed a coefficient of .838, above the accepted value of 0.800. Hence, the instrument was internally reliable (Field, 2009; Platsidou &Metallidou,2008). The reliability and validity findings of this study justified the claim that Felder's' ILS is a suitable instrument for assessing learning styles (Baasanjav, 2013; Sapp & Simon, 2005; Wang; Woo, 2007). Equally important, the outcome of the results from this study further confirmed that the compilation supports the claim that people learn differently, which is venerable and originated with the ancient Greeks (Bernard et al., 2009; Doey & Kincaid, 2012). Moreover, Educators have long noticed that some students prefer specific learning methods compared to others. They have suggested that one of the first things educators can do to aid the learning process is to be aware that student populations have diverse learning styles (Dawson (2006).

Findings

Characteristics of the Sample

The total number of eligible respondents was 227, but there were only 49 respondents. Of the 49 respondents, 34 (69.4%) were females, and 15 (30.6%) were males, as illustrated in Table 1 The respondents ranged in age from 25 to greater than 61, with the majority of males (66.7%) being forty-one years or older compared to the majority (46.9%) of females 40 years or younger.

Table 1. Demographic Profile of Respondents by Gender and Age Group

Category	Male		Female		Subtotal	
Age-Group*	**%**	**(N)**	**%**	**(N)**	**%**	**(N)**
25–30	6.7	1.0	15.2	5.0	12.2	6.0
31–35	13.3	2.0	15.2	5.0	14.3	7.0
36–40	13.3	2.0	24.2	8.0	20.4	10.0
41–45	13.3	2.0	12.0	4.0	12.2	6.0
46–50	13.3	2.0	18.2	6.0	16.3	8.0
51–55	20.1	3.0	6.1	2.0	10.2	5.0
56–60	6.7	1.0	6.1	2.0	6.2	3.0
>61	13.3	2.0	3.0	1.0	6.2	3.0
Missing	0.0	0.0	0.0	0.0	2.0	1.0
Total	**30.0**	**15**	**69.4**	**34**	**100**	**49**

As shown in Table 2, the highest percentage 12 (24.5%) of the respondents' academic qualifications was related to a Master of Science (MSc.) degree. An additional 10, 20.4% of the respondents' postgraduate qualifications were not listed (Other). Of the total number of respondents identified, 11 (18.3%) had a graduate qualification that was not science related.

Table 2. Academic Qualification of Respondents

Category	Male		Female		Subtotal	
Academic Qualification**	**%**	**(N)**	**%**	**(N)**	**%**	**(N)**
MA	6.7	1.0	5.9	2.0	6.1	3.0
MEd	6.7	1.0	8.8	3.0	8.2	4.0
MSc	33.4	5.0	20.6	7.0	24.5	12.0
MBA	13.3	2.0	5.9	2.0	8.1	4.0
MPH	0.0	0.0	14.7	5.0	10.2	5.0
MHS	13.3	2.0	20.6	7.0	18.4	9.0
MPA	13.3	2.0	0.0	0.0	4.1	2.0
Other	13.3	2.0	23.5	8.0	20.4	10.0
Total	**100.0**	**15.0**	**100.0**	**34.0**	**100.0**	**49.0**

Table 3. Number of Credits Completed by Respondents

Category	Male		Female		Subtotal	
Credits	**%**	**(N)**	**%**	**(N)**	**%**	**(N)**
1-10	26.7	4.0	29.4	10.0	28.6	14.0
11-20	13.3	2.0	8.8	3.0	10.2	5.0
21-30	6.7	1.0	14.7	5.0	12.2	6.0
31-40	6.7	1.0	5.9	2.0	6.1	3.0
41-50	6.7	1.0	17.7	6.0	14.3	7.0
>51	33.2	5.0	23.5	8.0	26.5	13.0
Missing	6.7	1.0	0.0	0	2.1	1.0
Total	**100**	**15.0**	**100.0**	**34.0**	**100**	**49.0**

Each respondent must complete the online doctoral program successfully with 55 credits. Among the 49 respondents, 14 (28.6%) of students completed a maximum of 10 credits, as shown in Table 3, compared to 13 (26.5%) of students who completed more than 51 credits. More than 16 (32.7%) of the respondents had completed between 21 and 50 credits.

The 16 survey items were analyzed with at least four survey questions representing each learning style, as shown in Figure 4. All respondents were distributed among one of the four learning styles. However, the most extensive distribution, 25 (51.0%) of the respondents, was observed to be verbal learners, but the smallest 3 (6.1%), were active learners. Four per cent (4%) of the respondents had more than one learning style (visual and verbal).

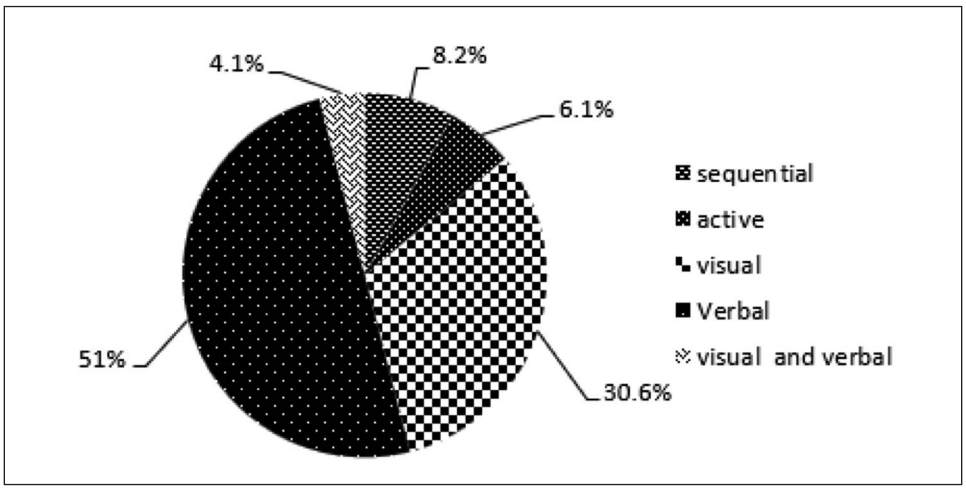

Figure 4. Preferred Learning Styles of Respondents

Among the learning styles distributed by gender in Table 4, 6(40.0%) and 19 (55.9%) of the male and female respondents, respectively, were verbal learners. Visual learning was the second most prevalent learning style among the respondents, accounting for five (33.3%) and 10 (29.4%) males and females, respectively.

Table 4. Learning Style of Respondents by Gender

	Male		Female		Sub Total	
Learning Styles	**%**	**(N)**	**%**	**(N)**	**%**	**(N)**
Active	6.7	1.0	5.9	2.0	6.1	3.0
Visual	33.3	5.0	29.4	10.0	30.6	15.0
Verbal	40.0	6.0	55.9	19.0	51.0	25.0
Sequential	13.3	2.0	5.9	2.0	8.2	4.0
Visual and Verbal	6.7	1.0	2.9	1.0	4.1	2.0
Total	**100.0**	**15.0**	**100.0**	**34.0**	**100.0**	**49.0**

As shown in Table 5, 31 (63.3%) respondents indicated that they understood something better after trying it out, compared to 18 (36.7%) of the respondents who preferred to think something through. The most significant respondents, 13 (41.9%), were visual and verbal learners. These respondents were willing to try something out when given a task. On the other hand, for verbal learners, 12 (66.7%) understood something better when they thought it through.

Table 5. Effect of Learning Styles on Learning Outcomes in Understanding Something Better

Variables	**Learning Styles**				**Total**	
	Active	**Visual**	**Verbal**	**Sequential**	**(N)**	**%**
Understanding something better after I: try it out	3.0	13.0	13.0	2.0	31.0	63.3
think it through	0.0	2.0	12.0	2.0	18.0	36.7

The highest percentage of visual learners was 12 (80.0%) of respondents whose preferred way to obtain new information was via pictures, diagrams, graphs, or maps (see Table 6). In contrast, 24 (75.0%) was the highest percentage among verbal learners who preferred written directions or verbal information.

Table 6. Effect of Learning Styles on Learning Outcomes in Obtaining New Information

Variables	Learning Styles				Total	
	Active	Visual	Verbal	Sequential	(N)	%
I prefer to get new information in:						
a. pictures, diagrams, graphs or maps	2.0	12.0	1.0	0.0	15.0	31.9
b. written directions or verbal information.	1.0	3.0	24.0	4.0	32.0	68.1

In the follow-up question illustrated in Table 7, there was a slight difference among verbal learners for either or both responses to the questions. These self-reported verbal learners indicated that once they understood all the parts, they eventually understood the whole and saw how the parts fit. The self-reported verbal learners responded more positively, 14 (66.7%) and 11 (42.3%), respectively, to both questions, and the visual learners had the highest percentage, 12 (46.2%), for understanding the whole thing. They will eventually see how the parts fit.

Table 7. Effect of Learning Styles on Learning Outcomes in Understanding Information

Variables	Learning Styles				Total	
	Active	Visual	Verbal	Sequential	(N)	%
Once I understand:						
a. all the parts, I understand the whole	1.0	3.0	14.0	3.0	21.0	44.7
b. the whole, I see how the parts fit.	2.0	12.0	11.0	1.0	26.0	55.3

When the respondents worked on complex materials in a study group (see Table 8), 18 (58.0%) self-reported verbal learners actively contributed their ideas. Nine (29.0%) self-reported visual learners followed self-reported verbal learners. Responses seen by the self-reported verbal learners, 7(43.8%), and visual learners, 6 (37.5%), showed that these individuals usually sit back and listen rather than contribute their ideas.

Table 8. Effect of Respondents' Preferred Learning Styles on Learning Outcomes in a Study Group

Variables	Learning Styles				Total	
	Active	Visual	Verbal	Sequential	(N)	%
In a study group working on complex material, I am more likely to: Jump in and contribute ideas	2.0	9.0	18.0	2.0	31.0	66.0
Sit back and listen	1.0	6.0	7.0	2.0	16.0	34.0

As shown in Table 9, the 25 to 50 age group preferred it when the professor explained information and laid out the materials in sequential steps. The 36 to 40 age group had the largest number (13) of responses to both questions. The most compelling evidence is that as the respondents aged, they became less dependent on the professor.

Table 9. Respondents' Perception by Age Groups on how Professors' delivery mode affects their Learning.

Age-Group	Spending a lot of time explaining	Lay out the material in clear sequential steps	
	(N)	(N)	Total
25–30	4.0	6.0	10.0
31–35	6.0	6.0	12.0
36–40	6.0	7.0	13.0
41–45	6.0	4.0	10.0
46–50	6.0	5.0	11.0
51–55	3.0	3.0	6.0
56–60	1.0	2.0	3.0
>61	3.0	2.0	5.0
Missing	0.0	1.0	1.0
Total	**35.0**	**36.0**	

The results of the survey question in Table 10, " When I see a diagram or sketch in class, I am more likely to remember the information as a picture or what the professor said about it, " indicated that approximately 30 (61.2%) of respondents reported being more likely to remember information when shown in a pictorial form.

On the other hand, 19 respondents (38.8%) indicated that they were more likely to remember what the professor said about the diagram or sketch than the infor-

mation presented in a pictorial form. Across all age groups, most respondents indicated that they would remember the picture and the professor's words. This included 20% of the respondents from the 36 to 40 age group.

Table 10. Respondents 'Perception of Diagrams or Sketch in the Classroom done by the professor

Age-Group	Perception		
	Picture	What the Instructor said about it	Total
25–30	5.0	1.0	6.0
31–35	7.0	0.0	7.0
36–40	6.0	4.0	10.0
41–45	3.0	3.0	6.0
46–50	5.0	3.0	8.0
51–55	1.0	4.0	5.0
56–60	2.0	1.0	3.0
>61	0.0	3.0	3.0
Missing	1.0	0.0	1.0
Total	**30.0**	**19.0**	**49.0**

The Spearman's Correlation in Table 11 revealed a strong relationship between age group and learning styles, resulting in a significant *p*-value of .000 (Salkind, 2011). The correlation between age group and learning styles was significant, $r = 1$ (Salkind, 2011). This was indicated by *a p-value* of 0.044. The relationship between age groups and learning style fits the 95% confidence interval. A significant negative correlation between age groups and learning styles exists.

This means that older respondents expressed one preferred learning style as opposed to the younger respondents in the study. The respondents' age group and learning styles were negatively correlated, $r(47) = -.288$, $p = .044$ (Field, 2009). There is a 0.08 variance that accounts for other variables, such as after individual learning styles are known and how long it will take the learner to adapt to improve his or her academic performance. This indicates that the 8% variable in respondents' learning styles can be explained by the variance in the respondents' age and gender. Even though the correlation of -.288 is strong, 92% of the respondents' preferred learning style cannot be explained.

