



# Journal of Arts Science and Technology

Vol. 16, No. 1

June 2024

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## Editorial

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Dear Reader,

The 10 research papers and four invited commentaries that comprise this issue of JAST, **Volume 16, Issue 1**, cover a diversity of topics that again unequivocally confirm the journal's multidisciplinary nature. The invited commentaries are intended to "provide insight, analysis, or criticism of a topic to encourage readers to think critically about the issue."

The lead paper, **The Effect of Gruesome Crime Scenes on the Personal and Professional Lives of Forensic Crime Scene Investigators in Jamaica**, investigated a topic that is of much significance within the context of the island's high rates of crime and violence. The authors identified how repeated exposure to gruesome crime scenes affects FCSIs' personal and professional lives and the coping mechanisms employed by them. In addition, they proffer recommendations to ameliorate the challenges faced by this important group of law enforcement professionals.

The second paper, **An Evaluation of a Conventional Activated Sludge Treatment Plant for Compliance with the Regulatory Standards**, assessed the operational efficiency of an existing wastewater treatment plant by measuring key chemical and biological parameters and proposed practical solutions for improving its efficiency.

Paper three, **Evaluation of the Environmental Energetic Sustainability of a Municipality in the Republic of Cuba**, examined crucial factors influencing the environmental energy sustainability of the name municipality and proposed a procedure whereby the level of energy sustainability may be determined using a sustainability index function.

The author of the fourth paper, **Managing and Growing an Aerospace Multinational Corporation: A Case Study of the Embraer Company**, identified and surfaced the suite of determining factors that enabled the named company to emerge as the world's largest manufacturer of midsize passenger jets, despite the tough competition dynamics in the aircraft manufacturing industry.

Paper five, **Evaluation of an Alternative Industrial Work Experience Programme for Final-Year Undergraduate Engineering Students During the COVID-19 Pandemic**, reports the results of a study of the effectiveness of an alternative Industrial Work Experience (IWE) programme that was implemented in response to the challenges imposed by the COVID-19; the authors also explored viable alternative engineering cooperative education practices that HEIs may deploy in the post-pandemic era.

In the sixth paper, **Female Leadership Practices and Their Influence on School Effectiveness in Jamaican Primary and Secondary Institutions**, the author investigated the knowledge gap related to female principal leadership practices that impact school management effectiveness and reported a suite of salient factors that were unearthed.

The findings presented in paper seven, **Online or Face-to-Face Modality: Students' Preferred Instructional Modality for French and Spanish after the COVID-19 Pandemic in Jamaica**, provide useful information that will serve to assist the policymakers of tertiary institutions in their post-pandemic decision-making when selecting their teaching modality to determine the best approach to language learning in post-pandemic Jamaica. The findings may have utility in other developing countries with similar socio-economic circumstances.

Paper eight, **Systematic Review of a Specialised STEM Course of Study Based on Industry Relevance and Sustainability**, presents the results of a two-year review of three graduating cohorts from a specialized undergraduate STEM course of study. The views of stakeholders, including currently enrolled students, graduates, and industry partners/employers who engaged graduates during and after their industrial experience are presented and used to inform conclusions and recommendations.

The authors of the ninth paper, **The Effectiveness of the Transition and Placement Process to a Special Education Institution for Children with Special Needs From an Early Intervention Programme in Jamaica**, investigated the roles parents/caregivers, professionals, and paraprofessionals play in promoting the education and welfare needs of children with disabilities, and report findings that they assert “will help to improve policies and programmes targeting families and their children with disabilities.”

The authors of the tenth paper, **Effects of First-Time Parenting on the Quality of Marriage**, investigated an intriguing question and presented equally interesting findings that undoubtedly will be of interest to married couples contemplating venturing, or have ventured, into parenthood.

Paper eleven, **Silent Epidemic: Uncovering the Health-effects of Sexual Harassment in the Workplace**, is an invited commentary that delves into the problematic issue of sexual harassment in the workplace and makes a link to the associated sequelae of adverse health effects, which are enumerated and discussed by the author, who also makes recommendations for preventing sexual harassment in the workplace.

Paper twelve, **Will an Increased Minimum Wage Lead to Healthier Eating by Low-Income Earners?** is another invited commentary. Given the recently announced increase in Jamaica's minimum wage, the author poses an intriguing question, the answer to which is of significant import not just for the minimum wage earners themselves but also for policymakers in relation to the latter establishing a liveable minimum wage in Jamaica.

Paper thirteen, **Jamaica's Data Protection Act: Implications for Researchers**, is also an invited commentary. It addresses the very topical issue of how Jamaica's Data Protection Act (DPA), enacted in 2020 but took effect on December 31, 2023, will impact the handling of data by researchers. The author posits that "The introduction of the DPA necessitates a paradigm shift in how researchers approach data management."

The fourteenth and final paper, **Unpacking Jamaica's Recently Unveiled Education Philosophy**, is the fourth invited commentary in which the author breaks down and discusses, through critical lens, the various aspects of the recently unveiled philosophy of Jamaica's education system and renders a verdict on it.

Paul W. Ivey, PhD  
Editor-in-Chief



# The Effect of Gruesome Crime Scenes on the Personal and Professional Lives of Forensic Crime Scene Investigators in Jamaica

DELTON A. GORDON, ANDREA FENDER-LONGMAN AND DUJON DUNN  
University of Technology, Jamaica

### *Abstract*

*Forensic Crime Scene Investigators (FCSIs) suffer emotionally from the effects of regularly witnessing gruesome crime scenes. The problem is worsened by the increasing rates of crime and violence in Jamaica. This study identifies how repeated exposure to gruesome crime scenes affects FCSIs' personal and professional lives and the coping mechanisms employed by them. Data were collected from 136 FCSIs using a survey instrument comprising 41 open and close-ended items, and structured interviews with nine supervisors of Scene of Crime Units. A paired t-test was conducted to determine the effect of repeated exposure to gruesome crime scenes (GCS) on family relationships among the FCSIs. The results indicate a significant difference between family relationship scores before joining the FCSI Unit and family relationship scores after joining the FCSI Unit, suggesting that repeated exposure to GCS caused a change in how FCSIs interact with their family members. The structured interviews also corroborated a change in their professional relationships. A chi-square test performed to investigate the relationship between coping strategies after processing a GCS with age and gender showed there was no statistically significant association between these variables. This finding indicates that FCSIs island-wide used similar adaptive and nonadaptive coping strategies to mitigate the effects of repeated exposure. After exposure to GCS, Jamaican FCSIs exhibited diminished interpersonal relationships in their personal and professional lives. Some experienced post-traumatic stress disorder symptoms resulting in the use*

*of adaptive and nonadaptive coping mechanisms. Based on these results, collaboration with the FCSI Units and psychiatrists would be beneficial to improve the mental fortitude of Jamaica's FCSIs. In addition, early rotation from the FCSI Unit would significantly reduce the exposure to GCS and the associated trauma.*

**Keywords:** Forensic Crime Scene Investigators, Gruesome Crime Scene, Post-traumatic Stress Disorder, Coping Mechanism, Jamaica

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**Corresponding Author:** Delton A. Gordon – [delton.gordon@utech.edu.jm](mailto:delton.gordon@utech.edu.jm)

## Introduction

Forensic Crime Scene Investigators (FCSIs) are forensic practitioners who are essential components of the investigative process within a legal framework (Dutelle, 2016). In fact, the criminal justice system considers the scientific evaluation and forensic evidence collection to be the pinnacle and most significant aspect of any criminal investigation and court proceeding, thus creating a high demand for the services of forensic scientists (Holt et al., 2016). Forensic Crime Scene Investigators' crucial role in processing a crime scene spans identification, documentation, collection, preservation of physical evidence, and reporting of evidence found at the crime scene to the court (Dutelle, 2016; Pepper, 2010). In Jamaica, FCSIs are members of the Jamaica Constabulary Force Scene of Crime Unit and the Independent Commission of Investigations (INDECOM), both of which are responsible for forensic evaluation of crime scenes. Currently, there are 13 Scene of Crime offices island-wide, located in Areas 1 to 5, hosting 130 FCSI personnel, with the responsibility to process over 3,000 crime scenes annually (Deputy Superintendent of Police C. Ricketts, personal communication, July 25, 2023).

According to the World Population Review (2024), Venezuela, Honduras, Trinidad and Tobago, Guyana, El Salvador and Jamaica are ranked in the top ten countries of the world with the highest crime index rates of over 60 per 100,000 citizens. The crime index rates for these countries are elevated when compared to others such as Qatar (12.03), Switzerland (21.62) and Japan (22.28). Some of the countries with the highest homicide rates in the world can be found in Central America and the Caribbean regions with El Salvador, Honduras, and Jamaica being notably higher than the global average (HEUNI Publication Series, 2010; World Population Review, 2024).

Jamaica has a long-standing crime problem linked to several political, economic and social factors. Over the years, a mostly escalating trend in crime problems has been observed despite improved laws and investigative efforts which incorporate modern crime solving technologies (Morris-Francis et al., 2019; Harriott, 2000). The crime problem is epidemic, particularly homicides (Morris-Francis et al., 2019). In 2020, Jamaica recorded the highest homicide rate in Latin America and the Caribbean at 46.5 per 100,000 citizens (Jamaica Gleaner, 2021). The Jamaica Constabulary Force (JCF) reported 1,474 murders in 2021, almost a 10 per cent increase above the murder total for the previous year (Jamaica Observer, 2022). Yet, again in 2022, there was a slight increase of 2 per cent in the murder rate over the previous year (Radio Jamaica News, 2023). The citizens of Jamaica are impacted by the elevated homicide rate psychologically, financially, physically and spiritually. High homicide rates also affect aspects of the country's development, such as economic growth (Morris-Francis et al., 2019). Tourism which is one of the largest sources of revenue for Jamaica, is potentially affected since high violent crime rates raise concerns among tourists when selecting a vacation destination (Alleyne & Boxhill, 2003). A result of this is reduced employment within the tourism sector, and potential investors are discouraged. Jamaica's high homicide rate has a profound impact on those who investigate and process gruesome crime scenes daily. Many FCSIs, after only working a few years in the Unit, request to be transferred due to the cumulative effect of exposure to gruesome crime scenes.

In the context of this research, the Dual Representation Theory of Trauma serves as a valuable theoretical framework which encapsulates post-traumatic stress disorder. This framework suggests that traumatic experiences, such as exposure to gruesome crime scenes, may lead to dual representation in memory. Brewin and Holmes (2003) posit that there are two (or more) memory systems – a verbally accessible memory system and a situationally accessible memory system. For FCSIs, the verbally accessible memory system could negatively influence their thought process and communications when discussing cases. In contrast, the situationally accessible memory system is thought to be responsible for the presence of flashbacks and nightmares, which are only triggered involuntarily by situational reminders of the trauma.

The purpose of the study was to highlight how repeated exposure to gruesome crime scenes affects FCSIs in Jamaica. To date, there is no published literature on the physiological and psychological effects of their repeated exposure to gruesome crime scenes. The study was conducted during the period of February to April 2020 using a multimethod data collection technique. Survey data were collected

island-wide from FCSIs of the JCF and INDECOM, and structured interviews were conducted with supervisors of the Scene of Crime Units.

The primary research questions of the study were:

- a) How does repeated exposure to gruesome crime scenes affect Jamaica's FCSI personal and professional lives?
- b) What coping mechanisms are employed by FCSIs to mitigate the effects of repeated exposure to gruesome crimes?

This study is far-reaching because answering these questions now provides a framework to guide interventions to ensure psychologically healthy FCSIs in Jamaica. The production of empirical work on this issue may encourage government officials and the Jamaica Constabulary Force leadership to review policies that govern the management and operation of the FCSI Units.

## Literature review

Exactly what constitutes gruesome crime scenes (GCS) has not been well defined in the literature. Therefore, for this study, "GCS" refers to crime scenes inspiring horror or repulsion, violent sexual assaults, murders, cases involving mutilation, dismemberment and decapitation (Author, 2020). Another limitation of the existing literature is that it does not fully explore the physiological and psychological effects experienced by FCSIs from witnessing gruesome crime scenes on a regular basis. Few investigations have assessed the traumatic effects of exposure that searching a crime scene for evidence, collecting and handling that evidence, viewing autopsies, and, in some cases, processing evidence back at the laboratory has on FCSI personnel (Mountain, 2021; Rosansky, 2019). Instead, investigations in the area regarding crime exposure-related stress mainly focused on first responders, police officers (non-FCSIs), and victims (Mountain, 2021; Slack, 2020; Dobney et al., 2017; Figley 2012).

Police officers and other first responders, in the performance of their duties, face a range of intensely traumatic events. These have the capacity to cause significant personal distress, leading to short and long-term changes in mood, psychological functioning and social activity (Feuer, 2021; Bartol & Bartol, 2006; Marmar et al., 2006, Evans et al., 1993). Repeated exposure to violence and trauma puts them at risk for developing post-traumatic stress, which is a common adaptive reaction to traumatic events or incidents that subside after days or weeks. Factors which influence post-traumatic stress in FCSIs include anxiety attacks, length of time spent as



an investigator in the discipline of forensics, type of personality, emotional intellect, lethargy, and witnessing undetermined deaths 3–4 times weekly (Galatzer-Levy et al., 2013; Sock Yoo et al., 2013; Carpenito Moyet, 2008). Post-traumatic stress could further lead to the development of post-traumatic stress disorder. On the contrary, post-traumatic stress disorder is a clinically diagnosed condition listed in the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as a mental illness diagnosis (Tjin et al., 2022; Pai, 2017; Marmar et al., 2006). Comparable to other mental disorders, post-traumatic stress disorder can present both physiological and psychological symptoms. Physical symptoms of post-traumatic stress disorder can include hyperarousal, exaggerated startle response, and changes in appetite or sleep patterns, while psychological symptoms can include extreme fear or helplessness and reliving the traumatic experience, i.e. flashbacks. When it comes to experiencing the symptoms of post-traumatic stress disorder, it is common for those afflicted to not have any symptoms until they are triggered by a person, place, or event that reminds them of the original trauma (Sistrunk, 2022). In addition, Figley (2012) postulated that accumulated stress from repeated crime exposure had the ability to climax i.e. the exposure affects cognitive functions, resulting in a reduction in productivity, emotional burnout, and eventually affecting the quality of work of police officers, whereas, Marmar et al., (2006) indicated that first responders with post-traumatic stress disorder present higher rates of absenteeism and early retirement. Similarly, FCSIs experience cumulative occupational exposure to traumatic events not only through the physical processing of gruesome crime scenes but also by exposure to victims' accounts, graphic digital material, and bloody or otherwise sullied physical evidence. Therefore, they are also likely to be afflicted by any variation of post-traumatic stress disorder symptoms and vicarious trauma, depending on their degree of involvement in their cases (Slack, 2020).

Researchers have also shown that as a result of repeated exposure to traumatic events, police officers and first responders employ various coping mechanisms to mitigate the impact of the stress experienced (Diaz-Tamayo et al., 2022; Wassermann et al., 2019). As quoted by Wassermann et al. (2019), coping is a process of cognitive and behavioural efforts to manage stress in a way that minimises the effects of the stressor. However, the coping mechanisms employed can be adaptive, which includes acceptance, focusing on the problem or seeking emotional support, or nonadaptive, with the main strategy being avoidance, which downplays the perceived stressful event (Diaz-Tamayo et al., 2022; Wassermann et al., 2019). Rosansky (2019) showed that crime scene investigators with higher

post-traumatic stress disorder scores were even associated with drinking alcohol more frequently to cope with the crime exposure-related stress experienced. Others use mental hardening or toughening as a coping strategy. This strategy may result in isolation or compartmentalization whereby negative emotions are separated and 'filed' away to allow normal cognitive functions to be maintained. However, this in itself has some drawbacks, as individuals may differ in their capacity to make psychological partitions without unwarranted emotional seepage into other areas of their private and professional lives (Miller, 2008). Yet another coping mechanism employed is intellectualization, whereby emotionally gruelling tasks and experiences are detoxified by using detachment techniques (Miller, 2007). Despite the use of varied coping mechanisms, Figley (2012) explained that it is very important that crime-exposure-related stress be detected at an early stage by a medical professional to control the condition and prevent future issues. Screening and early intervention are vital, given that the symptoms may contribute to adjustment problems in social, family, and work settings.

## Materials & Method

### Participants

A pilot study was conducted in January 2020 with 15 FCSIs from Area 4 Scene of Crime Office (Spanish Town Road). Subsequently, survey data were collected island-wide, during the period of February to April 2020, throughout Police Area 1 to 5 locations using a cluster sampling technique. In total, 136 (82%) FCSIs from the JCF (126) and INDECOM (10) participated in the study. Purposive sampling was employed where interviews were conducted with 9 supervisors of the Scene of Crime Units. Participation was voluntary, and participants were assured of the anonymity of their responses through the fulfilment of ethical guidelines for conducting surveys and interviews as approved by the ethical review body.

### Material

This study used a multimethod data collection technique. Survey – The questionnaire design consisted of 41 closed and open-ended items categorized as sociodemographic data (age, gender, family status, job experience, number of gruesome crime scene processed and location, see Appendix 1) and behavioural

data (interpersonal relationships—before and after exposure to gruesome crime scenes, post-traumatic stress disorder symptoms and coping mechanisms).

*Structured Interview* – A 21-item interview was conducted with nine supervisors of the Scene of Crime Units island-wide to get their perspective of FCSIs' attitudes, emotions, and demeanour after cumulative exposure to gruesome crime scenes.

## Statistical analysis

Statistical analysis of data was performed using Statistical Package for Social Sciences, version 22 (SPSS V22.0). The differences in interpersonal relationship scores (before and after repeated exposure to gruesome crime scenes) were evaluated using a Paired t-test. The expression of post-traumatic stress disorder symptoms was analysed using Likelihood Ratio tests. Coping mechanisms distribution was analysed using Chi-square. The sociodemographic data of the participants were presented in real numbers and percentages.

## Results

### Sociodemographic

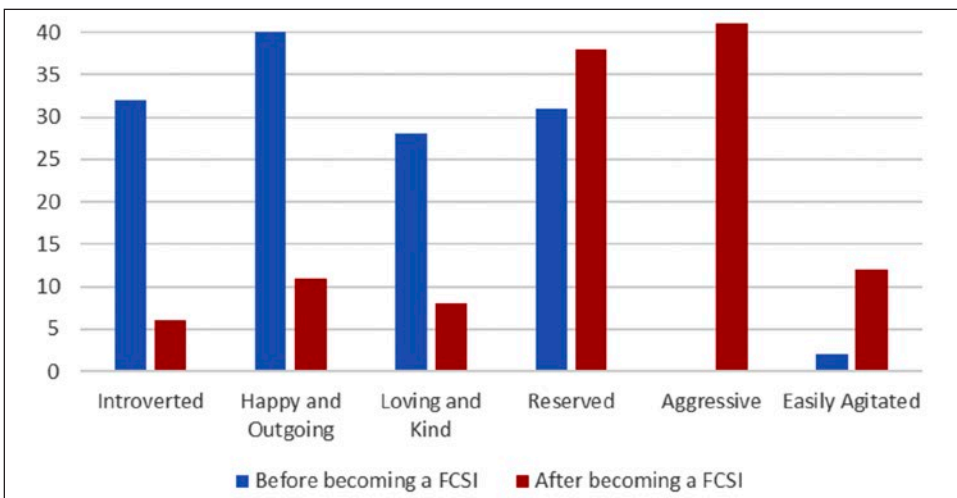
Table 1 shows demographic information collected from the survey, with the percentage of participants shown for each variable. One hundred (73.5%) of the participants were male and thirty-six (26.5%) were female. The age of the respondents showed extremes; notably, fifty-nine respondents (43.3%) were between 31 and 36 years, whilst only two (1.5%) were between 18 and 24 years. Regarding job experience, seventy participants (61.5%) were FCSIs for 6–10 years, whilst only six (4.4%) actively served for over 16 years. Family status depicted twenty-one (15.4%) participants were single parents, sixty-four (47.1%) had a nuclear family, forty-nine (36%) lived with an extended family, and only two (1.5%) had no family relations. Fifty-two (38.2%) of the participants processed between 101 and 300 gruesome crime scenes, while only 6 (4.4%) processed over 1000.

### *Interpersonal Relationships*

Figure 1 shows family relationships of FCSIs before and after joining the FCSI Unit depicting the variables: introverted, happy and outgoing, loving and kind, reserved, aggressive and easily agitated. A paired t-test was conducted to determine the effect of repeated exposure to gruesome crime scenes (GCS) on family

**Table 1.** Demographic Descriptive

Variable	N	Percentage
<b>Gender</b>		
Male	100	73.5
Female	36	26.5
<b>Age (yrs)</b>		
18–24	2	1.5
25–30	28	20.6
31–36	59	43.4
37–40	34	25
41–Over	13	9.6
<b>Job Experience (yrs.)</b>		
0–5	45	33.1
6–10	70	51.5
11–15	15	11
over 16	6	4.4
<b>Family Status</b>		
Single Parent	21	15.4
Nuclear	64	47.1
Extended	49	36
None	2	1.5
<b>Number of gruesome crime scenes processed</b>		
0–100	44	32.4
101–300	52	38.2
301–1000	34	25
over 1000	6	4.4



**Figure 1.** FCSI's Family relationships before and after joining the FCSI Unit in Jamaica.

relationships among the FCSIs. The results indicate a significant difference between family relationship scores before joining the FCSI Unit ( $M=2.33$ ,  $SD=1.21$ ) and family relationship scores after joining the FCSI Unit ( $M=4.15$ ,  $SD=1.57$ ;  $t= 11.23$ ,  $p < 0.001$ ). The 95% confidence interval of the difference between means ranged from  $-2.14455$  to  $-1.50250$  further supporting the significant difference in family relationships subsequent to their roles as FCSIs.

Figure 2 compares personality traits before and after joining the FCSI Units and being exposed to GCS. Before exposure to GCS, 56.6% were loving and kind, 55.9% were happy and outgoing, 52.2% were introverted, 0.7% were aggressive, 8.1% were easily agitated, 47.1% were reserved, and 10.3% were outspoken.