Table 11. Correlation of Age, Gender, and Learning Styles among Respondents

Items	Spearman's Correlation Coefficients		
	Age Group	Gender	Learning Styles
Age group			
CC	1	-.059	-288*
Sig. N	49	686	.044
Gender			
CC	-.059	1	.051
Sig. N	.686	49	.728
Learning styles			
CC	-288*	.051	1
Sig. N	.044	.728	49

*. Correlation is significant at the 0.05 level (2-tailed)

The self-reported verbal learners illustrated in Table 12 had the most significant 25 (51.0%) responses of the 49 respondents to solving problems in a group. In comparison, the highest number of self-reported verbal learners preferred to solve problems via steps in the solution process. Although self-reported visual learners were the next highest, 15 (30.6%) of the 49 respondents preferred to be a part of a group to solve problems, and the majority, 12 (41.4%) of 29 responders, indicated that they preferred to solve problems in groups via steps in the solution process.

The chi-square analysis (X^2=32.470; p =0.000) revealed a significant relationship between group problem-solving and learning styles. This suggested that approximately four (8.2%) respondents indicated that a solution's possible consequences or application was likely related to a wide range of areas.

Table 12. Respondents Perception on The Effect of Learning Styles on Solving Problems in a Group

Learning Styles	Steps in the solution process	Possible consequences or application of solution in a wide range of areas	Total
Active	0	3	3
Visual	12	3	15
Verbal	14	11	25
Sequential	3	1	4
Visual and Verbal	0	1	1
Missing	0	1	1
Total	**29**	**20**	**49**

$X^2 = 32.470; p = 0.000$

The self-reported verbal learners, 13(52.0%), illustrated in Table 13, preferred to start at different parts when writing a paper instead of at the beginning, 12(48.0%). The majority, 28(57.1%) of the respondents represented all the learning styles and preferred to start at different parts of the paper instead of at the beginning, 21(42.9%). Self-reported sequential learners did not prefer starting at the beginning or different parts of the paper.

Table 13. Respondents Perception on The Effect of Learning Styles and Writing a Paper

Learning Styles	Beginning of the paper	Different parts of the paper	Total
Active	0	3	3
Visual	7	8	15
Verbal	12	13	25
Sequential	2	2	4
Visual and Verbal	0	2	2
Total	**21**	**28**	**49**

Cronbach's alpha reliability scale revealed a coefficient of .838, above the accepted value of 0.8 (see Figure 5), indicating that the survey instrument was internally reliable (Field, 2009).

Cronbach's Alpha	N of Items
.838	17

Figure 5. SPSS Output for the Reliability Analysis of all Variables

Discussion

The demographic profile of the respondents reflected a higher percentage of females (46.9%) compared to males (33.3%) in this study. These females were found in the younger age groups compared to the males. In this study, most males were older than 41 years in contrast to their female counterparts, who were considerably younger, 40 years and younger (Rovai, 2003). All respondents had a graduate degree. However, most respondents' master's degrees were related to health science. Most respondents fell in at least one of the four main learning styles assessed: visual, active, verbal, or sequential. The most extensive distribution among the respondents' learning styles was a 20.4% difference, indicating that

most respondents had one dominant self-reported or preferred learning style. Most respondents in the self-reported survey (51.0%) were self-identified as verbal learners, with a distribution rate of 40.0% males and 55.9% females, respectively.

Among the respondents, 25 (51.0%) were identified as self-reported verbal learners. These learners preferred written directions or verbal information when obtaining new information (Cole et al., 2019; Felder, 2002 & 2010) compared to 12 (25.0%) of the respondents were self-reported active, visual, or sequential learners (Bulter & Pinto-Zipp, 2005). A similar trend was seen among the respondents when trying to understand something better, they preferred to think it through and try it out. While this study found that most respondents were self-reported visual and verbal learners, respectively (Felder &Terrell, 2002), the teaching strategies in these settings are that of verbal learners.

On the other hand, the second 15 (30.6%) most considerably preferred learning style identified among the respondents were self-reported visual learners. These self-reported visual learners expressed a high preference similar to the self-reported verbal learners when asked how they understand something better. The study's self-reported visual and verbal learners indicated that after trying something out, they would understand it better than thinking it through. It should be noted that self-reported visual learners were less likely to jump in and contribute ideas when working on a complex matter in a study group compared to the self-reported verbal learners, who were three times more likely to jump in and contribute ideas when working on a complex matter in a study group. This finding, substantiated by Doey and Kincaid (2012), showed that 50% of students retained what they saw and heard. At the same time, while one predominant learning style was identified among the respondents, as the need arises for students to complete and understand a learning objective, a secondary learning style is utilized in conjunction with the primary learning style.

The self-reported visual learners are most interested in learning new information through pictures, graphs, diagrams, and maps. Among the self-reported verbal learners, a more significant percentage of the respondents preferred written directions or verbal information when obtaining new information. Regarding the effects of learning styles on virtual classroom behaviour, the study respondents in the 25 to 50 age group preferred it when the professor spent much time explaining information and laying out the materials in precise sequential steps. The findings revealed that among the older respondents, there was a shift in their learning styles, and they were less dependent on professors and more on their understanding of the materials (de Jong, 2006).

Among the respondents in the 36 to 40 age group, they relied more heavily on a picture than what the instructor had to say in analyzing a picture the professor gave. Older respondents relied more on what the professors had to say about the picture. The findings of this study revealed that among the study's older respondents, their learning styles changed to one preferred style. The self-reported verbal learners had the most significant responses to solving problems in a group. However, the highest number of self-reported verbal learners preferred to solve problems via steps in the solution process compared to thinking of the possible consequences or application of the solution in a wide range of areas. Although the self-reported visual learners were the next highest group among the respondents to solve problems using the steps of the solution process, the majority preferred to solve problems in groups via steps in the solution process.

Self-reported verbal learners, followed by self-reported visual learners, preferred to start at different parts of writing a paper and arrange the parts in order instead of starting at the beginning. Although the self-reported verbal learners preferred to start either at the beginning or at different parts when writing the paper, most respondents, representing all the learning styles, preferred to start at different parts of the paper instead of the beginning. On the other hand, self-reported sequential learners did not prefer starting at the beginning or different parts of the paper.

In this instance, the findings revealed a significant relationship between group problem-solving and self-reported learning styles. This suggested that self-reported verbal learners were 1.6 times more likely to solve problems in a group when compared to self-reported visual learners. The self-reported visual learners preferred to use steps in the solution process rather than using possible consequences or application of a solution in a wide range of areas. Regarding the possible consequences or application of the solution in many areas, the self-reported verbal learners were 3.7 times more likely to solve problems this way than self-reported visual learners. While this study found no relationship between gender and age groups, it did identify a strong and significant correlation between age groups and self-reported learning styles. This means that older respondents indicated that their learning styles changed.

Identifying different predictive patterns of students' self-reported learning styles in online doctoral programs suggested the need for instructional differentiation of the increasingly popular online education doctoral programs was critical. The study results suggested that female and male students participate and respond to online courses differently. More importantly, their self-reported learning style

changed among older respondents. Therefore, as the Internet and online training programs become more critical and time-sensitive and form an integral part of student's lives and education, the need to determine its effectiveness, as an instructional medium to address diverse educational needs drives and stretchs educators to examine learner variables which seems to influence student success in online educational environments.

Conclusion

Although many consider learning styles to be one of the main success factors, a long way remains to go to understand the diversification of learning styles, especially among online graduate students. The findings of this research indicate that older respondents indicated one preferred learning style. As such, the implications for designing proper learning activities for online students are clear, and adjustments should be made where necessary. The online environment is an exclusive instructional channel, which can cause disengagement among students in virtual learning environments. Therefore, it has become a compelling issue for instructors to understand the learning engagement of students in an online or distance environment and the factors contributing to student effort expenditure, which may differ from traditional face-to-face courses (Yang et al., 2011).

Some similarities exist in how students in the online and face-to-face modalities process information because the online teaching modality is a successor. Although some of the same learning activities were designed and utilized in both learning environments, online instructors must observe priority to make the courses more valuable and exciting. This will assist the promotion of students' efforts, allowing the instructors to become more aware of learners' differences, including gender issues and team learning orientations, which may contribute to the betterment of distance education programs. Understanding students' learning styles can assist both students and instructors in identifying and using the most appropriate online learning strategies to add the most value to the learning experience. Therefore, to ensure that online educators remain committed to the education of their students and the structural and revenue advantages for any university, online professors must ensure that more students in a distance learning environment can thrive and survive.

Consequently, recognizing and reflecting on benchmarking guidelines for online-mediated doctoral programs is imperative for promoting continuous quality in higher education. Careful attention must be given to partnerships

that promotes the adaptation of best practices of pedagogy. This will increase the potential for quality to be maintained and enhanced as new academic programs increasingly move to Internet-based delivery models. Equally, seeking students' feedback to assess the professional socialization aspects of higher education provides another significant dimension to online program evaluation reviews. Prior to now, there were impossible geographical and quality barriers to online doctoral programs. However, in the last few years, there has been a change in thinking about accessing high-quality online academic experiences in higher education, leading to a terminal degree. For that same reason, the program evaluation matrix and evaluative feedback are critical tandem components to monitoring best practice approaches of Internet-based doctoral education. Simply put, increased access to online doctoral education and the understanding of self-reported learning styles among students and avoiding the removal of faculty members from the workforce are imperative to preparing healthcare professionals for the 21st century and beyond.

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The Impact of The COVID-19 Pandemic on The Teaching and Learning Process at a Rural Tertiary Institution

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Abstract

The COVID-19 pandemic changed the landscape of Jamaica's economy, health, and education system. This study aimed to assess its impact on lecturers and students at a rural tertiary institution in Western Jamaica. The current study is a mixed-method design, and the case study research method was utilized to collect data. A representative sample of 18 lecturers and 129 students was surveyed using an online Google form questionnaire employing convenience sampling. The findings showed that Broadband Internet from a leading local service provider was mostly utilized by students (55.2%) and lecturers (88.2%). The internet portal mostly used was Schoology (43.8%); 23.5 % of lecturers disclosed it was their first time teaching online and 52.9% reported having received prior training on how to use an online platform. Of the students, 43.9% reiterated that they appreciated using the web portal Zoom as against Moodle which saw 27.3%. 54.7% of the students preferred face-to-face in comparison to online (22.7%) and 22.7% favoured the blended approach. Students reported challenges returning to school due to fear of COVID-19 (27.2%) underlying ailments (18.4%), financial challenges (44%) and other challenges (10.4%). Statistical analysis showed that there was no significant difference between students' overall performance between courses taught during the pandemic and pre-COVID-19 (p=.551). The COVID-19 pandemic significantly impacted the teaching and learning process at the institution. However, with the implementation of online portals, training, access and upgrade to Internet service, lecturers and students were adapting to

the virtual classroom. The paper gives recommendations towards embracing the digital transformation.

Keywords: COVID-19 Pandemic, Online Teaching and Learning, Virtual Classroom

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Introduction

Jamaica announced its first case of COVID-19 on March 10, 2020; this swiftly impacted every area of our lives – it impacted our economy, health, and education sector. It had a debilitating effect on the education system, as the education system was not prepared for this catastrophic event. On March 18, 2020, the Ministry of Education Youth and Information (MOEYI) announced a full lockdown of all public schools in Jamaica. The institution under study, was proactive in following the mandate issued by the government under the Disaster Risk Management Act (DRMA). The students had completed about 10 weeks of Face-to-Face (F2F) classes but owing to the mandate the institution had to follow suit and moved its delivery modality to online and distance education, using such tools as Schoology, Moodle, and Google Classroom.

The MOEYI also started to have partnerships with telecom companies to improve network coverage Island-wide, especially in rural communities. The institution had not commenced its formal online or blended learning system and procedures. What existed before COVID-19 was an informal process that included individual lecturers blending his or her F2F course with a small component of online synchronous or asynchronous content which was evident predominantly in the Information and Communications Technology (ICT) department due to the nature of many of the courses delivered by its lecturers. In contrast, the other departments (mathematics and science, language, business, education and visual and the performing arts, social studies and history) used online content as support for their regular F2F classes. Graham (2009) posits that blended learning takes place at four (4) levels: activity, course, programme or institutional. The lecturers were using the activity and course levels in their teaching and learning processes.

The college administration was also mobilized to upgrade the ICT infrastructure of the College and acquired additional computer devices to accommodate the shift from F2F to online. The college understands the strategic significance of providing effective ICT resources and support but at the same time must be

cognizant of the "old wine in new wineskin or new bottles" design. Bates (2019) noted that when transforming to online teaching and learning, a critical analysis must be done to ensure that one does not move the "old classroom techniques" to online/blended learning. The college has started the journey but requires deliberate strategic focus and resources to transform into the digital educational environment of 21st-century tertiary institutions. Furthermore, a COVID-19 steering committee was organized at the College to assess the available resources and to prepare the College for the new protocols from the Ministry of Health and Wellness under the DRMA.