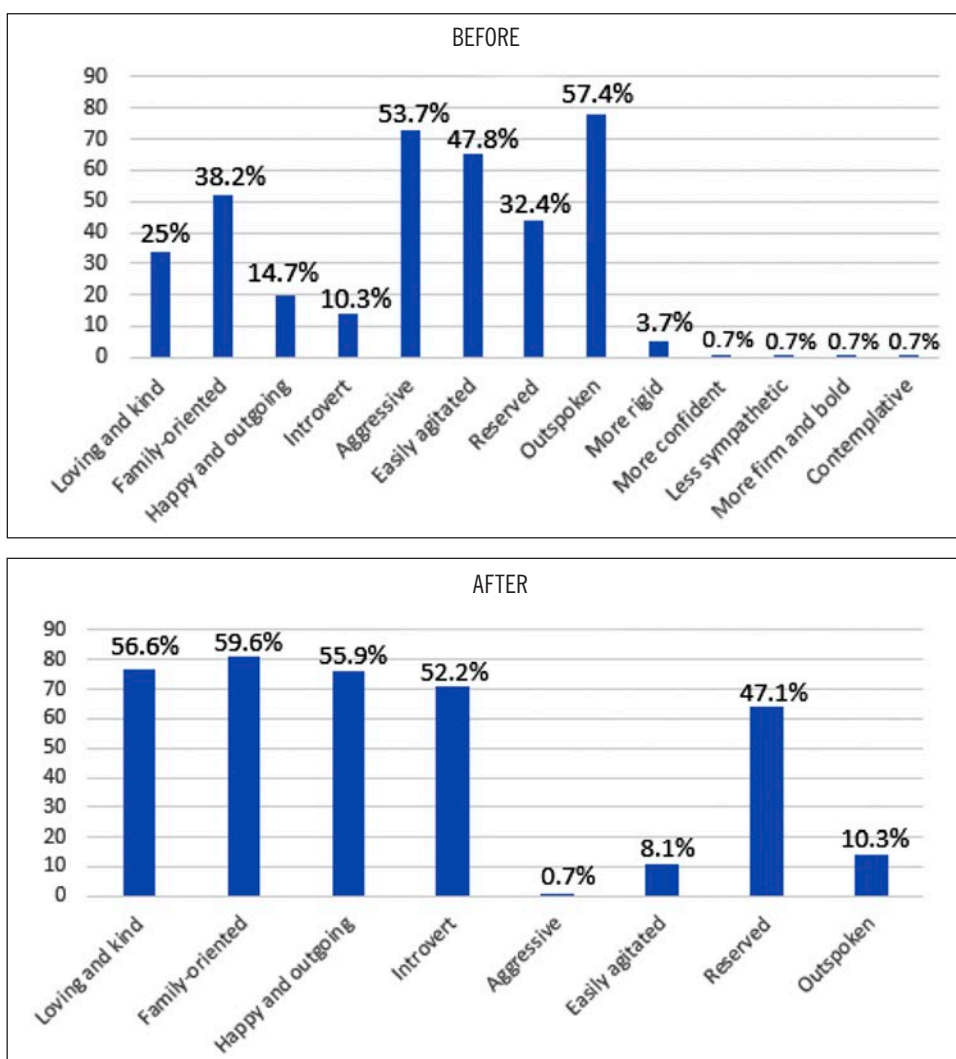


Figure 2. FCSI's Personality traits before and after joining the FCSI Unit.

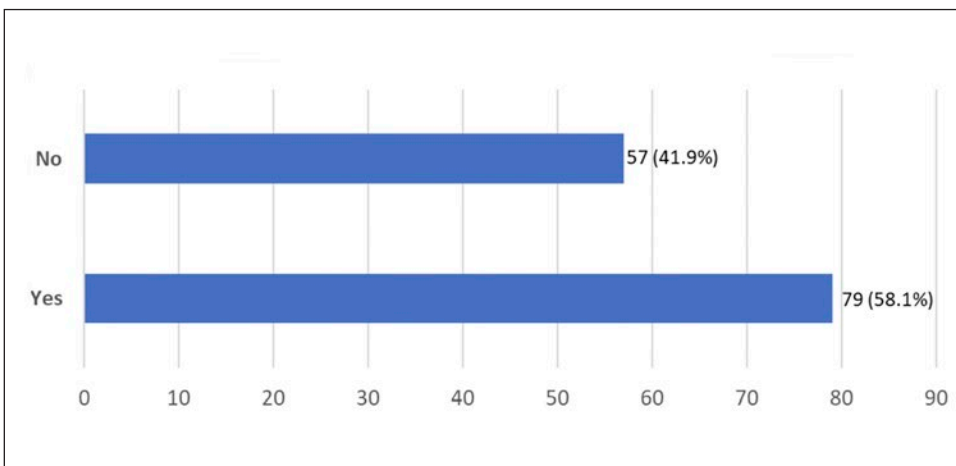
were easily agitated, and 10.3% were outspoken. To note, no respondent recorded being more rigid, more confident, less sympathetic, and firmer, bolder, and contemplative before joining the FCSI Units. In contrast, after repeated exposure, 25% were loving and kind, 14.7% were happy and outgoing, 10.3% were introverted, 53.7% were aggressive, 47.8% were easily agitated, and 58.1% were outspoken.

### Expression of Post-traumatic Stress Disorder Symptoms (Difficulty of Sleeping and Flashbacks)

Seventy-nine (58.1%) of the participants indicated that they had difficulty sleeping after joining the FCSI Unit (see Figure 3). Furthermore, as a result of repeated exposure to GCS, a majority (62%) of the participants also reported experiencing flashbacks that affected their sleep.

**Table 2.** Likelihood Ratio Test results for Age group, number of GCS processed and Period as a FCSI and Flashbacks.

Effect	Model Fitting Criteria	Chi-Square	df	Sig.
Intercept	52.572a	0	.000	0
Age _ Group	57.437	4.865	4	.301
GCS _ Processed	71.860	19.288	4	<.001
Period _ FCSI	68.425	15.852	3	.001



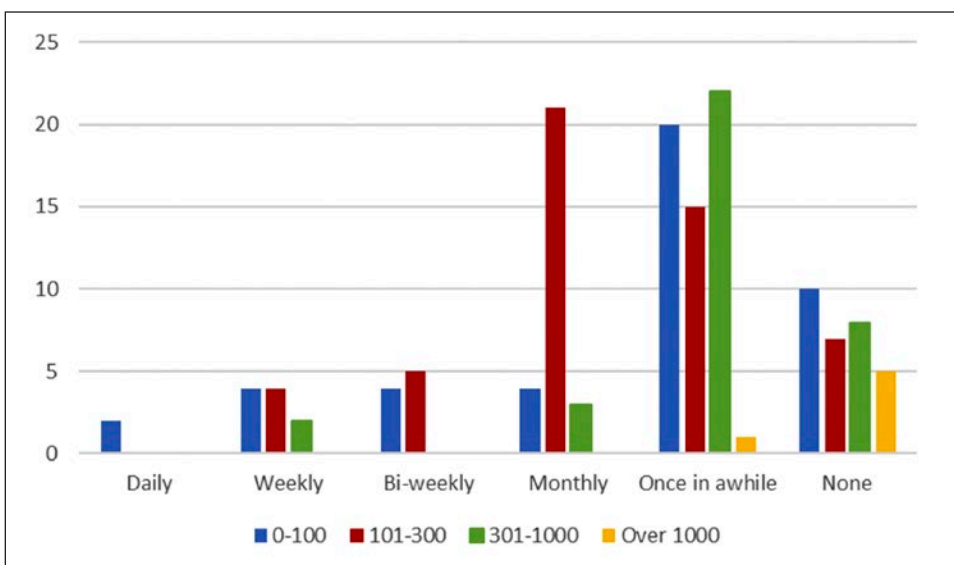
**Figure 3.** Percentage of FCSIs showing difficulty sleeping.

In this case, a Likelihood Test was used to compare the likelihood that there is no association between the number of GCS processed (GCS\_Processed), the length of time spent as a FCSI (Period\_FCSI), and age groups of FCSIs and the likelihood that there is an association between at least one of these variables and the likelihood of experiencing flashbacks affecting sleep. The Likelihood ratio test was able to detect significant associations between GCS\_Processed and Period\_FCSI, but not between age groups of FCSI and the likelihood of experiencing flashbacks affecting sleep (see Table 2).

Fifty-eight participants (48%) indicated experiencing flashbacks once in a while and participants who had processed 301–1000 GCS dominated this group. Conversely, only 2 (0.01%) experienced daily flashbacks and were associated with the 0-100 GCS processed group (see Figure 4). Many of the participants (52.9%) revealed that they did not believe they expressed any PTSD symptoms. One hundred and thirty-three (97%) had never engaged in any form of therapy (see Table 3).

**Table 3.** Percentage of respondents who believe they are suffering from post-traumatic stress disorder and those who engage in therapy.

FCSI belief/action after exposure to GCS	Yes	No
Believe to be experiencing post-traumatic stress disorder	64 (47.1%)	72 (52.9%)
Engage in Therapy	3 (2.2%)	133 (97%)

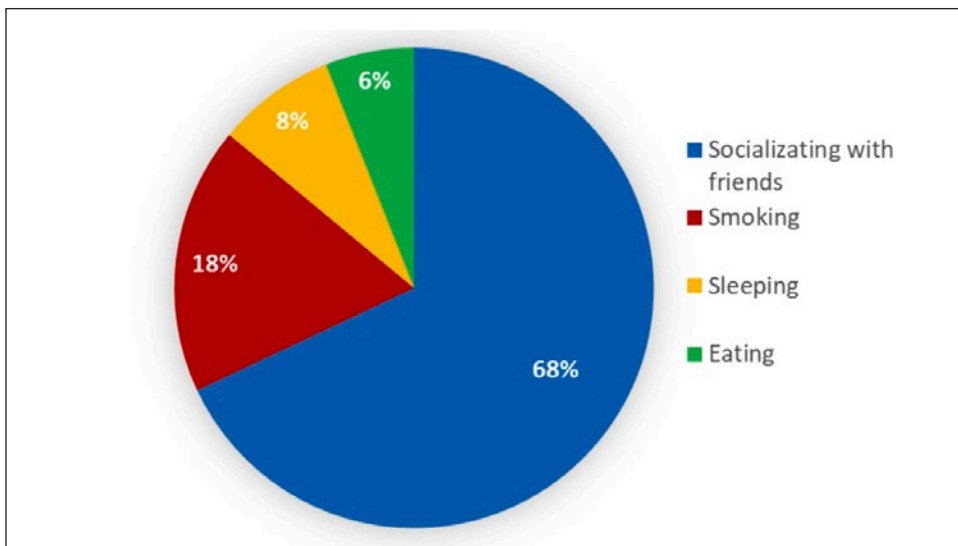


**Figure 4.** Frequency of Flashbacks experienced after repeated exposure to GCS and number of GCS processed.

*Coping Mechanisms*

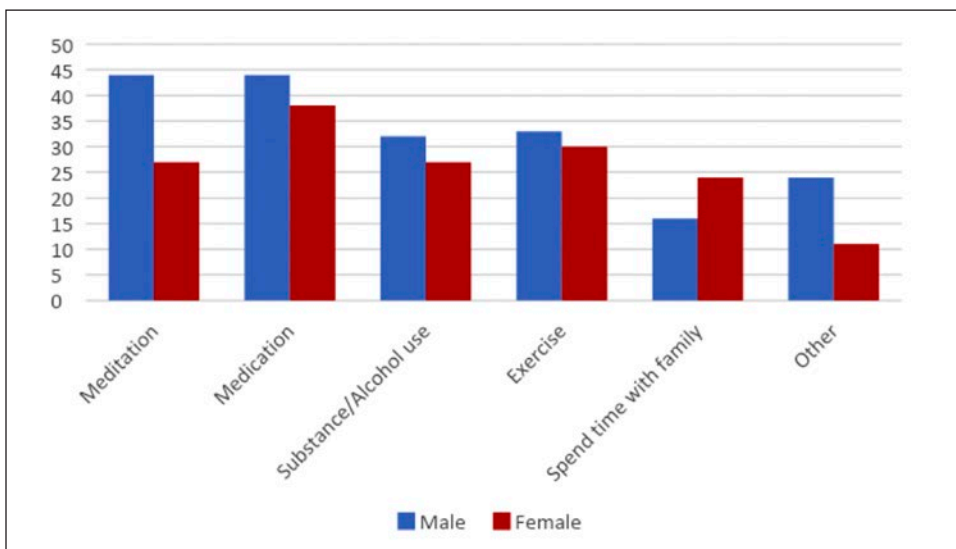
In general, FCSIs employed a number of coping mechanisms to deal with the processing of gruesome crime scenes; the majority (68%) utilised the outlet of socializing with friends. A Chi-square test was performed to investigate the relationship between age and coping after processing a gruesome crime scene. The results revealed that there was no statistically significant association between these variables ( $\chi^2 = 23.476$ ,  $df = 30$ ,  $p = .789$ ). Also, a Chi-square test to determine if there is a relationship between coping mechanisms after processing a gruesome crime scene and gender was conducted. The results indicated that the association between coping after a gruesome crime scene and gender was not statistically significant ( $\chi^2 = 10.807$ ,  $df = 9$ ,  $p = .289$ ).

Coping mechanisms for difficulty sleeping were more varied, and strategies employed included medication, meditation, substance/alcohol use, exercise and socializing. A Pearson chi-square test was conducted to determine the relationship between coping mechanisms for difficulty sleeping and age group. The results revealed that there was no statistically significant association between these variables (Pearson's chi-square = 39.298,  $df = 40$ ,  $p = .502$ ). Similarly, to determine the relationship between coping mechanisms for difficulty sleeping and gender, a Chi-square test was conducted (see Figure 5). The results indicated that the association between coping for the lack of sleep and gender was not statistically significant (Pearson's chi-square = 17.188,  $df = 10$ ,  $p = .070$ ).



**Figure 5.** FCSIs coping mechanism after processing a gruesome crime scene.





**Figure 6.** Male and female coping mechanisms for difficulty sleeping.

### *Interview*

Supervisors reported observable changes in FCSIs over time, which later manifested in the quality of their work. One supervisor stated that “. . . numerous young FCSIs joined the section, and after a few years, the attitude, emotion and demeanour changed drastically. The supervisor(s) are not doctors, but we can observe the changes in our FCSI over time, and the changes do affect their work in the future” (Personal Communication, April 4, 2020). While another supervisor noted that “. . . some may become less expressive, others become hostile or sad.” In addition, it was reported, that some FCSIs became overwhelmed and sought to be transferred or rotated from the Unit. Other factors highlighted by the supervisors which affected FCSIs well-being included remuneration, lack of resources, and inadequacies in their work environment.

## **Discussion**

The FCSI field is male-dominated in Jamaica, showing vast disparity in numbers between genders (see Table 1). Although women are under-represented in policing organizations and STEM careers, they are reportedly well-represented in certain forensic disciplines (Marshall et al., 2021). The Jamaican scenario could have been influenced by the preferential selection of male police officers to work in the FCSI

Units, due to the high exposure to GCS, many responsibilities and strenuous, long working hours. In the future a policing system geared towards reduction in gender bias, gruesome crimes and interventions for psychologically healthy FCSIs would narrow this gap, positively leading to gender equity.

### **Interpersonal Relationships**

The cumulative exposure to GCS by FCSIs can affect their personal lives and relationships outside of work. This is expected, as according to Miller (2008), officers who work on multiple murders or serial murders possess the strength and determination necessary to handle crises by putting their careers before their personal feelings. This being the case, it can be postulated that the behaviour of FCSIs will change overtime and have an influence on their interpersonal relationships. Violanti (2007) agreed with this supposition as he posited that on a psychological level, officers socialized in their working roles will take on an array of predispositions and behaviours which will eventually become a permanent part of their personality. The foregoing is likely to be a direct consequence of the noticeable changes in interpersonal relationships amongst FCSIs as shown in Figures 1 & 2. FCSIs were less “loving & kind” and “happy & outgoing” after repeated exposure to GCS. Conversely, they exhibited more aggression, irritability and outspokenness in their interpersonal relationships. Comparably, a study highlighting the interactions between police officers and their wives indicated that law enforcers experiencing stress were more likely to display anger, spend time-off away from the family and be impartial in family matters (Jackson & Maslach, 1982). Considering the occupational stresses which affect their interpersonal relationships, one study indicated that there should be counselling programs for police officers to balance their personal and professional lives. Counselling helps to relieve their stress and maintain a healthy relationship with not only their organization but also with the family (Kapade-Nikam & Shaikh, 2014). Similarly, an urgent recommendation is being made for mandatory counselling to be provided for all FCSIs in Jamaica.

### **Expression of Post-traumatic Stress Disorder Symptoms (Difficulty Sleeping and Flashbacks)**

Symptoms of post-traumatic stress disorder include difficulty sleeping, re-experiencing the event, avoidance of situations that bring back memories of the

event, and trouble concentrating. Generally, these symptoms may persist during the first few weeks after exposure to any traumatic event. However, lingering symptoms of a month or more may indicate a diagnosis of post-traumatic stress disorder (Hartley et al., 2013), noting that post-traumatic stress disorder is a clinical mental illness (Marmar et al., 2006). While not confirming a post-traumatic stress disorder diagnosis for the FCSIs in Jamaica, the findings showed some exhibited post-traumatic stress disorder symptoms, particularly, difficulty sleeping and flashbacks which affected their sleep (see Figures 3 & 4). Even though post-traumatic stress disorder symptoms were identified in the sample population, 97% of the participants never engaged in any form of therapy. This indicates that Jamaican FCSIs are not accessing or receiving healthcare to safeguard their mental health despite the high exposure to GCS (see Table 3), possibly due to the cultural stigma attached to mental illnesses or inadequate knowledge of mental health literacy. Similarly, a study conducted by Lorey & Fegert (2022) found that 75.5% of police officers thought to be suffering from mental health disorders or traumatization did not report the issue. In this instance, the reporting process was perceived to be too stressful. Collaboration with the FCSI Units and psychiatrists, including regular sensitization of mental issues associated with the job, would be beneficial to improve the mental fortitude of the FCSIs.

Examining more closely the association of flashbacks and sleep, some FCSIs were affected after processing GCS (see Figure 4). This is supported by Dunkley-Willis (2013) who stated that after viewing or being exposed to gruesome scenes, the images are likely to permeate the mind. The findings also suggest a significant association between the number of crime scenes processed and the likelihood of experiencing flashbacks during sleep among FCSIs. Additionally, the length of time as a FCSI was identified as another influential factor in the occurrence of flashbacks during sleep. The evidence suggests that interventions should facilitate FCSIs' early rotation from the FCSI Unit after a few years of service as this measure would significantly reduce the exposure to GCS and the associated trauma. The analysis did not reveal a significant association between age groups and the occurrence of sleep disturbances among FCSIs, indicating that age does not play a substantial role in influencing the impact of sleep disturbances (see Table 2). Cumulative lack of sleep due to flashbacks can give rise to obesity, heart disease, high blood pressure and diabetes (Dunkley-Willis, 2013). Daytime symptoms can also persist as a result of lack of sleep. Symptoms identified include fatigue, poor concentration and irritability which can spill over into the work arena (Richardson et al., 2020). Given the critical role FCSIs play in the criminal justice system, the

ineffective processing of crime scenes, analysis of physical evidence, preparing reports and testifying in court would be detrimental. Therefore, measures must be instituted that safeguard against the foregoing.

## Coping Mechanisms

Successful coping is paramount for staff well-being, retention and reducing absenteeism, especially for those employed in high-emotional labour jobs such as crime scene investigation (Craven et al., 2022). Coping mechanisms are encouraged since if emotions are not managed, they are likely to manifest themselves negatively in the form of isolation, substance abuse, depression, and post-traumatic stress disorder (Hulsey, 2008). The findings revealed that a number of coping strategies, both adaptive and nonadaptive, were employed by FCSIs. Predominantly used was the adaptive coping response of seeking social support (Blum, 2012). Nonadaptive strategies such as substance or alcohol use, sleeping (avoidance) and eating were used less frequently (see Figure 5). To mitigate against nonadaptive coping strategies among FCSIs, early introduction to a systematic program which encourages the utilization of adaptive rather than nonadaptive coping strategies during training could be beneficial (Wassermann et al., 2019). This service could be offered through the JCF Chaplaincy Unit. The findings also highlighted that coping strategies used to deal with the stress of the FCSIs' work showed no differences between males and females.

The interviews validated the survey responses of the FCSIs. The supervisors' assessment concurred with the findings from the study regarding interpersonal relationships, challenges and coping mechanisms. Due to the close working relationships with the FCSIs, the supervisors were adept in identifying their behaviour patterns before and after exposure to GCS, noting that predominantly drastic changes occurred in personalities and work attitudes.

## Conclusion

After exposure to GCS, Jamaican FCSIs exhibited diminished interpersonal relationships in their personal and professional lives. Some experienced post-traumatic stress disorder symptoms resulting in the use of adaptive and nonadaptive coping mechanisms. These results indicate the need for periodic evaluation and interventions geared towards prioritizing the health of forensic crime scene investigators. Given that the post-traumatic stress disorder symptoms may contribute to

adjustment problems in social, family, and work settings, early screening is vital.

Collaboration with the FCSI Units and psychiatrists, including regular sensitization of mental issues associated with their job, would be beneficial to improve the mental fortitude of the FCSIs. The evidence suggests that interventions should facilitate FCSIs' early rotation from the FCSI Unit after a few years of service. This measure would significantly reduce the exposure to GCS and the associated sequelae of trauma FCSIs experience.

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## Appendix

### Appendix 1. Jamaica Constabulary Force Police Areas

	Area 1	Area 2	Area 3	Area 4	Area 5	Total no. of FCSIs working at each location
Summit	✓					15
Bethel Town	✓					8
Trelawny	✓					4
Hanover	✓					4
Pompano Bay		✓				18
Portland		✓				4
May-Pen			✓			10
Williamsfield			✓			9
St. Elizabeth			✓			7
Spanish Town Road				✓		23
Central Village					✓	25
Linstead					✓	6
St. Thomas						9
Training FCSI				✓		
Major Investigations Division (MID)	✓					8
The Independent Commission of Investigations (INDECOM)	✓			✓		10

# An Evaluation of a Conventional Activated Sludge Treatment Plant for Compliance with Regulatory Standards

BRITNEY DALLINGTON, PATRICK ANDERSON, JEROHN BROWN,  
SHEMONE WRIGHT, LISA D. A. BRAMWELL AND NATALA BURNETT

University of Technology, Jamaica

## Abstract

Agencies responsible for providing utilities are generally underfunded and understaffed. This is especially true in developing countries, but the situation does provide an opportunity for the involvement of students and faculty members as interns, trainees, or consultants. Final year undergraduate students from the University of Technology, Jamaica, took the opportunity to evaluate an existing wastewater treatment plant, assessing plant efficiency and proposing practical solutions for improving efficiency while at the same time gaining valuable practical understanding of the day-to-day operations of the plant. Wastewater treatment plant aquot was assessed through a series of four laboratory tests. Plant A treats domestic wastewater, commonly referred to as sewage, from a community in the Kingston Metropolitan Area (KMA), Jamaica. Samples were collected from the plant over four weeks to track the effectiveness of the plant's operations. On each trip to the plant, seven grab samples were collected from specific sampling points. These seven sampling points were: (1) the raw influent, (2) effluents from the wet well, (3) the anaerobic basin, (4) the aerobic chamber, (5) the secondary clarifier, (6) the slow sand filter, and finally (7) the chlorination chamber. Each sample was tested for specific parameters, notably chemical oxygen demand (COD), pH, the concentration of nitrates, phosphates, residual chlorine, and total suspended solid (TSS). The characteristics of the sample obtained at sampling point seven were compared with the established

*regulatory standards of the National Environmental Protection Agency (NEPA) for treated sewage. Over the four testing periods, the compliance of the plant with the standards varied among parameters. Nitrate and phosphate levels complied with regulatory standards whereas COD and TSS were non-compliant with current effluent standards.*

**Keywords:** Regulatory Standards, Chemical Oxygen Demand (COD), Wastewater, Total Suspended Solids (TSS), Nitrates, Phosphates, Residual Chlorine.