Purpose

The purpose of this study was to:

1. Describe the impact of the COVID-19 pandemic on the teaching and learning process at a tertiary institution in rural Jamaica.
2. Provide an analytical description of the college's experiences, lessons learned and the adaptation of lecturers and students to the e-learning environment.
3. Offer recommendations or solutions to mitigate the challenges identified and highlight the opportunities for teaching, learning and innovation in the post-pandemic education era.

Research Questions

1. What was the impact of the COVID-19 pandemic on the teaching and learning process?
2. How did the pre-training activities in Schoology & Moodle prepare students and lecturers for transitioning to online teaching & learning?
3. What solutions were implemented to mitigate the challenges experienced?

Significance and Relevance of the Study

This study will assist the college in the strategic planning of the integration of technology in the teaching and learning process. It will also guide the development, management, and usage of web portals at the college. More so, it seeks to implement strategies for change management in an e-learning environment and highlight the critical need for an increase in the training of educators and students in using e-learning. Additionally, the study endeavours to accentuate the need for digital literacy skills and to underline best practices in alternative assessments.

Literature Review

This literature review seeks to shed light on the various dimensions through which the pandemic has influenced the education sector and more so the tertiary sector. It will explore the multifaceted impact of the COVID-19 pandemic on teaching and learning globally, regionally and nationally.

Global Findings

Based on medical research, there was a global consensus among infectious disease specialists and public health officials to limit face-to-face (F2F) classes as a means of protecting the students and the community at large from the spread of the pandemic (Murphy, 2020). Bacow (2020) indicated that the extraordinary preventive measures that have been taken in most higher education institutions to limit exposure to the pandemic will essentially change the ordinary way that classes take place. In addition, Blumenstyk (2020) argued that global crises such as the COVID-19 pandemic would prompt colleges and universities to stop distinguishing between classroom and online programmes. UNESCO reports showed that more than 1.5 billion students in about 165 countries were affected by the lockdown of schools and campuses. As a result, schools, colleges, and universities were forced to shift in some way or another to online learning as a replacement for on-site delivery. This immediate transformation to online modality posed challenges to both lecturers and students. Some of these included economic, psychological and technological with lower enrolment, disruption to traditional teaching methodologies and the loss of face-to-face interactions with peers and lecturers.

Caribbean Region Findings

The Inter-American Development Bank (IDB) published an article in 2020 entitled, "Caribbean Tertiary Institutions and the Impact of the COVID-19 Pandemic" noted the three main challenges revolved around economic challenges to institutions and students, technological challenges and delivery of courses, as well as the effect of great uncertainty on lecturers and students alike. The article highlighted that tertiary institutions had insufficient technological infrastructure to shift to online teaching and learning; the critical need for staff training in digital tools; the well-documented digital divide was highly noticeable among lecturers and

students and the psychological effects of the pandemic were stressful to both lecturers and students.

National Findings

According to Thorpe (2020 as cited in Advertorial, 2020), the pandemic forced many institutions to quickly adopt digital technology. He expounded further that although 'painstaking' the education sector must embrace the change. This acceptance, I believe, will be dependent on teachers' attitudes. Al-Zaidiyeen et al (2010) asserted that teachers with positive attitudes toward ICT are more likely to use blended learning. Notwithstanding, online learning poses various challenges as opposed to traditional learning. For example, Onyefulu & Roofe (2019) empirical analyses revealed that unavailability of face-to-face interaction, lack of knowledge of how to use the technology, problems with internet connectivity and power outages, lack of access to the internet, lack of technical support, problems with time management and meeting deadlines, very demanding, vague instructions, large discussion groups, and no follow up by lectures/ opportunities for probing were the challenges in-services teachers at a tertiary institution in Jamaica reported that they had with online learning. Dunn (2020 as cited in Advertorial, 2020) postulated that for the national implementation of an integrated system of remote and virtual digital education to be effective the government would have to implement a policy commitment that is differentiated to the needs of all stakeholders.

The disadvantages of blended learning presented by Onyefulu & Roofe (2019) were reported before the COVID-19 pandemic in 2020; it is warranted to do this study during the time of a global crisis to gain insight into lecturers' and students' perceptions of hybrid learning at a rural tertiary institution, as well as to ascertain the response of the institution's administrators and Jamaica's government to digital transformation.

Methodology

This study was conducted using the mixed-method research design. According to Creswell (2013), quantitative and qualitative data can be collected to complement each other rather than using either method by itself. The research method used was a case study (Creswell, 2014), which served the purpose of highlighting the effect of a global pandemic on education.

An online Google form questionnaire was used as the instrument to collect the data since it is a convenient tool for conducting web-based surveys and it is also a free software. The questionnaire consisted of 21 questions (open-ended and closed-ended). The questions evaluated the effect of COVID-19 on the teaching and learning process, the most effective teaching platform, evaluation of the theoretical and practical aspects of teaching and learning, challenges encountered in online learning and recommendations to improve the teaching and learning process in the virtual classroom.

The rated instrument was based on Theall, Franklin & Cashin (1990) and Davis (1993); a 5-point Likert Scale was utilized. Lecturers and students were invited to participate via email. A total of 18 lecturers and 129 students responded to the survey.

Statistical Analysis

To measure the effect of COVID-19 on the academic performance of the students, data were exported and analysed using SPSS version 20.0 (IBM Corporation). A paired t-test was used to do a comparative analysis between the pass rate achieved in twenty (20) different courses offered during the pandemic and pre-COVID-19 for the first semesters. These 20 courses were from all departments for both the Teachers' Colleges of Jamaica (TCJ) and Council of Community Colleges of Jamaica (CCCJ) final assessments.

Ethical Considerations

Ethical clearance was received to conduct the research at the institution. The invitation to fill out the questionnaire was sent to all lecturers and students regardless of age, sex, colour or religious persuasion to provide a more robust level of equity and randomness in the responses. There were no incentives offered to the participants and their participation was voluntary. Implied consent was obtained once the participant attempted the survey. The data collected was held in the strictest of privacy and confidentiality.

Results

The study included responses from 129 students and 18 lecturers. It investigated the impacts on students' performances in selected courses across the three faculties

for the same lecturers who taught these courses between semester one 2019 and 2020. Online satisfaction surveys of lecturers and students, IT infrastructure audits before and during COVID-19, comparative analysis of course grades and an analysis of students' attendance for online classes during COVID-19 were used to generate data about the institution's experience during the pandemic.

The current study showed that a vast majority of the lecturers had limited experience with online teaching (Figure A1). Approximately 50% of the lecturers had previous training with online teaching and learning before the onset of the pandemic (Figure A2), therefore, the institution had facilitators from the IT department and other personnel come to train both lecturers and students on how to use different online portals in the teaching and learning process. Our data show that Zoom had the highest preference in the students' online learning (Figure A3). It has been reported that Zoom, Google Meet, Microsoft Teams and WebEx have been used widely in online teaching since the pandemic (Chong et al., 2020). Students were less satisfied with the effectiveness of the online platforms used (Figure A4) compared to lecturers who indicated that they were very satisfied with the platforms (Figure A5). This, therefore, means that lecturers had higher satisfaction with the online/blended teaching and learning process than students. These results confirm the disparities experienced between lecturers and students due to the impact of the pandemic and that, in reviewing the institution transformation to online/blended learning, greater attention and resources must be considered to support lecturers and students but with the students at the center. Notwithstanding, the vast development in communication and information technology has impacted the delivery and quality of teaching and learning. According to Negi et al. (2011), virtual classrooms and instructors have replaced traditional classrooms in several university courses worldwide. Lecturers reported that this way of teaching is engaging, flexible, accessible, easy to use and offers a wide range of teaching tools (Figure A6). Based on Avila et al. (2013), this novel way of teaching has also been welcomed by most students due to its flexibility, convenience and lower cost.

The new norm of teaching and learning also has its challenges. The most common problems reported included the availability of Internet, especially in rural areas, the speed and cost of Internet service, power outages, lack of electronic devices to access the Internet, lack of interaction between lecturers and students, communication barriers and challenges in doing a formative or summative assessment of students (Figure A7, A8). Xu & Xu (2019) suggested that unequal access to computers and the Internet alters the effectiveness of online learning.

The challenges imposed by this digital divide also negatively impacted students' class attendance. 1–3 students reported being absent ≥10 times due to some of the challenges listed (Table A1). 52.7% of students reported having had practical courses. Students doing practical courses were also challenged in getting to do the hands-on practicals that generally enhance their learning or expose them to real-life situations. The alternatives to doing their practical or labs F2F were YouTube (12.3%), virtual lab (6.8%), using materials and equipment found in and around their home (60.3%) and other means (20.5%). A total of 22.2% reported that the alternative lab was effective and 5.6% found it extremely effective. Virtual resources to mimic the laboratory, using interactive tools, such as videos and 3D animation have replaced most of the practical lessons in the virtual classroom.

The institution was proactive and promptly alleviated some of these inequalities/challenges. To examine the response of the institution to this disruptive thrust to online/blended teaching and learning, an audit of the information communication technologies (ICTs) infrastructures and resources was done by the research team before and during the pandemic (Table A2). This audit was conducted to evaluate ICT infrastructures and resources available to lecturers and students. The evidence from the audit indicated that there were significant improvements to the college's ICT infrastructure and resources. Additional bandwidth, tablets and laptops, smart boards, Wi-Fi access points, smart classrooms and online learning platforms were purchased by the college to support the online/blended learning shift. Professional development and training activities were conducted internally and externally for lecturers and students in using the different platforms for teaching and learning. This was a positive approach to the online/blended learning shift even though a small number of lecturers and students came onsite to use these additional ICT resources. This was due to the distance and cost involved in coming onsite. This overall improvement in the ICT infrastructure impacted both students and lecturers positively where the level of satisfaction increased by four percent (4%) between 2020 and 2021.

How does education in the virtual classroom impact students' performance? Bettinger et al. (2017), posited that taking online courses has a negative effect on students; a reduction in students' progress and success has been reported to be associated with taking online college courses instead of traditional in-person courses. On this basis, the researchers conducted statistical analysis (paired t-test) to compare the final grades achieved in twenty (20) different courses offered during the pandemic and pre-COVID-19 period for the first semesters (Table A3). These 20 courses were from all departments for both TCJ and CCCJ final assessment.

The comparative analysis showed that there was no significant difference between students' overall performance (grades) between F2F and online/blended modalities of the same courses taught during the pandemic and pre-COVID-19 (p=.551). This result is like previous studies conducted in other jurisdictions before the pandemic in 2019, indicating no significant difference in students' grades between F2F and online/blended courses (Paul & Jefferson, 2019). This research did not consider demographics or other learning performance variables in the results for the comparable semesters. However, despite the sudden thrust to online/blended modality, ICT infrastructure and access issues, plus limited competency in online/blended facilitating; students' performance in terms of semester one grades pre-COVID-19 and during the pandemic was not impacted.

The analysis of responses showed a positive attitude by both lecturers and students to the sudden shift to online/blended teaching and learning for the semesters of 2020 and 2021. Most of the lecturers reported that they were satisfied with the online teaching and learning process (Figure A9). Fifty-three percent (53%) of students indicated in 2020 that they preferred the blended modality of teaching and learning, then (31%) F2F and lastly, (16%) fully online. A follow-up survey in 2021 showed a dramatic reversal with fifty-five (55%) percent preferring F2F, blended learning (22.7%) and fully online learning (22.7%). This flip in learning preference was after experiencing online/blended for one year. This has brought to the forefront the digital inequality between lecturers and students with those who have a reliable Internet connection, sufficient bandwidth, financial resources, access to computer devices, etc, especially in the deep-rural and rural communities served by the institution. Online learning should, therefore, be considered as an alternative and effective modality of teaching rather than a substitute for the traditional F2F classroom. Nguyen (2015) purported that literature have presented strong evidence to suggest that online learning is at least as effective as traditional learning.

Conclusions

COVID-19 had a tremendous impact on the teaching and learning process at the rural tertiary institution. However, with the implementation of online learning platforms, training, access, and upgrades to Internet services, lecturers and students are adapting to the virtual classroom. Lecturers' and students' views differ on the online teaching and learning process. Students indicated a preference for blended learning as opposed to fully online. Some of the challenges encountered

were unreliable and unaffordable access to Internet service, financial constraints for the students and the college, and an unsuitable learning environment. There is, therefore, an opportunity for more in-depth and qualitative research on the impact of the COVID-19 pandemic on education on a larger scale of population and sample size.

Recommendations

1he transformative and disruptive thrust caused by COVID-19 will impact the college's organisational and corporate structure. Therefore, as the college continues its journey to fully online courses, the recommendations are:

1. Technical personnel should be put in place to manage the ICT transformation, online pedagogical expertise and 24/7 support to lecturers and students.
2. Continuous improvement in communication/ feedback between lecturers and students.
3. Continuous training and research.
4. Increased blended learning modality and both synchronous and asynchronous should be incorporated into the online teaching and learning process.
5. Champions/change agents/ influencers for online teaching and learning should be engaged.
6. Administrators and the entire College stakeholders should invest in the transformation of the tertiary institution to a digital educational environment.
7. Use the shift to e-learning as an opportunity to embed marketing strategies to increase enrolment in the College by giving access to more students who may be desirous of studying online from anywhere in the world.
8. The institution must also focus on shifting resources to support online teaching and learning.
9. Partnerships should be forged with future-ready Internet Service Providers (ISPs) to give increased and quick Internet access, especially in rural areas.
10. Partnership with MOEYI, ISPs and other universities that are more advanced in online teaching and learning is also a necessity for the College to further develop in blended learning modality.