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**Corresponding Author:** Lisa D. A. Bramwell – [lbramwell@utech.edu.jm](mailto:lbramwell@utech.edu.jm)

## Introduction

Wastewater is composed of liquid and solid waste discharged from domestic residences, commercial properties, industrial plants, and agricultural facilities to name a few. Wastewater contains a wide range of inorganic and organic matter (pollutants) and must be treated before its eventual disposal. Within our current wastewater management systems, the pollutants commonly monitored include suspended solids, phosphates, nitrates, microorganisms, and chlorine. Other ‘emerging’ pollutants which are not as commonly monitored include grease and oils, pesticides, and other agricultural chemicals as well as pharmaceuticals including hormones and antibiotics (Adetunji and Olaniran, 2021; Saleh et al., 2020; Samal et al., 2022).

These pollutants, if released into the environment without treatment, threaten wildlife, aquatic life (both marine and freshwater), domestic animals, and livestock. This also has great implications for humans as with the pollution of the environment there is the possibility for seepage into the water table and the potential of these pollutants to enter the food chain and affect humans and other organisms.

Wastewater treatment plants in the Kingston Metropolitan Area (KMA) in Jamaica need to be assessed on their ability to efficiently manage pollutants and to be retrofitted if they fall short of expectations. This is especially important considering increased urbanization and industrialization as the KMA expands with the growth of various industries and housing solutions.

A group of undergraduate students from the School of Engineering at the University of Technology, Jamaica assessed a wastewater treatment plant as the laboratory component for the module, Wastewater Treatment. Samples were taken from multiple units within the wastewater plant: the Inlet Chamber, Wet

Well, Anaerobic Basin, Aerobic Basin, Secondary Clarifier, Slow Sand Filter, and Chlorination Chamber. The parameters assessed include Chemical Oxygen Demand (COD) mg/L, Phosphate (mg/L), Nitrate (mg/L), Residual Chlorine (mg/L), pH, and Total Suspended Solids (TSS) (mg/L).

The Chemical oxygen demand (COD) measures the oxygen required to oxidize organic compounds in wastewater. Nitrates and phosphates are micronutrients present in wastewater as inorganic salts and as organic compounds. Untreated or undertreated wastewater contains high levels of these compounds which if leached into marine or freshwater habitats cause eutrophication resulting in hypoxic or anoxic conditions and dead zones within the affected ecosystems (Korostynska et al., 2012).

Chlorine is a powerful disinfectant frequently used to reduce microbial population in wastewater treatment plants. These microbes may include common inhabitants of the digestive tract, viruses, bacteria, and parasitic cysts.

Many of these organisms are pathogens, and treatment then becomes necessary to reduce any incidence of contamination. Chlorine itself however is also monitored closely due to its residual oxidative effects, its effect on pH and its ability to produce toxic metabolites for example, trihalomethanes which are mutagenic and carcinogenic (Abdo et al., 2022).

Wastewater contains suspended organic and inorganic material generally labelled as total suspended solids (TSS). These particles cause increased turbidity and reduce the effectiveness of most chemical treatments used, leading to inefficient systems with increased costs. Protection of the environment and human beings necessitates the monitoring of Wastewater Treatment Plants (WWTPs) to ensure continuous compliance with the National Environment Planning Agency's (NEPA) standards for treated sewage effluent. Previous studies have noted that the operation of these WWTPs within the KMA was inadequate due to a lack of financing and inadequate maintenance and as such a detailed analysis and upgrade to the system is overdue. Surveys done in 2005 and 2019 reveal that the sewer connection rate is 30% of the KMA population (JICA, 2010). Further, an evaluation of 70 treatment plants across Jamaica saw 97.3 % of the treatment plants being dysfunctional (Dixon, 2020). The purpose of this project was thus for student engineers to evaluate the performance of select wastewater treatment plants, first starting in the KMA, to identify problem areas and suggest probable solutions. This paper represents the first study associated with this initiative.

## Methodology

The methodology was divided into two segments: The collection of samples from the treatment plant and the procedures undertaken to test the samples for specific parameters.

### Collections of Samples

To prevent harm to the researcher and contamination among samples, plastic bottles and sterile disposable gloves were prepared before visiting the treatment plant. Seven samples were collected per week, which totalled twenty-eight (28) samples in four weeks. When the samples were collected at specific points along the plant, they were properly labelled 1 to 7, using a bright-coloured marker. Samples were taken at points of great turbulence to ensure a proper degree of mixing. Grab sampling was deemed the most suitable technique for this research. As shown in Table 1, the label number of a sample corresponds to the area from which the sample was taken.

**Table 1** Sample number for the area of collection

Sample Number	Area of Sample Collection
1	Raw Influent Stream
2	Wet Well
3	Anaerobic Basin
4	Aerobic Basin
5	Secondary Clarifier
6	Slow Sand Filter
7	Chlorination Chamber

Figure 1 depicts the plants process flow diagram and illustrates the Sampling points identified in Table 1. Samples 1 to 5 were taken within the unit operation (for example, sample 2 was taken from within the Wet Well). Samples 6 and 7 were taken directly after passing through their respective unit operations. After the samples were collected and labelled, they were placed into a cooler containing, containing ice to halt biochemical transformations. These samples were then carried back to the laboratory and within three (3) hours analysis began to determine parameters such as the COD, phosphates, nitrates, total suspended solids, and residual chlorine.

## Testing of Samples

Each parameter tested in the samples required the use of different procedures, as shown in Table 2. These procedures were taken from the HACH Water Analysis Handbook (Hach, 2023). Tests for parameters like COD, nitrates, phosphates, residual chlorine, and TSS made use of a spectrometer.

### *Part I: The pH Test*

1. Ten (10) ml of sample was poured into a small beaker.
2. A small strip of pH paper was placed into the sample. Based on the colour change of the strip, the pH was determined by comparing the colour to the pH colour scale.
3. When available the pH probe granted more accurate readings. The measuring probe was placed into the sample and then a reading from the high input impedance meter was recorded.
4. The process was repeated for all samples.

### *Part II: The COD Test*

1. One (1) mL of sample was added to a vial with potassium dichromate in sulphuric acid solution. This mixture was inverted 5 times.
2. Afterwards, the mixture was placed into the digester for 2 hours.
3. When digestion was completed, a cuvette containing only the reagent was placed into the spectrometer to zero it.
4. The cuvette containing the sample and the reagent was placed into the spectrometer and the COD program was run. After the program was terminated, the COD value was recorded.

Steps 1 to 4 were conducted simultaneously for all other samples.

### *Part III: The Nitrate Test*

1. Ten (10) mL of sample was added to a 10 mL cuvette and was placed into the spectrometer. The spectrometer was zeroed.
2. The reagent (ferrous sulphate) was added to this cuvette and shaken for a minute. This cuvette was then placed in the spectrometer. Absorbance was measured at 500 nm.
3. Steps 1 to 3 were repeated for all other samples.

#### *Part IV: The Phosphate Test*

1. One (1) mL of sample was added to a 10 mL cuvette then 9 ml of distilled water was added to the sample to take it up to the 10 mL mark.
2. The 10 ml cuvette was added to the spectrometer and the spectrometer was zeroed.
3. A reagent (ascorbic acid-ammonium molybdate) was added to this cuvette and placed in the spectrometer.
4. The phosphate program ran then the cuvette was left for two minutes.
5. After two minutes had passed, the phosphate reading was taken.
6. Steps 1 to 4 were repeated for all other samples.

#### *Part V: The Residual Chlorine Test*

1. Ten (10) mL of sample was added to a 10 mL cuvette.
2. This cuvette was added to the spectrometer and zeroed.
3. The reagent, DPD Power Pillow, was added to the sample and returned to the spectrometer.
4. The residual chlorine program was run for three minutes, and readings taken.
5. Steps 1 to 4 were repeated for all other samples.

#### *Part VI: The TSS Test*

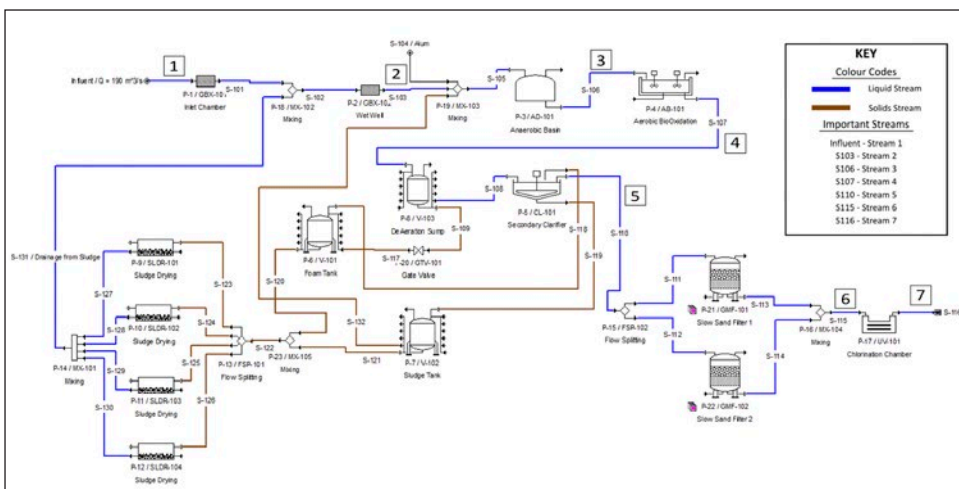
1. A twenty-five (25) ml, cuvette was filled with distilled water and used to zero the spectrometer.
2. Twenty-five (25) mL of sample was added to another 25 mL cuvette.
3. The 25 ml cuvette was placed into the spectrometer. The TSS program ran then the TSS reading was taken instantaneously.
4. Steps 3 to 4 are repeated for all other samples.

**Table 2:** Parameters Tested Testing Methods and NEPA Effluent Standards

Parameters	Unit	Method	NEPA Standard
COD	mg/L	HACH 8000	< 100 mg/L
Nitrate	mg/L	HACH 8039	30 mg/L
TSS	mg/L	HACH 8006	30 mg/L
Phosphates	mg/L	HACH 8048	10 mg/L
pH	pH Unit	HACH 8156	6.5–8.5
Residual Chlorine	mg/L	HACH 8021	1.5 mg/L

### Reliability and Validity

The sample collection was carried out to ensure that the integrity of the sample was preserved and provided the best results. Taking samples at high points of turbulence was done to ensure a high degree of mixing. This is important, as a high degree of mixing gives a better representation of the area where the sample was taken. The pH tests were conducted on-site instead of after the samples were carried to the lab. This was done to preserve the integrity of the sample, as the temperature can influence pH. However, there was an instance where data was compromised. In the first week, sample 4 was taken out of the cooler to be tested. However, by the time the sample had undergone tests, it had been left out for too long. Hence, the integrity of the sample could no longer be validated, and the data related to it was rejected.



**Figure 1:** Process Flow Diagram of Wastewater Treatment Plant A



## Results

Results presented in this section of the paper are organized first by providing an overview of the stream characteristics in Table 3. For Table 3, historical data are compared with the data obtained for the duration of this study, and these values are addressed in more detail within the discussion section of this paper. Within Figures 2–11, the weekly trend in parameter levels was compared with NEPA’s effluent standards, for treated sewage (NEPA, 2013).

**Table 3:** Results of the Experiments Conducted on the Samples taken from Plant A

Parameters	Week	STREAM DESCRIPTORS							NEPA Standards (New Plants)
		Influent (1)	Wet Well (2)	Anaerobic Basin (3)	Aerobic Basin (4)	Secondary Clarifier (5)	SS Filter Effluent (6)	CC Effluent (7)	
COD (mg/L)	1	440.0	566.0	11090.0	–	90.4	119.0	128.0	<100
	2	699.0	537.0	9870.0	16500.0	109.0	820.0	552.0	<100
	3	353.0	420.0	54300.0	7770.0	624.0	147.0	107.0	<100
	4	418.0	831.0	8700.0	8470.0	86.1	121.0	424.0	<100
	<b>Average</b>	<b>477.5 (729.9)</b>	<b>588.5</b>	<b>20990.0</b>	<b>10913.3</b>	<b>227.4</b>	<b>301.8</b>	<b>302.8 (11.5)</b>	<100
Total Phosphates (mg/L)	1	9.8	11.8	207.0	–	5.9	3.6	3.7	<10
	2	13	1.21	64	496	1.53	1.34	2.2	<10
	3	14	2.1	300	146	4.6	6.1	5.8	<10
	4	3.20	25.80	404	368	2.11	3.27	2.30	<10
	<b>Average</b>	<b>10.0 (11.7)</b>	<b>10.2</b>	<b>243.8</b>	<b>336.7</b>	<b>3.5</b>	<b>3.6</b>	<b>3.5 (3.1)</b>	<10
Total Nitrates (mg/L)	1	8.8	7.7	136.0	–	2.0	0.2	4.2	<30
	2	11.5	10	500	1332	3	6	2.8	<30
	3	-0.1	11	400	701	8	7	0.3	<30
	4	19	10.0	1459	1227	0.2	0.8	5.0	<30
	<b>Average</b>	<b>9.8 (54.3)</b>	<b>9.7</b>	<b>623.8</b>	<b>1086.7</b>	<b>3.3</b>	<b>3.5</b>	<b>3.1 (6.9)</b>	<30
Residual Chlorine (mg/L)	1	0.30	-0.21	3.00	–	0.30	0.20	2.08	<1.5
	2	-0.02	-0.11	1.5	3.6	-0.01	0.00	1.81	<1.5
	3	-0.08	-0.13	10	8.5	-0.05	-0.01	0.01	<1.5
	4	-0.15	-0.14	2.8	2.5	0.07	-0.02	0.48	<1.5
	<b>Average</b>	<b>0.01</b>	<b>-0.15</b>	<b>4.33</b>	<b>4.87</b>	<b>0.08</b>	<b>0.04</b>	<b>1.10</b>	<1.5

Parameters	Week	STREAM DESCRIPTORS							NEPA Standards (New Plants)
		Influent (1)	Wet Well (2)	Anaerobic Basin (3)	Aerobic Basin (4)	Secondary Clarifier (5)	SS Filter Effluent (6)	CC Effluent (7)	
pH	1	8	8	8	–	8	8	8	6–9
	2	7.65	7.47	7.35	7.35	7.58	7.42	7.46	6–9
	3	8	8	8	8	8	8	8	6–9
	4	7.55	7.50	7.21	7.40	7.56	7.52	7.60	6–9
	<b>Average</b>	<b>7.8 (8.1)</b>	<b>7.7</b>	<b>7.6</b>	<b>7.6</b>	<b>7.8</b>	<b>7.7</b>	<b>7.8 (7.5)</b>	6–9
TSS (mg/L)	1	124	173	8710	–	42	37	28	<30
	2	240	223	1248	948	62	53	77	<30
	3	98	131	6675	5700	49	73	78	<30
	4	231	229	9725	7475	48	74	62	<30
	<b>Average</b>	<b>173 (411)</b>	<b>189</b>	<b>6590</b>	<b>4708</b>	<b>50</b>	<b>59</b>	<b>61 (&lt;10)</b>	<30

\*SS – Slow Sand Filter, CC – Chlorination Chamber Effluent

\*Bracketed values are historic data points from the plant’s inception year (2017)