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Appendices

Table A1. Students Absent from Classes due to Challenges Faced by the Pandemic

Course	Semester	# Of Students	Ab 1x/	Ab 2xs	Ab 3xs	Ab 4xs	Ab 5xs	Ab 6xs	Ab 7xs	Ab 8xs	Ab 9xs	Ab 10≥xs
1	1	2 (AP)										
2	1	8	1		1		1			2		3
3	2	8	2		1	2						1
4	2	6										1
5	2	6										
6	1	25	13	1	1	1	1	1	1			
7	1	34	14	8	4							
8	1	8	2	1	1	1						1
9	1	21	2	2	3	1	3	2	1	4		3
10	1	11	4			3	1					
11	2	4		1			1					
12	2	2										
13	2	12	2	3	1	2				1		
14	2	4 (AP)										
15	2	7 (AP)										
16	2	4 (AP)										
17	2	21	2	1		2	1	2	2		1	5
18	2	17	6	3	1							
19	2	8	2	4	1							
20	2	11	5	1	1							

Note. Ab= Absent x/xs= time(s) AP= Always Present

Table A2. ICT Infrastructure Pre-COVID-19 vs During COVID-19

ICT Infrastructure	Quantity Pre-COVID-19	Quantity (since COVID-19)
Academic and Technical Staff	10	10
Bandwidth – Digicel and FLOW	140Mbps	160Mbps
Access points	33	36 (New)
Laptops	4	5 (New)
Smart Boards	1	0
Web Camaras	3	10 (New)
Microphones	3	0
Tablets Computers	0	10
Servers	5	2 (New)
Desktop Computers	73	0
Smart TVs	7	5 (New)
School Management System (SMS)	1	–
Learning Management System (LMS)	1 (Schoology)	4 (Moodle, Microsoft Teams, Zoom, Google Classroom)
Smart Classrooms	0	5
E-library	6	–
ICT Training/Professional Development	Ongoing	>5 (Ongoing)
WIFI Capacity (number of users)	4000	7000
LAN	250	250

Table A3. Percentage Course Pass Rate Pre-COVID-19 vs During COVID-19

Course	Pass Rate Semester 1 2019	Pass Rate Semester 1 2020
1	98	99
2	100	89
3	100	70
4	100	100
5	100	89
6	84	87
7	100	86
8	93	100
9	74	90
10	100	80
11	98	100
12	91	100
13	93	94
14	92	75
15	90	89
16	96	93
17	71	93
18	89	84
19	88	100
20	84	87

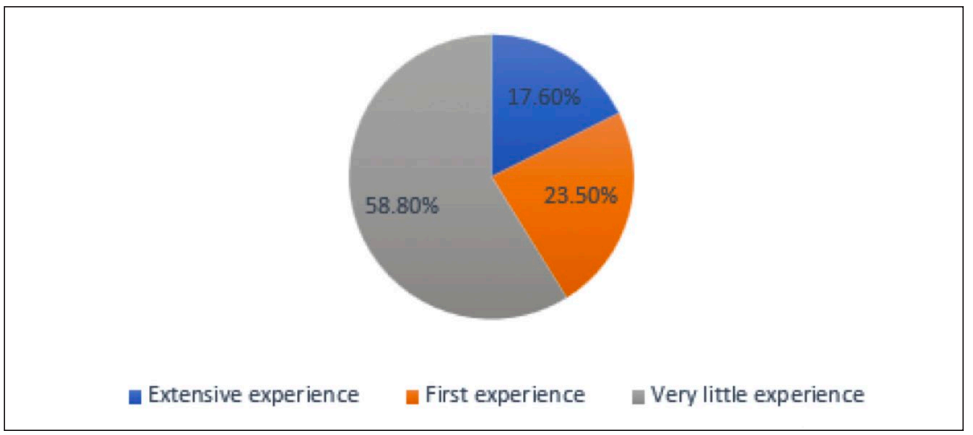

Figure A1: Lecturers' Experience with Online Teaching Pre-COVID-19

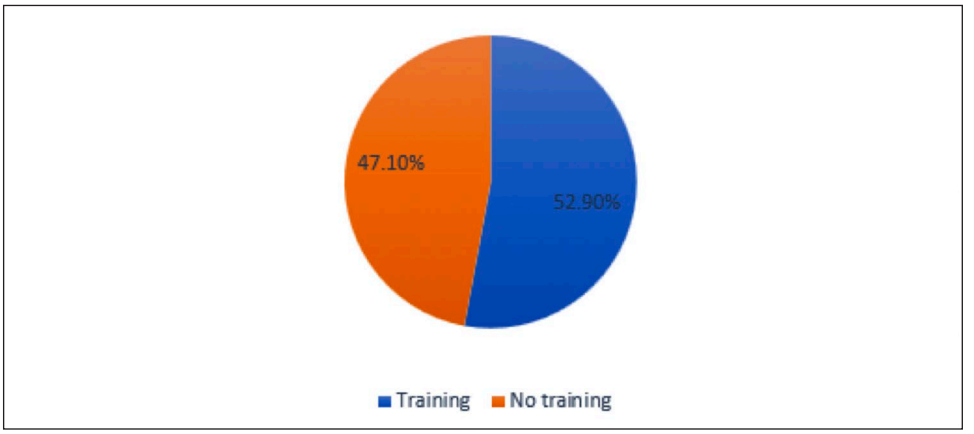

Figure A2: Lecturers' Training on the use of Online Learning Tools

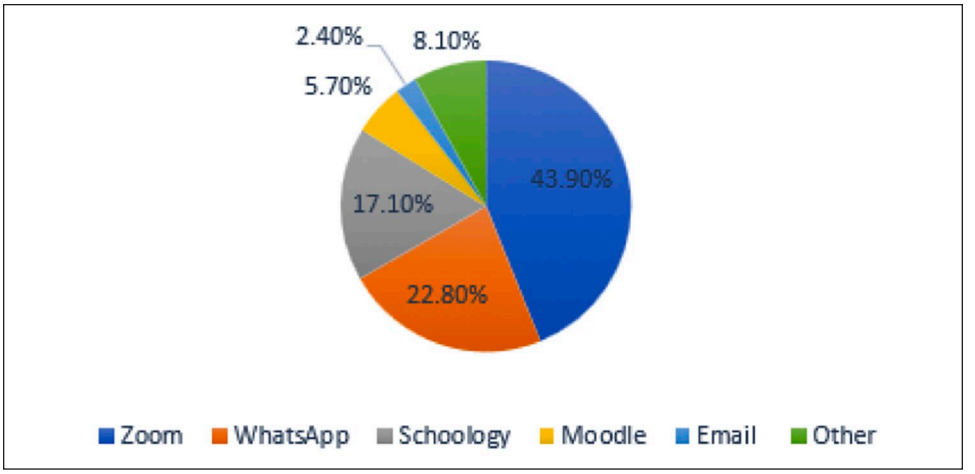

Figure A3: Online Teaching Platform Liked by Students

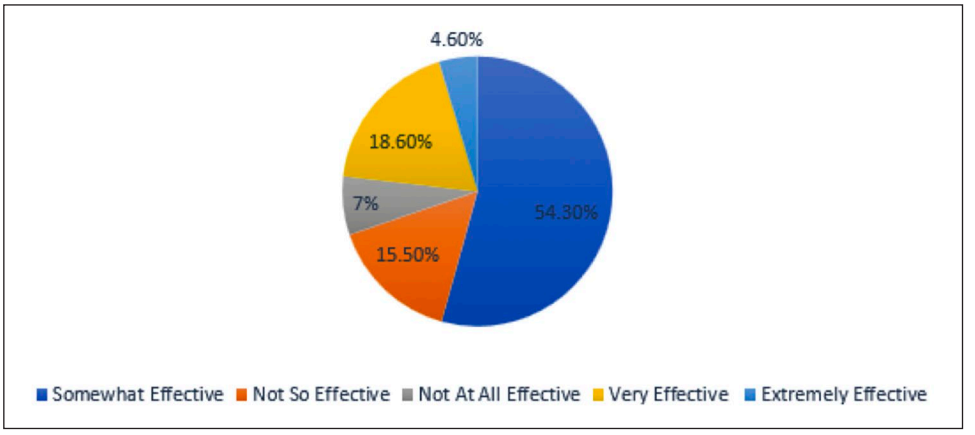

Figure A4: The Effectiveness of Online Learning Platform Utilized as Reported by Students

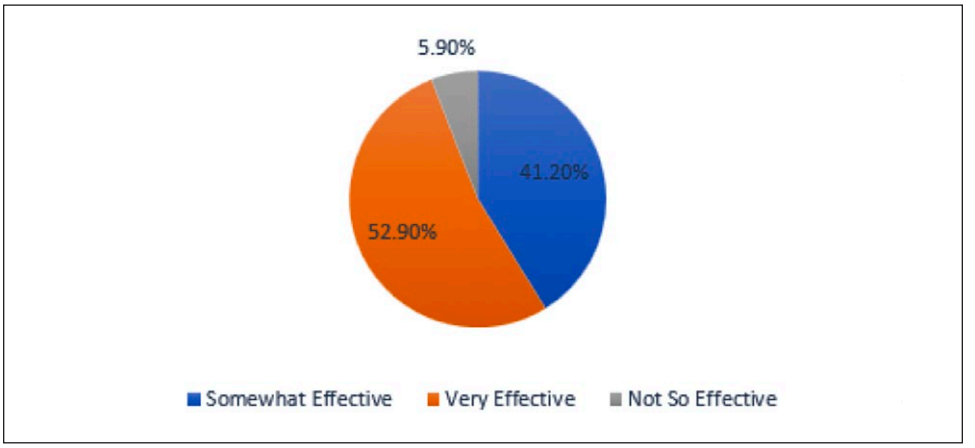

Figure A5: The Effectiveness of Online Learning Platform Utilized as Reported by Lecturers