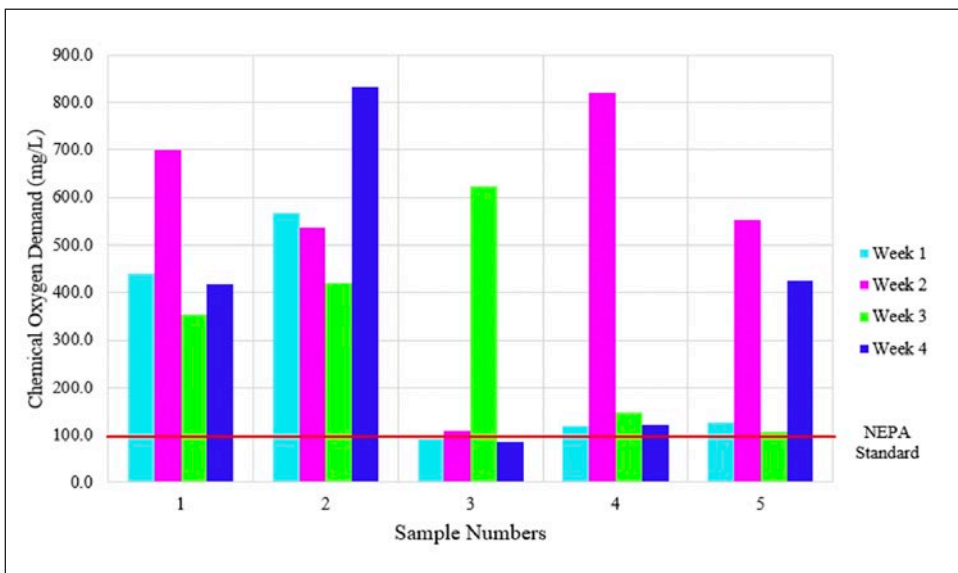


Figure 2: Variation in COD Levels Over the 4 Weeks

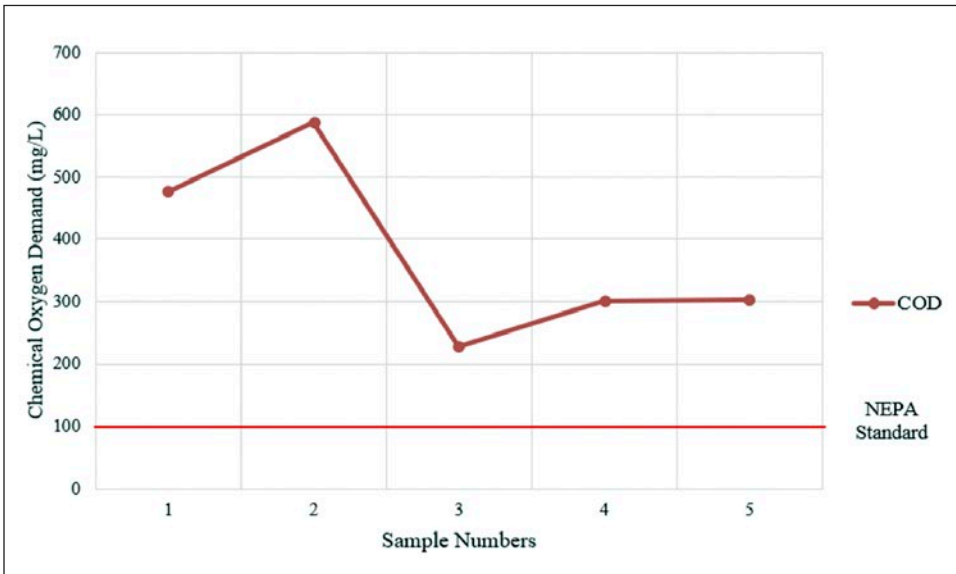


Figure 3: Average COD Levels Over 4 Weeks



Figure 4: Variation in Phosphate Levels Over the 4 Weeks

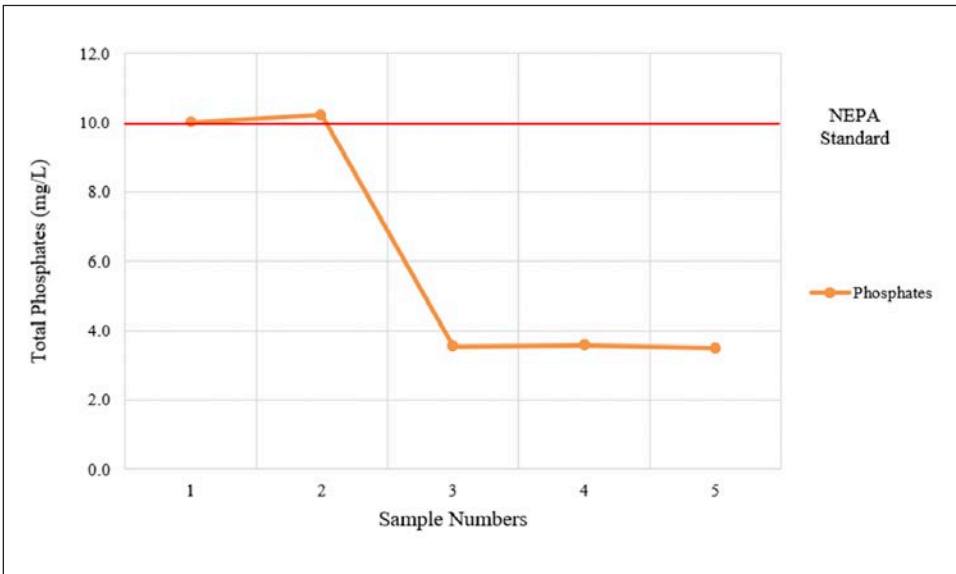


Figure 5: Average Phosphate Levels Over the 4 Weeks

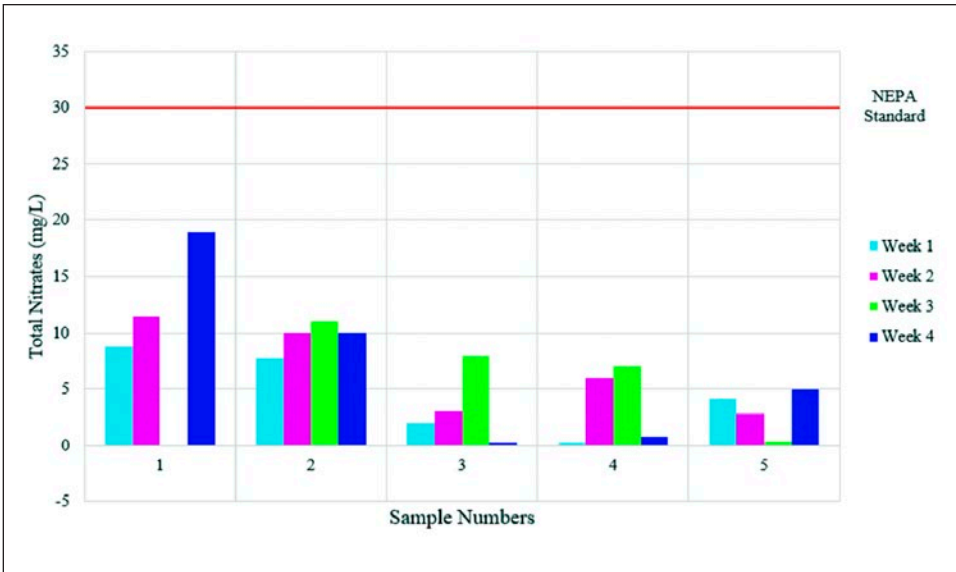


Figure 6: Variation in Nitrate Levels Over the 4 Weeks

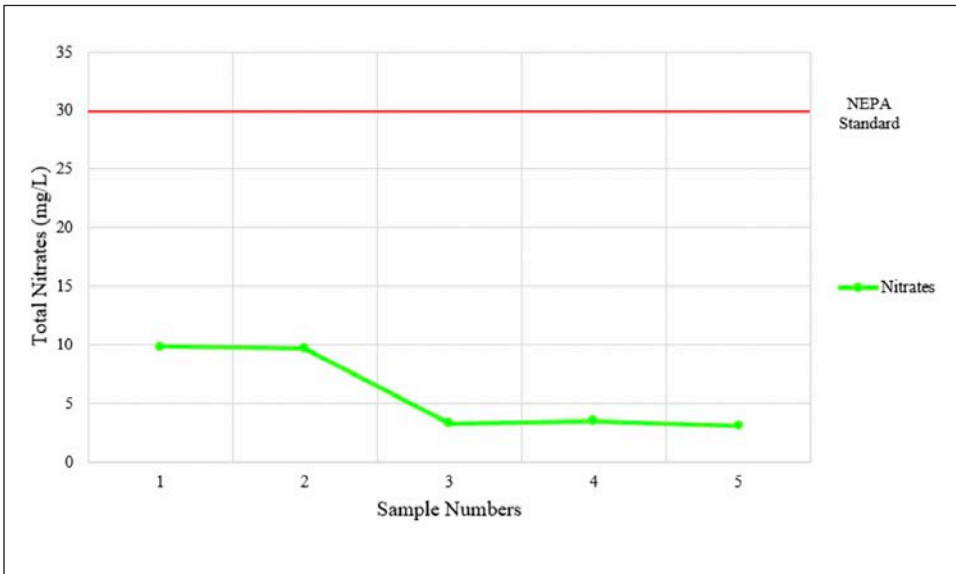


Figure 7: Average Nitrate Levels Over the 4 Weeks

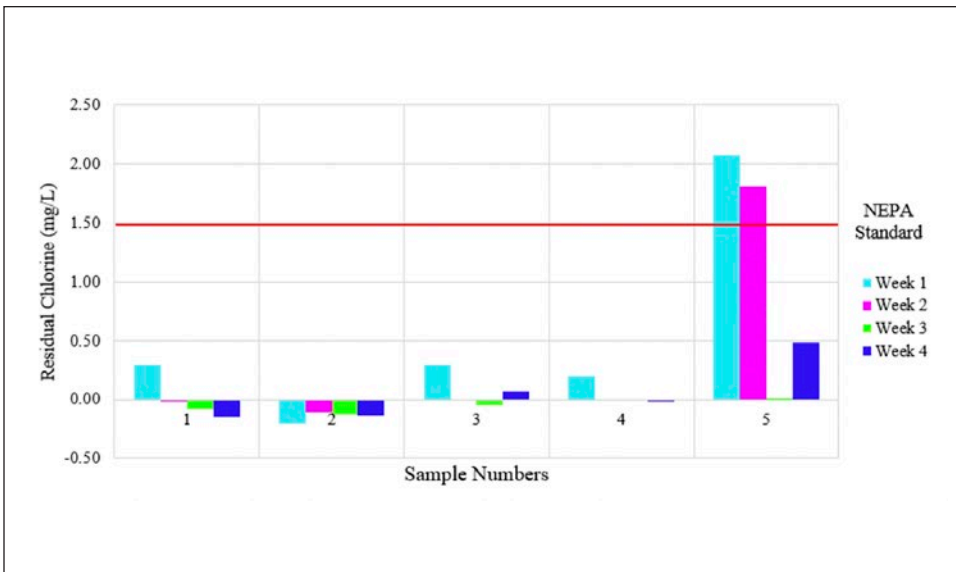


Figure 8: Variation in Residual Chlorine Levels Over the 4 Weeks

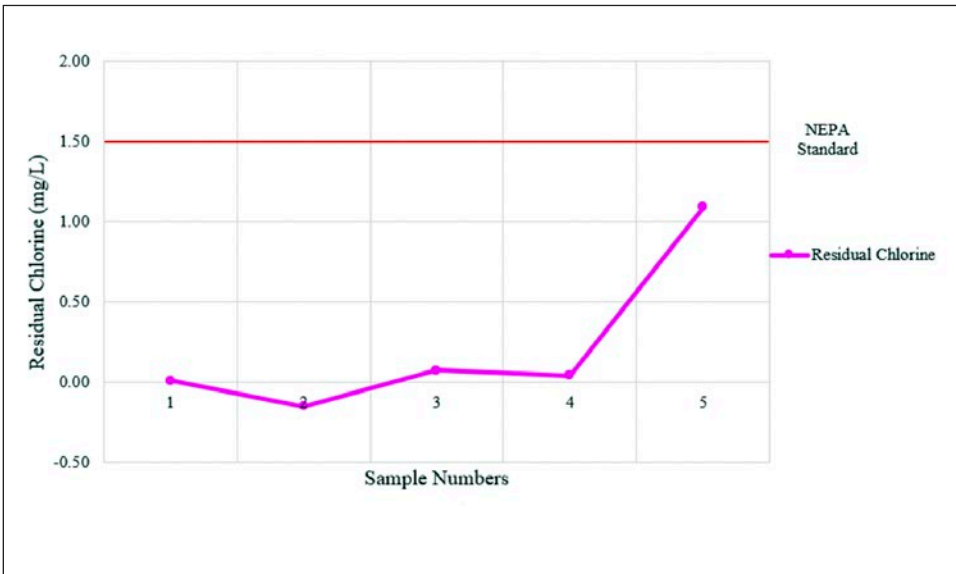


Figure 9: Average Residual Chlorine Levels Over the 4-week Period

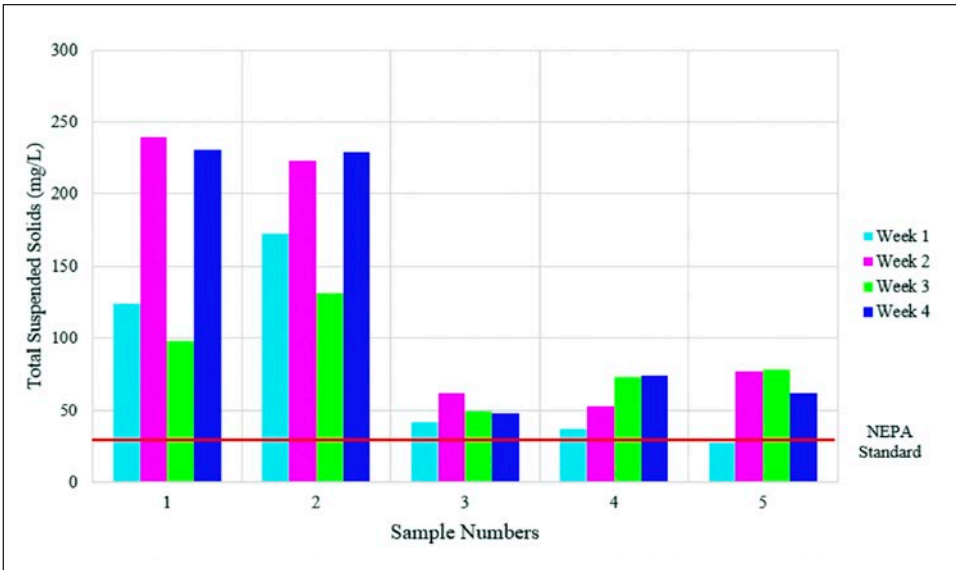
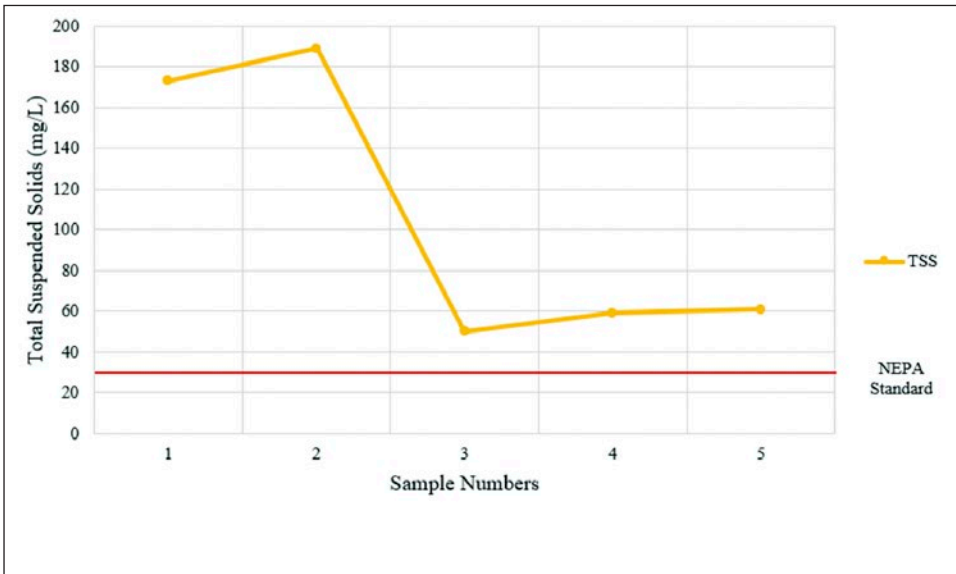


Figure 10: Variation in TSS Levels over the 4-week Period



**Figure 11:** Average TSS Levels Over the 4 Weeks

## Discussion

### Plant Compliance

Analysis of the plant at the sample points mentioned in Table 1 was conducted starting on September 19th and ending on November 7th, 2022. Compliance with NEPA's 2013 Regulations was 100% for Total Phosphates, Total Nitrates, and pH. All samples of the treated effluent leaving the plant, complied with nitrate, phosphate, and pH standards as prescribed within the NEPA Regulations for all four sampling days. Conversely, compliance levels for COD, Residual Chlorine, and TSS were rather low at 0%, 50%, and 25 % respectively. The plant effluent poses a low risk of eutrophication for neighbouring waterways as nutrient levels are consistently compliant. The other parameters, however, are a cause for concern.

### Chemical Oxygen Demand (COD)

According to Jain and Singh (2003), COD is a measure of the oxygen equivalent of the organic matter in a water sample that is susceptible to oxidation by a strong chemical oxidant. COD is widely used as a measure of the susceptibility to oxidation of the organic and inorganic materials present in water bodies and

in municipal and industrial wastes. The NEPA Wastewater and Sludge 2013 Regulations treated effluent COD standard for new and existing plants is 100 mg/l. From the data gathered, the COD levels of the effluent from week one (1) to week four (4) are 128.0, 552.0, 107.0, and 424.0 mg/l, respectively. Based on the data, it was observed that the COD levels were above the required level based on the standards. At weeks 1 and 3, the COD levels were just above the standards set by the regulatory agency, which is poor for the plant, but for weeks 2 and 4, the levels were grossly out of range compared to the standards (see Figure 2).