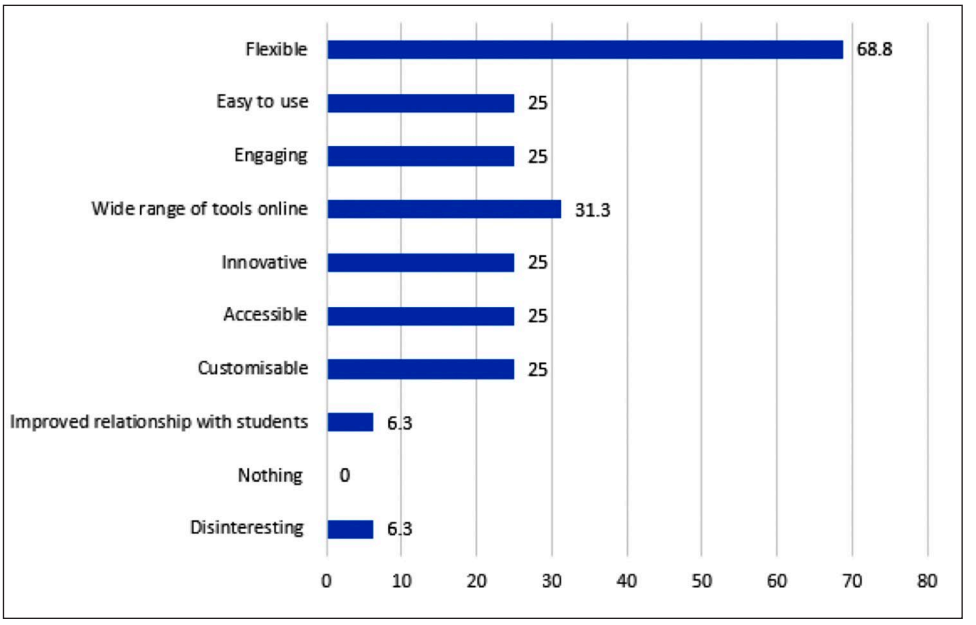

Figure A6: Percentage Lecturers' Experiences with Online Teaching

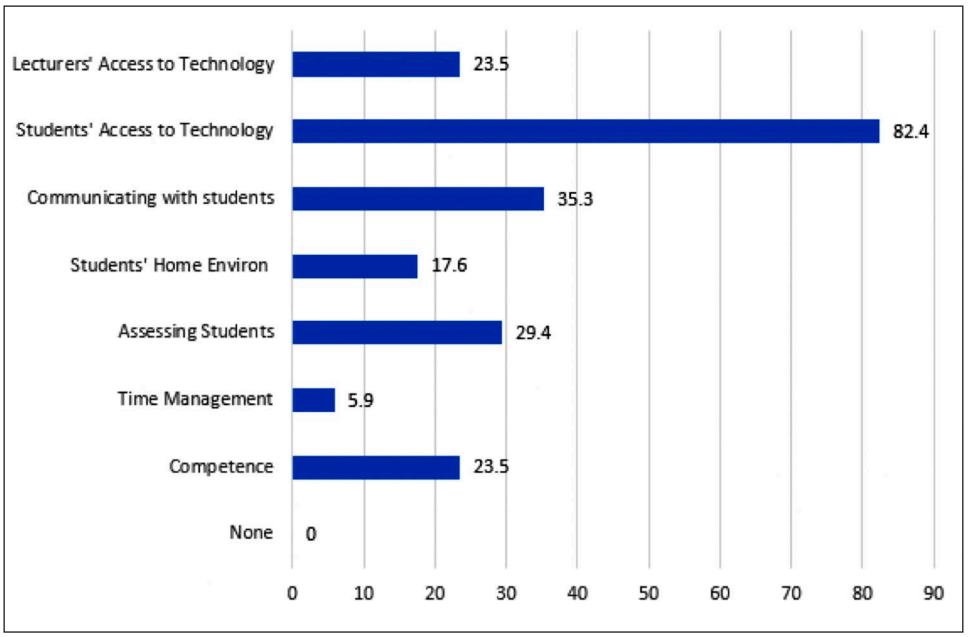

Figure A7: Challenges Faced by Percentage of Lecturers

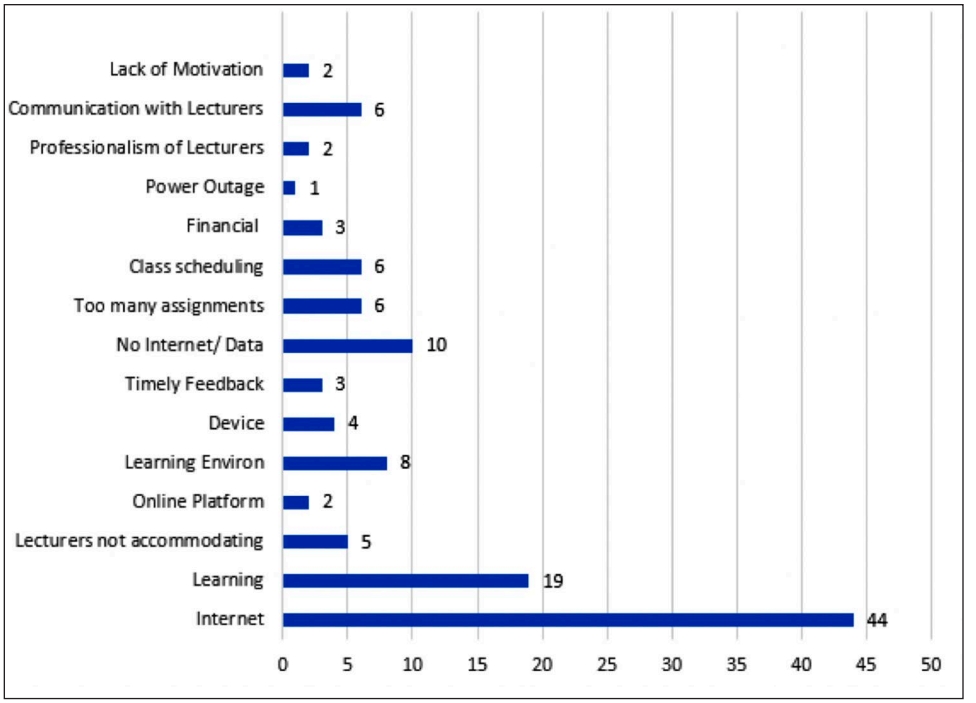

Figure A8: Challenges Faced by Amount of Students

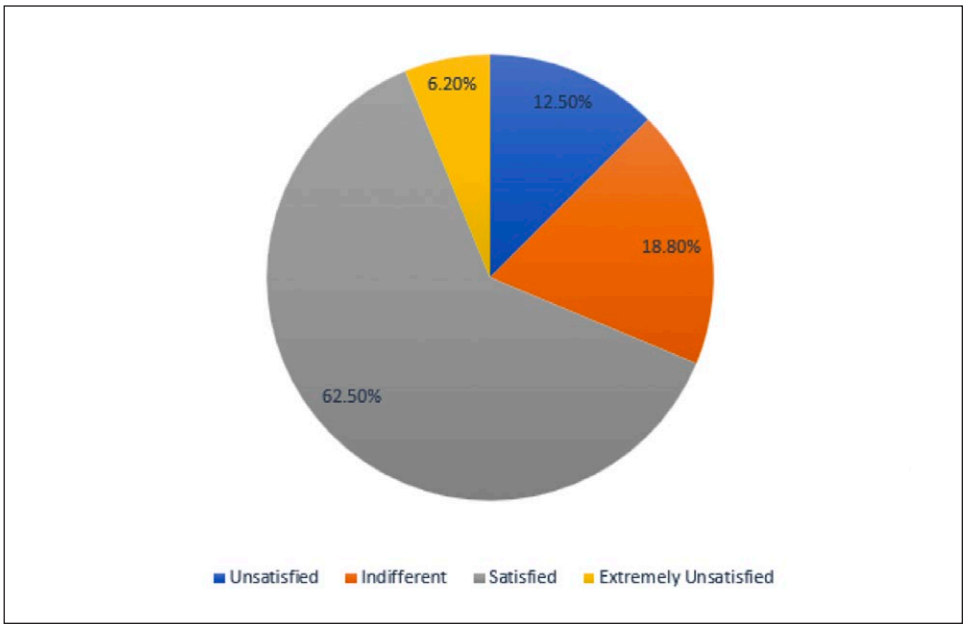

Figure A9: Lecturers' Satisfaction with the Online Teaching and Learning Process

JOURNAL OF ARTS SCIENCE AND TECHNOLOGY

Representations of Jamaica Ahead of its Diamond Jubilee in Four 'Town' Murals

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Abstract

This paper takes a Cultural Studies approach to thematic analysis of four public murals in Kingston and urban St. Andrew, Jamaica, which comprise a case study. The Vision 2030 mural in Southside, Kingston, is an independent interpretation of Vision 2030, the government's plan for Jamaica's optimal development by the target year. Two Liv Gud! murals, one outside Southside and another near Swallowfield in urban St. Andrew, were commissioned by the Jamaican government as part of a violence reduction campaign. The fourth, on the Gleaner Company media house's Kingston office, collates prominent elements of Jamaican life. Each mural was observed in its physical context, photographed from several angles, and analysed thematically, utilising Representation (Cultural Studies) and Social Representation Theory (Social Psychology) theories, for its depiction of race, gender and national identity, before comparative analysis of the individual outcomes. The paper finds that there is an imbalance in the murals' racial and gender composition, contributing to a limited depiction of Jamaican identity ahead of its 60th anniversary of Independence on August 6, 2022.

Keywords: Jamaica, Murals, Street Art, Representation, Social Representation Theory, Vision 2030, Liv Gud!

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Introduction

Background

This paper takes a Cultural Studies approach to analysing four murals in Kingston and urban St. Andrew, Jamaica, to assess their reflection of Jamaica's racial and gender composition, as well as depiction of Jamaican identity, ahead of the country's 60th anniversary of political independence on August 6, 2022. The striking visibility and public accessibility of this street art make them an important visual communicator, simultaneously conveying the artist's viewpoint and making the issue being depicted visually open to interpretation by viewers.

Three of the murals are in Kingston, Jamaica's capital city, which is the defined area concentrated around the Kingston Harbour Waterfront to the south. However, this area is habitually conflated with St. Andrew parish's urban sections, with Three Miles to the west, Harbour View to the east and Papine to the north as informal demarcations. Together, the capital and urban St. Andrew are called Kingston, or simply 'town' by many Jamaicans, who call the actual capital Downtown Kingston. Kingston marked its 145th anniversary as Jamaica's capital in 2017 ("Kingston celebrates 145th anniversary as capital") and, although not directly related to the anniversary, the murals project the sense of community which permeated the observances. The fourth mural, which is part of the same project as one in Kingston, is in urban St. Andrew, therefore all the street art being analysed is in 'town', Jamaica's cultural, political and financial centre.

One of the three murals in Kingston, at the main entrance to the inner-city community Southside, is an interpretation of the Jamaican government's Vision 2030 plan to make the country "the place of choice to live, work, raise families and do business" ("What is Vision 2030 Jamaica?", n.d., para. 2) by the target year. It is serendipitous that the Vision 2030 mural is less than a mile from where Edna Manley's Negro Aroused statue is mounted on the Kingston Waterfront, at the southern end of King Street. Negro Aroused marks the islandwide labour upheavals of 1938 that significantly impacted Jamaica's nationhood, ahead of political independence from Britain on August 6, 1962.

The analysis continues with the Liv Gud! murals, one of which is approximately 50 metres away from the Vision 2030 mural. Both are part of a Ministry of National Security and Justice's campaign of the same name to reduce crime by emphasising harmonious community interaction (Cross, 2019). The other Liv Gud! mural being analysed is in urban St. Andrew, at the intersection of Downer

Avenue and Old Hope Road, just outside an entrance to the inner-city community of Swallowfield. It is approximately at the midway point between opposing sections of the community (CVM Television, 2019). The Liv Gud! initiative was officially launched in September 2019, nine years after a 2010 police campaign to paint over the images of community dons (predominantly men who wield enormous financial and violent power in Jamaican inner-city communities and head a community structure which parallels the state) on walls in the communities where they are or were most influential (Jamaica police erasing gang murals in slums, 2013).

Despite the Tivoli Incursion of 2010, removal of dons' images and Zones of Special Operation established in various police divisions islandwide since 2017 (Timeline: Tracking #ZOSO – Jamaica's Zones of Special Operations – from inception to execution, 2017), gang activity has continued. Ironically, one of the Kingston flare-ups in 2020 was caused by a botched gun deal in 'Dunkirk', as a part of Southside is known (Barrett, 2020) and the community was one of the boundaries of the area in which a state of emergency was declared. The Southside Liv Gud! and Vision 2030 murals are painted on the outside of a Southside community wall along South Camp Road, close to where a military checkpoint was established (State of Emergency declared for central, west Kingston, 2020). This raises questions of the Liv Gud! campaign's effectiveness which, although beyond the scope of this paper, are directly related to the murals' composition.

The fourth mural being analysed is on the wall of The Gleaner media house's offices at the intersection of North and East Streets, Kingston. A distinct effort to depict various facets of Jamaican culture, it is close to the inner-city community of Fletcher's Land. Therefore, all four murals are physically linked to inner-city communities.

There is no mistaking Edna Manley's intentions, as she told her husband Norman "the Negro Aroused was trying to create a national vision – & it nearly killed me – it was trying to put something into being that was bigger than myself & almost other than myself" (Thompson, 2004, p. 31). Neither is there any mistaking the objectives of the two murals outside Southside, although the Vision 2030 mural is a personal interpretation of the government's Vision 2030 plan and the Liv Gud! mural is mandated by the state.

Manley was formally trained, while the painter of the Liv Gud! mural outside Swallowfield is Leighton Estic (Jamaica Gleaner, 2019) and the style of the others, whose artist has not been identified, does not indicate the advantages and constrictions of formal training. Self-taught artists differ from intuitive artists, as

Poupeye (2007) says the latter "paint, or sculpt, intuitively. They are not guided by fashion. Their vision is pure and sincere, untarnished by art theories and philosophies, principles and movements" (p. 74). The murals being analysed are guided by the intentions of those who commissioned them or a project external to the artists who present personal interpretations. Therefore, they lack the initiative's requirement of inner motivation, as Boxer states "although there is no one style which distinguishes the intuitives of Jamaica, they do share characteristics of working from an inner vision of reality which they record through skills they have developed without formal artistic training" (Archer-Straw, 1995).

Rationale

Analysis of the four murals will reveal the artwork's intention and meaning. As the research was done in 2020, two years before Jamaica's 60th anniversary of independence, its Diamond Jubilee, depictions of Jamaica's racial and gender composition, as well as Jamaican identity, are especially important. The murals were still in place when Jamaica celebrated its Diamond Jubilee in 2022.

When the artist painting the mural responds to state policy, as the Vision 2020 mural does, it expresses a personal interpretation of that policy while simultaneously influencing viewers, who may uncritically accept the individual's interpretation or have their own viewpoint on the issue. When the artwork is commissioned or sanctioned by the state or a specific organisation, as is the case with the Liv Gud! murals and the mural on the Gleaner Company's building, it presents the viewpoint of that entity and not the artist. The organisation's intention is didactic, although viewers will have their own interpretation.

Purpose

The purpose of this paper is to examine the racial composition and gender (im) balance, along with perceptions of Jamaica's national identity, in the four selected murals, keeping in mind that "the meaning of art can be decoded regardless of the artist's or patron's intent. Interpretation is often affected by the viewer's own knowledge, experiences, and interests" (Dacres, 2004).

Research objectives

The objective of this research is to assess the selected murals' accuracy in depicting Jamaica's racial and gender (im)balance, as well as their portrayal of Jamaica's

national identity ahead of the country's 60th anniversary of political independence in 2022.

Research question

Do the four murals being analysed accurately reflect Jamaica's racial and gender composition, and present a comprehensive view of Jamaican identity, ahead of its 60th anniversary of political independence in 2022?

Hypothesis

The four murals being analysed inaccurately depicted Jamaica's racial and gender composition, contributing to a limited presentation of Jamaican identity, ahead of Jamaica's 60th anniversary of political independence in 2022.

Methodology

The murals selected for analysis are not the only ones currently across Kingston and urban St. Andrew. The murals along Water Lane in Downtown Kingston, spearheaded by Kingston Creative, have attracted significant public attention with large images of renowned Jamaican Popular Music vocalists such as Jimmy Cliff, Bob Marley, Bunny Wailer and Millie Small, as well as artwork targeting specific social issues. It is part of Kingston Creative's Paint the City initiative (Kingston Creative). In 2019, Minister of Culture, Gender, Entertainment and Sport Olivia Grange announced a plan to increase the number of murals in Downtown Kingston (Jamaica Gleaner). The first was unveiled in February 2020 (Jamaica Information Service).

The Liv Gud! and Vision 2030 murals were chosen because of their direct relationship to state policy, and the mural on the Gleaner Company's building is a deliberate attempt at invoking nationalism, especially through the arts and sports. This is significant, as it is done by the English-speaking Caribbean's oldest newspaper, which is inseparable from Jamaica's history and sense of national identity through its ongoing news coverage. Supporting this mural's focus is an August 2022 poll, published in The Gleaner, which found that most persons considered music and sport Jamaica's greatest post-Independence achievements (Reid, 2022). There are other Liv Gud! murals in urban St. Andrew, notably inside the Top Range community of Nannyville and along Mountain View Avenue

near the intersection with Jacques Road. However, the former's reach is limited to residents of and visitors to the specific low-income community in which it is located. While the Mountain View mural is more accessible to the public, as it is along a major thoroughfare, it is very limited in depicting the human elements which are required for this analysis.

This qualitative research project takes a case study approach, consistent with Creswell's (2006) definition that "case study research is a qualitative approach in which the investigator explores a bounded system (a case) or multiple bounded systems (cases) over time" (p. 73). The "bounded system" is appropriate in the case study approach (Smith, 1978, as cited in Stake (1998) in Denzin & Lincoln (1998)). The case is bounded by the time the murals were painted, between 2018 and 2020, as well as geographically by their location within Downtown Kingston and urban St. Andrew, which are collectively called Kingston (or 'town' by Jamaicans). Additionally, all the murals are at, or very close to, inner-city communities. Also, all four murals are directly motivated by issues of national significance which are originated by institutions external to the artists. Applying Stake's (1998) case study approach, each mural will be analysed as an instrumental case study. Together, they will be done as a collective case study, an extension of the instrumental case study to several cases. The analysis will be extended into what Zainal (2007), referencing McDonough and McDonough (1997), calls an evaluative case study, adding my "judgement to the phenomena found in the data" (p. 3).

I employed two of the six data collection methods Creswell (2006) says Yin recommends, namely "documents, archival records, interviews, direct observations, participant-observations, and physical artifacts" (p. 75). There was direct observation of the murals. Each mural, which is a physical artefact, was then photographed for further thematic analysis.

Analysing photographs of the murals is consistent with "visual ethnography" (Marshall and Rossman, 2011, p. 183), although the subjects are not, strictly speaking, events or groups of persons. However, each mural is connected with a specific event or results from events which have taken place and depicts persons who are clearly connected to a particular group. Additionally, Cultural Studies is identified as one of the many academic disciplines which uses photographs as "sites for analyses" (Marshall and Rossman, 2011, p. 184), capitalising on their power to evoke emotion and create a visual record for generations which follow. As stated previously, this paper takes a Cultural Studies approach and the use of photographs is therefore appropriate.

Marshall and Rossman (2011) describe determining a data set's themes, categories and patterns as data analysis' most difficult mental phase. Miles and Huberman (1994) describe codes as "tags or labels" (p. 56) to information which the researcher collects. In the inductive approach (Patton, 2002, as cited in Marshall and Rossman, 2011, p. 214), themes emerge after collection and coding of the data, a process in which detailed analysis identifies trends. In the deductive approach the categories are pre-established, including possibly by the researcher. The research question and hypothesis clearly establish three themes (Jamaica's racial and gender composition, Jamaican identity). Also, as Miles and Huberman (1994) state, establishing the themes beforehand helps to prevent data overload.

Additionally, there is thick description of the murals. Geertz (1973) relates thick description to ethnography, attributing the term's origin to Gilbert Ryle. It was Geertz, however, who grouped the two words with parentheses, while Ryle put "thick" in quotation marks (Ponterotto, 2006). Thick description allows for the context within which the phenomenon being analysed is to be taken into consideration, as is done with the four murals. Ponterotto (2006) places thick description at the beginning of a process facilitating thick interpretation, then thick meaning, which this research aims for. Denzin (1989) (as cited in Ponterotto, 2006, p. 546) believes most thick description does not contain all 11 types he advances and many have only one or a few. There are five primary typologies in a complete thick description – biographical, historical, situational, relational and interactional. This paper utilises historical, situational and relational thick description in analysing the murals.

This mix of methods is consistent with Alasuutari's (1995) observation that the Cultural Studies analytic perspective is unique, as the methods are usually linked to other fields – or none at all.

Research design

Data collection procedures

The murals were observed extensively at the locations where they are painted, then photographed on May 28, 2020, by the author from multiple angles. The photographs which best captured the entire mural and specific sections of interest were selected for analysis.

Data analysis

Each mural will be analysed thematically in the areas identified in the research question, namely racial and gender composition, as well as depiction of Jamaican identity. The location of each mural will be taken into consideration for establishing the image's context. Comparative analysis will be done among the murals, according to the specified themes.

The murals will be analysed using representation and Social Representation Theory (SRT). Representation, from Cultural Studies, concerns itself primarily with ideas of power and communication and the meanings invested in and interpreted from signs. Social Representation Theory, from Social Psychology, focuses not only on communication, but also the effect of what is communicated on the audiences' thinking and feeling.

Social Representation Theory engages with the transformation of knowledge which is generated scientifically to knowledge which is taken as commonplace at the individual level. This inherently deals with how what is new – ideas, texts, images – become accepted and interwoven into societies. Its originator in 1961 and main thinker is Serge Moscovici. Communication is critical, as Wagner (1996) states "the concept of social representation (SR) was developed by Serge Moscovici in 1961 as a social psychological approach articulating individual thinking and feeling with collective interaction and communication" (p. 247). Wagner (1996) emphasises practical application, defining a social representation as "a socially constructed and organized set of beliefs, opinions, symbols, metaphors, and images of socially relevant objects, which play a vital role in constructing the immediate, everyday environment of the people by virtue of its consensuality and its practical implications" (p. 247)

Moscovici identifies three categories of social representations:

1. **Hegemonic:** Coercive/forceful, uniform, entrenched in a community or group with a strong structure.
2. **Emancipated:** Arising as various subgroups within a community interact with each other, sharing their interpretation of the representation.
3. **Polemical:** In situations of social conflict, when there is antagonistic interaction among group or community members, and the members of the community who do not collectively accept the representations.

This paper focuses on hegemonic and emancipated representations, as polemical representations do not arise.

Hall (1997a) moves from "identity" and "identity claim" to "identification" (p. 16), the last being the degree to which members of the audience can see themselves in the images being projected to them. In Representation theory, the concrete forms resulting from objectification, as ideas and concepts are expressed in tangible and intangible forms which can then be broadcast, are intended to become part of what are called the conceptual maps, which persons must have in common for a shared meaning to be created. These conceptual maps are "maps of meaning" or "frameworks of intelligibility" (Hall, 1997b, p. 9) and "frameworks of interpretation" (Hall, 1997a, p. 3). These maps and frameworks must be learnt, as a basic tenet of culture is that it is not passed down biologically. The murals being analysed are objectification of the initiating organisations' ideas, except for the Vision 2030 mural which is an objectification of the artist's conceptualisation of the state's idea. The murals' racial and gender composition, which contribute to their depiction of a Jamaican identity, will impact the level of identification which they achieve.

Hall's (1997a) understanding of communication's connection with power, with those who wield power determining what is represented in media, is critical. Hall (1997a) makes it clear that in speaking about communication he is referring to not only speech but "electronic languages, digital languages, languages communicated by musical instrument, languages communicated by facial gesture, languages communicated by facial expression, the use of the body to communicate meaning, the use of clothes to express meaning" (p. 11). Some of these languages are present in the murals.

Negro Aroused and the Vision 2030 (Figure 1) murals are very close physically and in their depiction of lower socio-economic class Jamaican Blacks' social progress, despite projecting images of their place in Jamaica almost 100 years apart. They are even closer historically than they are chronologically. While Negro Aroused has one Black male figure, there are five Black human elements in the Vision 2030 mural, the most dominant being the busts of a young male-female couple to the right (facing the image) in profile, looking into the distance to the left of the mural. The woman, who is to the foreground and therefore emphasises the primacy given to the female's image, is clearly dreadlocked, while the male has what may be plaited or 'budding' dreadlocked hair and a trimmed facial hair.

They are superimposed on a glowing yellow sun and their gaze travels the same path as its rays to look out over an image of Jamaica, which is itself superimposed on the sun's rays, which broaden as they go to the right, eventually going behind the words 'Vision 2030' in black before the mural's edge. The message is clear – the Black youth are looking towards a bright future for their country.

Figure 1. ***Vision 2030***
The Vision 2030 mural outside the entrance to Southside, South Camp Road, Kingston, on May 28, 2020.

That future includes family, the stereotypical (though not the typical Jamaican model) nuclear family being the last image the sun's rays catch, off Montego Bay and Negril on Jamaica's North Coast. Before that, there is a male figure in a seemingly ebullient mood off Port Antonio, also on Jamaica's North Coast, but much closer to the dominant, gazing figures. This opens up the possibility of the artist seeing a single person at one point close to the present becoming part pf a family unit as time progresses, closer to the realisation of Jamaica's Vision 2030 and therefore positions the family as central to the development plan. It is also possible that, with Portland being the birthplace of Jamaica's economically dominant tourism sector (although numerically it has fallen behind to the all-inclusive model centred around Montego Bay and Ocho Rios, also on Jamaica's North Coast), the happy man represents the country's appeal to the leisure traveller.

In the lower part of the image, Jamaica's territorial waters off its South Coast are contained in a curved glass bowl, the composite of oversized aquarium and country (which is true to Jamaica being termed a 'Land of Wood and Water') cradled in a large, Black, male hand. Again, just as reproduction and a sense of social bonds are given significance on the North Coast, a school of fish – one of which is very large and shown clearly in green and the other smaller ones seen in silhouette – shows not only that the island's fauna is important, but the reproduc-

tive process is also critical to maintaining population levels. This is significant, as Jamaica's main fishing areas are off its South Coast, especially around the Pedro Cays (which are not represented in the mural). This is underscored by two full-length male figures in silhouette observing the bowl, one pointing towards the edge of Jamaica's South Coast, thus emphasising the connection between land and water. As Southside is very close to Kingston Harbour which, although heavily polluted is also used for recreational fishing, as well as the well-established commercial Rae Town fishing beach, there would be a high interest in fish as a source of food and economic hub in Southside.

However, in totality this depiction of Jamaica's Vision 2030 is extremely narrow and exclusionary as, for example, only the Black residents who are the majority of a multi-racial society are depicted. Also, while there is an allusion to fishing and, at a stretch, tourism, there is no other indication of Jamaica's economic activity. Further, despite the large, foregrounded female figure, women are severely underrepresented, and it is a sole male hand which literally holds Jamaica in its palm. The irony of the multi-storey buildings of Southside looming being behind the mural is not to be overlooked, as these dwellings symbolise failed attempts to modernise 'town's' inner-city housing which have resulted in overcrowding and the development of political enclaves, or 'garrison communities', through allocation of accommodation based on political affiliation.

The Southside Vision 2030 mural resulted from a process of objectification of the government's Vision 2030 plan. It can therefore be broadcast, although the mural's potential to become part of Jamaicans' maps of meaning is limited by the location not being as heavily traversed by slow-moving traffic as some other parts

Figure 2. ***Liv Gud Southside***
A view of the Liv Gud! mural on a wall bordering Southside, downtown Kingston, looking across South Camp Road, taken on May 28, 2020.

Figure 3. ***Closer view of the Liv Gud! mural***
A closer view of the Liv Gud! mural on a wall bordering Southside, downtown Kingston, taken on May 28, 2020.

of 'town', as well as very limited pedestrian traffic in the area. Internet searches have not revealed any images of or commentary about the mural. Considering these factors, it is highly unlikely that the Vision 2030 mural at Southside has entered the general Jamaican population's maps of meaning about the government's Vision 2030 plan. From a Social Representation Theory perspective, the Vision 2030 plan is hegemonic, the state's plan among its bureaucracy for the country. The Southside Vision 2030 mural is emancipated Social Representation Theory, the artist's version of the Vision 2030 plan.

Southside's multi-storey buildings are also visible over the wall on which the Liv Gud! mural is painted outside Southside (Figure 2), the combination taking on added irony in June 2020 when a security checkpoint close to the Vision 2030 and Liv Gud murals, which had already been established because of a Zone of Special Operation (ZOSO), was intensified as a state of emergency was declared.

There is a concerted effort in the Southside Liv Gud! mural to depict harmonious community life (Figure 3), which is in keeping with the government's social and behaviour change project "geared towards strengthening social inclusion in crime fighting and violence prevention and reinforcing the social contract between the citizens and the State" (Government calls for Jamaicans to Liv Gud! 2016). So there are smiling faces as persons of both genders and a wider range of ages than in

the Vision 2030 mural engage in sport (cricket) and procuring food (transactions at the community shop and marketplace, as well catching fish with a net, which indicates a commercial scale, that is reinforced by the sale of seafood). There are also uniformed schoolchildren of both genders and a dancing, happy woman in an outfit which indicates being at a party. Ackee and banana trees represent the flora, while a dog and a chicken are included in the mural, indicating that these animals are an accustomed part of community life.

Southside's multi-storey buildings are not shied away from, as they are near the top of the mural, but the colourfully painted depictions, which are curved to reinforce the message of being stylish, are very different from the reality of dull, drab, uniform buildings which loom over the wall which the mural is painted on. Of the four murals being analysed, this is the only one which has hints of what the National Gallery of Jamaica representative who spoke in the Visual Arts module of the CLTR6030 Cultural Studies graduate class at the University of the West Indies (UWI), Mona Campus, on June 9, 2020, called the "journalistic style" of a few Jamaican painters. They included Sydney McFarlane, Roy Reid and Carl Abrahams, who recorded the everyday scenes of Jamaica, Abrahams especially focusing on Kingston inner-city life and the St. Thomas based McFarlane engaged by the relative sophistication in Kingston.

The composite of ideal (or at least happy) community life (although the church is noticeably absent) is in the present and reinforced by the dominant text exhorting all to Liv Gud!. This is written in red, gold and green, which are the colours of the Rastafarian flag, but which, especially through Rastafari's ubiquitous presence in Jamaican popular music, have come to signify Jamaica. In addition, Rastafari's credo of "one love" conveys the same sense of harmonious living as Liv Gud! and Veal (2007) states "Rastafari and its ideas became the most provocative articulation of Jamaica's postcolonial ethos by the end of the 1960s" (p. 15).

Outlines of the island of Jamaica are clearly utilised in the Vision 2030 and 'Liv Gud!' murals, but the depiction is much more obvious in the former, as in 'Liv Gud!' the outline is in black and used as a base for the words. Interaction with and exploitation of the sea is much more pronounced in the Liv Gud! mural than Vision 2030. However, although the gender balance is much better in Southside's Liv Gud! the myopic view of race continues, as only Black persons are represented. However, as this mural is specific to a community (as indicated by the multi-storey buildings which are included) perhaps this reflects the racial composition of Southside and is therefore more understandable than in the Vision 20230 mural, which is part of a campaign purported to be for the entire country.

The murals also differ in language, as Vision 2030 is written in the official Standard English of the state, which in Liv Gud! utilises Jamaican Nation Language, which reflects a diglossic situation. While Jamaica, where Standard English and Jamaican Nation language co-exist, qualifies as what Ferguson defines as a diglossia where, as Nordquist (2018) clarifies "two distinct varieties of a language are spoken within the same speech community", it does not go further to be a bilingual diglossia, where "one language variety is used for writing and another for speech." In this instance, however, the speech language is also being used for writing in public art.

Unlike the Vision 2030 mural which it is physically close to, the Southside Liv Gud! mural is not an emancipated social representation of the state's hegemonic social representation. Instead, it is an extension of that hegemonic representation in an attempt to visually represent the government's plan to reduce violence in one of the badly affected communities. While the campaign was launched nationally, its focus – exemplified by the positioning of the Liv Gud! murals at or close to strife-torn communities – is narrow. Therefore, the intention is to put Liv Gud! into the conceptual maps of the persons who live in those targetted communities. This applies to the Liv Gud! mural outside Swallowfield, at the corner of Downer Avenue and Old Hope Road.

Liv Gud! Swallowfield

As it is an islandwide campaign, the wording and images of harmony also feature in the Liv Gud! mural outside Swallowfield (Figure 4), but it is far less

Figure 4. *Closer view of the Liv Gud! mural: The Liv Gud! mural at the corner of Downer Avenue and Old Hope Road, facing one section of the urban St. Andrew inner-city community of Swallowfield, taken on May 28, 2020.*

Figure 5. *The only human figures in the Liv Gud! Mural outside Swallowfield, urban St. Andrew. The Ministry of National Security Liv Gud! Campaign's e-mail address is painted in white at the right.*

detailed a depiction of harmonious community life than the Southside mural and is somewhat generic – it does not have graphic elements that are immediately identifiable as part of the community, despite 'Unity for Swallowfield' being arched around the message to Liv Gud!

Additionally, as there are only two human figures (Figure 5) in the Swallowfield Liv Gud! mural, far fewer than the Southside equivalent, that they are both male is an even more striking gender imbalance than the 'Vision 2030' relatively low female presence. Again, the figures in the Swallowfield mural are smiling and enjoying a harmonious relationship; however, the Swallowfield mural's background is unrealistic, as it seems pastoral and is certainly devoid of the community's actual urban environment. There is some redemption for the lack pf community interaction and women, as coloured palmprints with the names of the persons – many of them female – who have made their impression on the mural are across the lower right-hand quarter of the painting (Figure 6). Significantly, though, instead of the artist's signature there is an inscription on the right-hand side which indicates its origin – the e-mail address of the Ministry of National Security's Liv Gud! programme, mnsgovjm@livgudjamaica (Figure 5). I am ambivalent about the effect, as on one hand the acknowledgement of state involvement in street art

Figure 6. ***Palm prints***
Palm prints, with the names of the persons who made them, on the lower left quarter of the Liv Gud! Mural outside the inner-city community of Swallowfield, urban St. Andrew, on May 28, 2020.

for social and behavioural change is honest and only a lasting acknowledgement of what has already been made public. However, it reinforces the campaign's external imposition, rather than being public depiction of a movement arising from a notoriously fractious community.

Figure 7. *The mural on the side of the Gleaner newspaper building, intersection of North and East Street's, Kington, Jamaica, on May 28, 2020.*

Figure 8. *The upper section of the mural at The Gleaner, corner of East and North Streets, Kingston, which shows a schoolgirl holding a copy of the publication, a sound system selector and literary/theatre icon Louise 'Miss Lou' Bennett-Coverley, taken on May 28, 2020.*

Figure 9. *A photographer captures an image, while Usain Bolt's men's 100 metre world record is painted on a metal container standing in front of the mural at The Gleaner.*

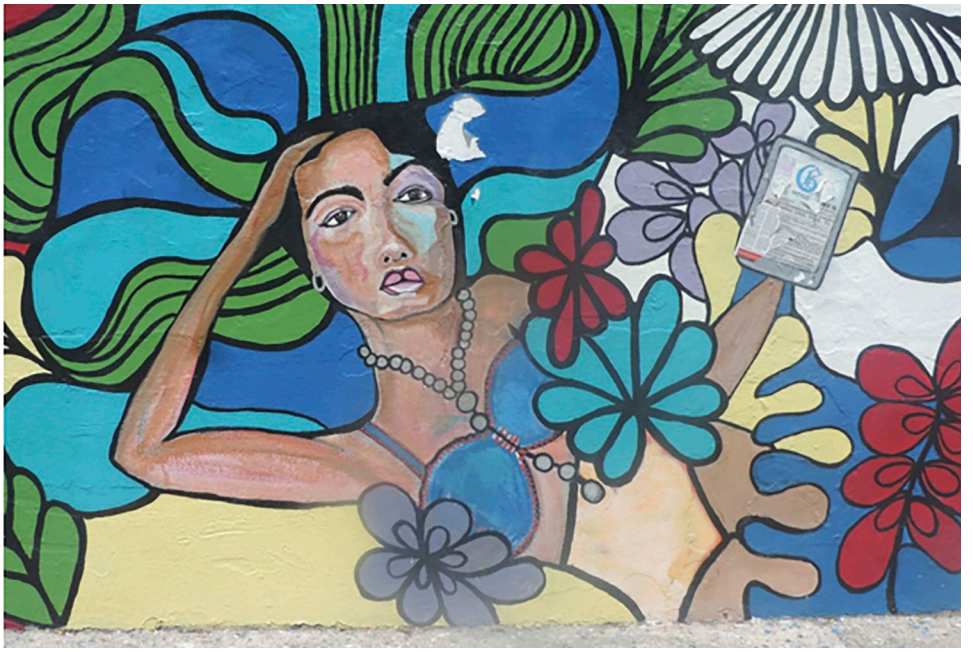

Figure 10. *A woman reclines, clutching a copy of The Gleaner, in the lower left-hand section of the mural on the wall of The Gleaner at the corner of North and East Streets, Kingston.*

Hands are also used to portray unity in the mural on The Gleaner's building, East and North Streets, Kingston. The intention is outright marketing and a fist bump between a Black male hand and one which also seems masculine, but wrapped in Gleaner newsprint, is at the top of the image to emphasise a connection between Jamaica and the publication. Continuing in this vein, the mural covers several prominent areas of national life which the newspaper reports on. Just below the touching fists is a sound system control tower, with the Jamaican flag on the console, flanked by an image of a schoolgirl carrying a copy of The Gleaner and literary arts/theatre icon Louise 'Miss Lou' Bennett-Coverley. As it is a marketing ploy, The Gleaner appears more than once in the mural. It is also held by a woman in repose at the lower left side, her features indicating a mixed ancestry which is a welcome departure from the exclusive focus on Blacks in the other three murals.

Underscoring the appeal to nationalism and pride in Jamaica's international achievements is a depiction of a male sprinter breasting the tape, Usain Bolt's 100m men's world record inscribed on a box which stands in front of the mural. With the image of a photographer in action at the lower right of the mural, it is clear that the newspaper is positioning itself as capturing Jamaican national life,

this after being founded in 1834, the same year slavery was abolished. Completing this is yet another insertion of The Gleaner into the mural, as a copy of the newspaper on a rack, displayed for purchase, is below the inscription of Usain Bolt's world record.

Contrary to its urban surroundings the mural is filled with flora, although there is no inclusion of animal life. This is the only mural of the four in which the female figures are in balance numerically with the male, although they are still excluded from the outright connection of The Gleaner and the Jamaican population through the masculine bumped fist greeting.

The information and viewpoint which the Gleaner Company's mural attempts to put into viewers' maps of meaning can be directly related to the newspaper's content. Therefore, although it is not a state initiative like the Liv Gud! murals, the mural is a hegemonic social representation.

Results

While Edna Manley's Negro Aroused is a valuable physical and historical reference point for the Vision 2030 mural in Southside, the murals in Downtown Kingston are located even closer to the Institute of Jamaica at the corner of East and Tower streets. It is at the Institute that its long serving secretary, Frank Cundall, "established the Jamaica Portrait and Picture Gallery, the first permanent display of art on the island" in 1891 (Thompson, 2004, p. 9). This was within two decades of Kingston becoming Jamaica's capital and, as the 150th anniversary of that establishment of Jamaica's centre approached in 2022, the murals' location in the same area as the Institute and Negro Aroused reflected progress in the portrayal of Blacks, which is now so commonplace as to be taken for granted. This is bearing in mind Thompson's analysis of Blackness in Jamaican art from 1922 – 1944, when many "blacks could not imagine themselves as representable" (3).

Therefore, as public art, the four murals reinforce the presence of black Jamaicans in the conceptual maps (or "maps of meaning", or "frameworks of intelligibility" (Hall, 1997a) or "frameworks of interpretation" (Hall, 1997b)) of viewers. For this vast majority of the Jamaican population, it would naturally achieve some level of objectification (Hall), even though this is bound to vary based on factors such as complexion and the viewer's social class.

Yet there is an unfortunately sexist stance in many instances and a myopic view of race in all, as except in one instance – which is open for interpretation – it is only Blacks who are represented. So even as their presence reflects an agency

of Jamaica's Black population, the movement from non-representation to over-saturation is troubling, even more so as, coupled with the murals' proximity to inner-city areas, it perpetuates a ghetto stereotype. As Veal (2007) says "by the 1960s, class distinctions between rich and poor were usually referred to by the words "uptown" (elite, Europhoile, light-complexioned) and "downtown" (poor, from rural origins, dark-skinned, and generally of clear African descent" (p. 14). Archer-Straw (1995) says of art "herein lies the necessity for the voice of the 'other'" (p. 13), that other, in an ironic reversal of status, being 'uptown', especially in the Vision 2030 mural, being absent, even though it can be argued that it is an interpretation of a national vision specific to Southside.

Dacres (2004) notes "the use of monuments to create and reflect national unity both obscures and reveals existing social fissures" (p. 138). The four murals analysed expose the racial gap in Jamaica while, in presenting at best an optimistic, naïve at most understanding and at worst deliberately false view of Jamaican life in pursuit of the mandates imposed externally on the artists, obscure the very elements which have to be addressed in order to achieve the purpose behind the murals. A prime example was the eruption of violence centred on Southside, which continues to experience intermittent spikes in gang warfare. This is true to what Dacres (2004) observes, that "rather than attempting to depict the historical referent, what emerges in contemporary memorials is an emphasis on the act of remembering and, conversely, forgetting" (p. 153). It also exposes the weakness of the Jamaican government's hegemonic social representation (Moscovici, 1988) strategy of containing violent crime, expressed through the Liv Gud! murals, although it must be noted that the programme is not an instant fix.

In answering the research question, the four murals being analysed do not accurately reflect Jamaica's racial and gender composition, and do not present a comprehensive view of Jamaican identity, ahead of its 60th anniversary of political independence in 2022. This is likely to result in a low level of identification among Jamaican viewers. Therefore, the hypothesis, that the four murals being analysed inaccurately depicted Jamaica's racial and gender composition, contributing to a limited presentation of national identity, ahead of Jamaica's 60th anniversary of political independence in 2022, is confirmed.

Conclusion

The four murals are a potentially powerful part of the nationalist project, Thompson (2004) relating text from an 1891 Journal of the Institute of Jamaica, that

"the power which art possesses over the minds of even the most unread and unthinking is remarkable". The description singled out painting as more influential than architecture and sculpture because "painting appeals more forcibly to the majority of laymen than do the other sister arts" (p. 9). Additionally, as public art the murals are more accessible than those in a gallery exhibition.

Unfortunately, the weaknesses of murals being installed under state direction may move even further away from the unfettered expression of self-taught artists, as it was announced in late 2019 that the Jamaican government was speaking with the Mexican Embassy to get "an internationally renowned muralist to share techniques with students at the Edna Manley College of the Visual and Performing Arts" (Cross, 2019).

Further analysis of murals in Jamaica is recommended, including developments on those which have been analysed. The Vision 2030 in Southside and Swallowfield Live Gud! murals have both been expanded, with Jamaica 60 images. Additionally, the increasing number of murals across Kingston and urban St. Andrew, some of which are private sector driven and specific to a commercial product or brand, deserve analysis for their messages and impact as public art.

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COMMENTARY

Impact of Artificial Intelligence on The Jamaican Job Market

Quantity and Quality

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Abstract

Previous waves of technological revolutions have been accompanied by the technology-job substitution effect. Artificial Intelligence (AI) the technology de jure is expected to have a similar impact. This paper evaluates the possible impact of AI on the Jamaican labour force by mapping a similar study that was conducted by the International Labour Organization (ILO). The jobs that have a high potential for AI-enabled automation are female dominated jobs especially clerical jobs and call center work. These information presented will be beneficial to labour market policymakers, educators, and others.

Keywords: Artificial Intelligence, Jamaica, Job Market, Automation, Technological revolution

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Introduction

Waves of technological revolutions have led to the modernization and socioeconomic evolution of society. Each wave is dichotomous; usually starts with an initial economic euphoria of opportunities followed by subsequent disconcerting societal issues. The industrial revolution contributed to tremendous wealth

creation, but this was accompanied by economic problems and gross inequality. The current wave focuses on data and the use of algorithms and artificial intelligence, using machines to learn and interpret external data fed into them and mimic the cognitive practices of humans. We expect that the dichotomy of previous waves to continue.

One of the debates that accompanies each technological wave is technology- job substitution. It is argued that technological unemployment will occur. There is a counterargument that each technological wave generates creative destruction: the deliberate dismantling of established processes to make way for improved production methods. The International Labour Organization (ILO) provides fodder for creative destruction, indicating that more than 60 per cent of employment in 2018 in the United States was in jobs that did not exist in the 1940s. There is, however, a third view by Daniel Susskind *(2020)* who imagines a world without work and raised the question on how technological prosperity should be shared. This is an especially intriguing question in a world where there is a substantial digital divide. This paper focusses on some immediate issues relating to technology substitution (job quantity) and job quality in Jamaica associated with Artificial Intelligence (A.I.) and specifically ChatGPT. This technology is evolving so rapidly that the September 25, 2023, new release has the following features (Metz, Chen, and Weise 2023):

- Can interact with people using spoken words. As with Amazon's Alexa, Apple's Siri, and other digital assistants, users can talk to ChatGPT, and it will talk back.
- Can respond to images: upload a photo of the inside of their refrigerator, and the Chabot can give them a list of dishes they could cook with the ingredients they have.

Focusing on job loss. The International Labour Organization (ILO) conducted an August 2023 study to quantify some of the potential effects of generative AI like ChatGPT can have on occupations from a global perspective (Gmyrek. Berg & Bescond 2023). The ILO examined jobs with similar capabilities to ChatGPT-4 (Figure 1).

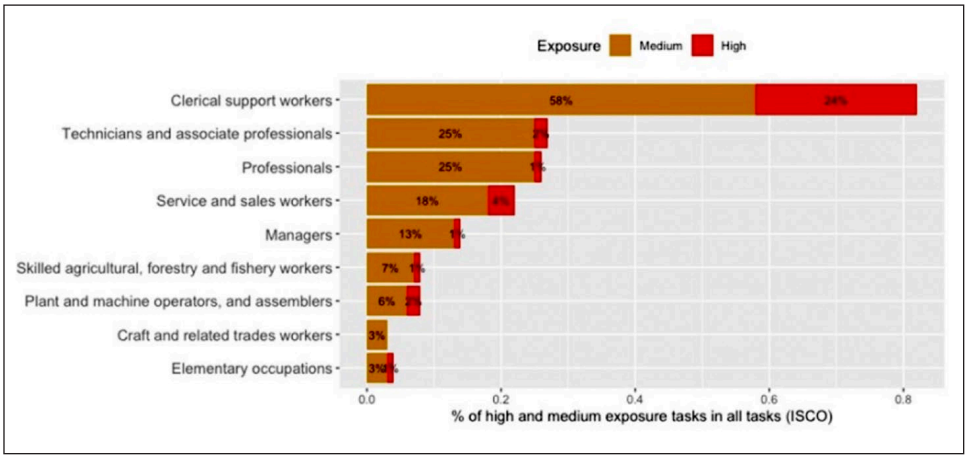

Figure1: Task with Medium and High GPT Exposure by Occupational Category *Source:* ILO (2023)

Automation

Jamaica's potential job loss is estimated based on the Statistical Institute of Jamaica (STATIN's) July 2023 Labour Force by Occupation Group (Table 1) using the ILO study.

Two levels of impact were considered. The first is Automation: Completely replaces human decision-making and actions with technology – i.e., technology replacement. As it relates to automation exposure, jobs with 0.5 or more exposure

Table 1: Employed Labour Force by Occupation

Employed Labour Force by Occupation Group						
Occupation Group	**Apr 2022**	**Jul 2022**	**Oct 2022**	**Jan 2023**	**Apr 2023**	**Jul 2023**
BOTH SEXES						
Professionals Senior Officials and Technicians	287,400	284,700	NA	NA	294,500	288,800
Clerks	118,400	132,200	NA	NA	129,500	142,700
Service Workers and Shop and Market Sales Workers	283,900	290,700	NA	NA	311,600	304,500
Skilled Agricultural and Fishery Workers	186,400	181,900	NA	NA	176,000	173,400
Craft and Related Trades Workers	163,400	157,200	NA	NA	160,100	158,700
Plant and Machine Operators and Assemblers	65,000	66,400	NA	NA	64,000	67,200
Elementary Occupations	160,300	150,300	NA	NA	173,100	173,800
Occupation not specified	4,500	4,600	NA	NA	3,800	6,000
TOTAL EMPLOYED LABOUR FORCE	1,269,300	1,268,000	NA	NA	1,312,600	1,315,100

Source: https://statinja.gov.jm/LabourForce/NewLFS.aspx

are considered medium, while jobs with exposure with 0.8 or more is considered high exposure. The scale is zero to one. It is estimated that approximately 22 percent of Jamaica's workforce (1,315,100) is exposed to high to medium automation, with 56,695, or 4 percent, having high exposure.

Based on the ILO report medium to high exposure jobs includes the following:

Applications Programmers
Librarians and Related Information Professionals
Authors and Related Writers
Securities and Finance Dealers and Brokers
Government Licensing Officials
Secretaries
Typists and Word Processing Operators
Data Entry Clerks
Bank Tellers and Related Clerks
Travel Consultants and Clerks
Contact Centre Information Clerks
Hotel Receptionists
Inquiry Clerks
Survey and Market Research Interviewers
Accounting and Bookkeeping Clerks
Statistical, Finance and Insurance Clerks
Scribes and Related Workers
Personnel Clerks
Clerical Support Workers Not Elsewhere Classified
Contact Centre Salespersons

Source: ILO (2023)

The jobs that have a high susceptibility to automation in Jamaica are female dominated jobs especially clerical jobs and call center work. Approximately 112,000 males and 184,000 females are exposed to automation. This gender skew is troubling as approximately 44 percent (410,000) of households are headed by women, these households tend to larger than the average and with more children. It should be noted that ILO and Jamaica's labour force classifications are not congruent. Jamaica uses Jamaica Industrial Classification (JIC) and while the ILO uses International Standard Classification of Occupations (ISCO). The major

difference is that the ISCO decouples Managers, Professionals and Technicians and associated professionals, while the JIC aggregates these categories.

Augmentation

Most of the debate on AI impact on work has focused on the automation of jobs, the first factor, yet the more far-reaching dystopian impact involves the technology capabilities to collect, generate, store, process and communicate data for the coordination of work. The second factor, Augmentation, has all these capabilities. Augmentation supports and improves human decision-making and actions with technology. Sounds benign, however, it includes some form of algorithmic management which can significantly affect the organization of work, job description, monitoring of work, performance evaluation and by extension job quality. Algorithmic management is the use of computer-programmed procedures for the coordination of labour input in an organization. Workers are often required to install software and hardware requirements, and these are laid down in the terms of service agreements of work platforms.

A case in point of how algorithmic management is used to control and monitor works is provided by Upwork, an American freelancing platform which connects independent professionals and agencies around the world. Upwork provides their workers with an hourly contract with a "work diary," which when enabled by the worker records the number of hours worked, number of keystrokes made and takes random screenshots (six times an hour) while they work on a project. The clients are given access to this information, and they can track the working hours and monitor the activity and progress of the worker in real time. Algorithms assign work, based on worker's performance, evaluate and rate workers based on predetermined indicators that the worker may not be privy to, and discipline and reward workers through incentives and punishment (Baiocco et. al 2022).

Since COVID-19 lockdowns algorithmic management has moved beyond digital platforms to factories, offices, hotels, retail and wholesale, warehouses, call center and healthcare. It is argued that eventually no sector will remain unaffected by algorithmic operations. Workers have complained about constant surveillance, as soon as they log on to the app, they are watched and scrutinized by the algorithms; at Uber, the ride hailing company the app tracks their GPS location, speed, and acceptance rate of customers. It instructs them which customers to pick up and how to get to their destinations. If the driver diverges from the app instruction, they can be penalized or even banned from the platform. These issues

raise job quality red flags. There is a loss of autonomy because it limits individual discretion and can lead to alienation and detachment from one's job. Workers have complained about deskilling, dehumanization, and isolation as they lack the opportunity to build a relationship with a supervisor or with other workers (Baiocco et al 2022). These are all quality issues.

Another major issue is a lack of transparency and privacy. The app learns a lot about the worker based on pervasive monitoring and surveillance to develop workers profile and classification-based parameters defined by the algorithms, which the workers do not understand or have any control. The fact is that algorithms are opaque in their functioning, consequently they are often referred to as "black boxes. However, as one author explains "If the decision about how many years one will spend in prison is made by an algorithm, the convicted should have the right to know how this decision is made."

Conclusion

In the short run, AI will replace some jobs and based on history new jobs should be created. This substitution replacement process is not simultaneous but sequential. This will therefore result in disruption and unemployment. The figures presented in this commentary are indicative of the level of disruption that AI is likely to occur. It is expected that algorithmic systems will be used on an ever-increasing scale and intensity, so there will be increased public pressure to develop effective control mechanisms. This is an opportune time for Jamaica to begin discussing the need to manage the transition of workers who are expected to be affected by AI both in terms of automation and augmentation.

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