Furthermore, based on Table 2, when current and historical data for the influent (Sample 1) and effluent (Sample 7) are compared, the average COD level for the influent is 477.5 mg/l, but in 2017, it was 729.9 mg/l, and for the treated effluent, it was currently 302.8 mg/l on average during the sampling campaign, whereas in 2017, it was 11.5 mg/l. Current COD removal rates do not exceed 71 %, while historical data indicate that removal rates were significantly higher at 98 %. The elevated levels of COD within units 3 and 4 (see Table 3), the anaerobic and aerobic basins respectively, are due to the microbial cells metabolizing the oxidizable organic matter within the waste stream and forming new protoplasm during the process. Typically, after these operations, wastewater is directed to the clarifier, where settleable materials are recycled to units 3 and 4, and treated effluent is then polished within the slow sand filter, unit 5. These slow sand filters are traditionally used to remove TSS, COD, and, to a lesser extent, pathogens, thus ensuring adequate COD removal by the plant. Currently, the slow sand filters present at Plant A are not in operation. Appendix 4 depicts an image of the current slow sand filter at Wastewater Treatment Plant A. The non-operational slow sand filter can account for the high COD values in the effluent stream. Ciao, Liu, and Meng (2010) observed COD removal rates above 40 % for slow sand filters operated at 0.1 m/hr during summer months. Operational slow sand filters can significantly reduce COD loadings provided high TSS loading does not cause premature fouling.

## Total Phosphates

The standard set by NEPA for the levels of total phosphate in the effluent is 10 mg/l as seen in Appendix 1. The treatment of this parameter was effectively carried out by the plant, as the average level of phosphate seen in the effluent over the 4 weeks was 3.5 mg/l. Another way we can assess the plant's capability of phosphate removal is to study the trends seen in Figures 4 and 5. Plant A has a combined primary/secondary treatment system, with alum being added to the anaerobic



basin before discharge to the aerobic basin and then, ultimately, the secondary clarifier. This is customary for low-flow rate plants. Adequate residence times within the two basins have resulted in significant phosphate removal from the wastewater treatment plant. This is clearly shown in Figure 5, where the average phosphate reading in sample 5 is 3.5 mg/L. Total phosphate removal for the plant varied from a minimum of 28 % in week 4 to a maximum of 83 % in week 2. As indicated by Table 2, the plant's current total phosphate level in the influent and effluent is 10.0 mg/l and 3.5 mg/l, respectively. As it relates to historical data in 2017, the influent total phosphate level was 11.7 mg/l, and the effluent total phosphate level was 3.1 mg/l. When compared, the values show great similarity, and one can safely say that Plant A is operating similarly as it was in its initial stages, concerning nutrient removal. Poor agricultural practices, runoff from municipalities and lawns, leaking septic systems, and sewage treatment plant discharges can all contribute to high phosphorus and nitrogen concentrations. High levels of these nutrients in the effluent have a high possibility of leading to eutrophication, the overgrowth of algae and large aquatic plants. High phosphate and nitrogen levels can also cause algal blooms, which can create compounds that are hazardous to both human and animal health and can even be fatal. It is, therefore, paramount that the plant continues to maintain current effluent phosphate levels.

### Total Nitrates

Nitrates have a similar impact on the ecosystem as phosphates as both are responsible for eutrophication. Ammonium compounds are converted to nitrates and nitrites by Nitrosomonas and nitroso coccus bacteria species in the aeration basin while within the anaerobic chamber, oxidized nitrogen is typically converted to gaseous nitrogen by Pseudomonas and Thiobacillus species. Adequate recycling of sludge between the two chambers resulted in significant nitrate removal rates for the plant. Removal efficiencies for the plant varied from a minimum of 52 % to a maximum of 75 %.

The NEPA standard for nitrates for new plants is less than 30 mg/l. Presently, the tabulated data values for total nitrates for Plant A in the influent and effluent are 9.8 mg/l and 3.1 mg/l, respectively during the 4-week sampling campaign. Sample influent and effluent readings during the 2017 calendar year were 54.3 mg/l and 6.9 mg/l respectively. The influent value from the historical data is very high when compared to the current value, but this is no fault of the plant as there is no control over the constituents of the raw sewage entering. Overall, both current

and historic effluent values show that Plant A is operating according to NEPA's established standards (see Figures 6 and 7).

### Total Suspended Solids

Based on the data gathered, it was observed that week 1 had the lowest TSS concentration in the effluent (28 mg/l). The subsequent weeks had higher levels of TSS, which doubled the standard set by the regulatory body. The standard concentration of TSS set by NEPA is less than 30 mg/l. The spike in the average concentration of the TSS in weeks 2–4 may be due to the malfunction of the slow sand filter on the plant. Particles from the defective filter may have entered the effluent stream, causing an increase in the TSS value. Also, another possible case may be due to the chlorine in the chlorination chamber. When chlorine enters the water, it reacts chemically with any organic matter found in the water. There is always some organic matter in natural waters. By-products of this reaction include trihalomethanes (THMs) such as chloroform, which increases the TSS concentration (Pedersen, 1997). Historically, the effluent leaving the plant averaged less than 10 mg/l of TSS. This complied with NEPA's recommended standard for TSS. In contrast to the current study, however, the average TSS in the effluent stream is 61 mg/l (see Figures 10 and 11). As for the influent in the current day, the average TSS is 173 mg/l. Historically, the typical TSS value in the influent was more than twice as high, coming in at 411 mg/l.

The total suspended solids (TSS) can consist of a wide range of substances, including sewage, silt, and dead plant and animal materials. For the health of streams and aquatic life, high suspended solids concentrations can result in a variety of issues (Murphy, 2007). Elevated levels of TSS can raise water temperature and reduce naturally dissolved oxygen levels in water (Cornwell and Davis, 2002; FELC, 2023). This could make it impossible for aquatic creatures, like fry, fingerlings, and tilapia, to thrive in Jamaican waters. TSS may also obscure sunlight, reducing photosynthesis and, thus plant viability and further reducing oxygen levels in the water.

### Residual Chlorine

As shown in Table 3, Plant A's current residual chlorine influent value is 0.01 mg/l, while the average effluent value is 1.10 mg/l. It is evident that, on average, Plant A's effluent value complies with the NEPA standard for residual chlorine, which is less than 1.5 mg/l. In samples 1, 2, 5, and 6, negative residual chlorine

values are also recorded in Table 3. The negative values were treated as negligible values of residual chlorine; that is, they fell below the detection limit of 0.02 mg/L for HACH method number 8021. For weeks 1 and 2 non-compliant levels of residual chlorine were observed, 2.08 and 1.81 mg/l respectively (see Figures 8 and 9). This may be attributed to the underperformance of the slow sand filter; higher quantities of chlorine may have been added to compensate. Wiant (2013) defines “residual chlorine”; as the low level of chlorine remaining in the water after a certain period of contact time after its initial application. Some chlorine stays in the water after a specific contact period during which chlorine kills microorganisms; this remaining level serves as a precaution against further microbial activity. Residual chlorine may be present as hypochlorite ions, hypochlorous acid, and chlorine gas in solution. Excessive levels of these oxidants may also be of some concern particularly when combined with older lead pipes, which raises the risk of lead corrosion. Residual chlorine is also toxic to many kinds of aquatic life and may react with organic materials in the aquatic environment to form carcinogenic trihalomethanes and organochlorines. It is then essential to monitor residual chlorine levels during wastewater treatment and before effluent release when dichlorination via reverse osmosis, catalytic carbon filters, sulfur dioxide, or other methods may be necessary (EPA, 2000).

## Conclusion

The setup at Wastewater Treatment Plant A is somewhat unconventional. Typically, primary treatment within a plant begins from the influent and stops at a primary clarifier, followed by secondary treatment, which makes use of biological processes to reduce oxygen-demanding wastes and nutrients such as phosphates and nitrates. Plant A, however, combines these two concepts into one by having a single clarifier after biological treatment. Nevertheless, historically, Plant A was operating within NEPA's standards, but over time, the plant's treatment ability has deteriorated.

Two of the key parameters tested, notably COD and TSS, are often well out of range for the current effluent standards. This paper has highlighted the causes of these findings and made suggestions for plausible solutions or corrective actions. The slow sand filter should preferably be renovated and brought back online while simultaneously adding a primary treatment dedicated to reducing the load of TSS which now passes through the secondary treatment units; this is necessary to prevent premature clogging of the slow sand filter. Careful assessment of sand

grading is another preventative measure which could increase the time before clogging the unit, and if acreage would allow, some redundancy is needed. Alternatively, if the slow sand filter is prohibitively costly, an effective COD and TSS polishing unit is needed that requires limited square footage, given the plant's small footprint. Membrane bioreactors, as well as trickling filters, are low-cost and low-maintenance options worth exploring in future student-affiliated projects.

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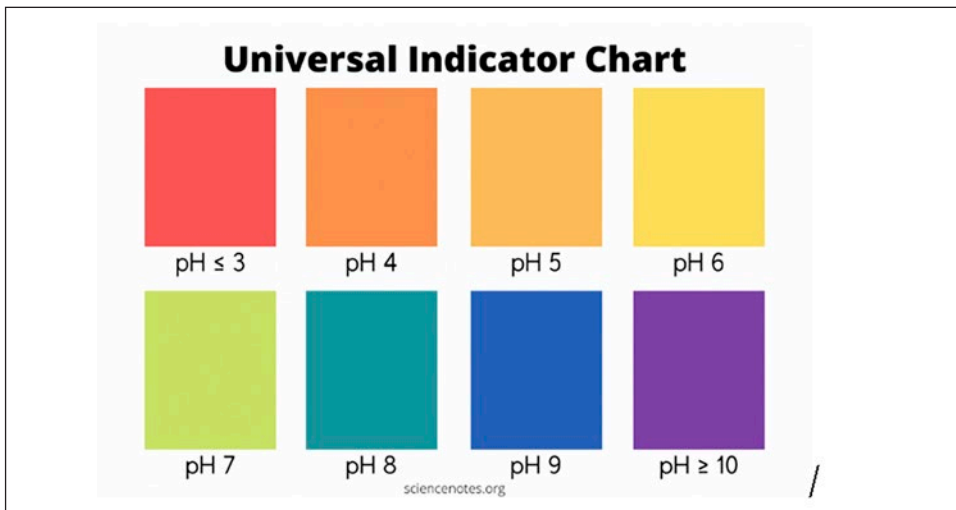
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## APPENDICES

Parameter	Effluent Limit
BOD <sub>5</sub>	20 mg/l
TSS	30 mg/l
Nitrates (as Nitrogen)	30 mg/l
Phosphates	10 mg/l
COD	100 mg/l
pH	6–9
Faecal Coliform	1000 MPN/100 ml
Residual Chlorine	1.5 mg/l

**Appendix 1:** NRCA Sewage Effluents Standards for existing plants (1997)



**Appendix 2:** pH colour chart



**Appendix 3:** COD Test

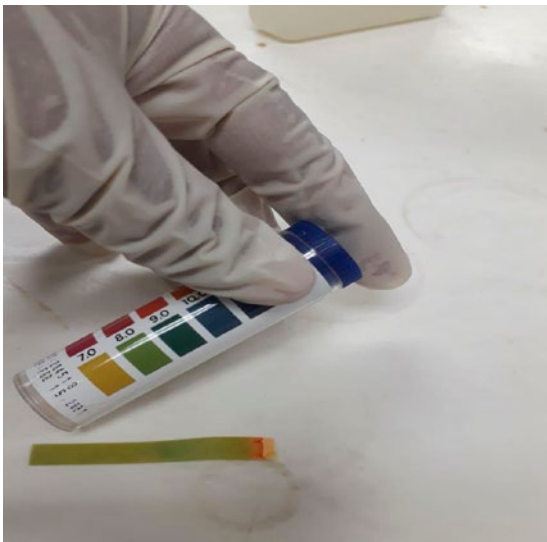


**Appendix 4:** Slow Sand Filter

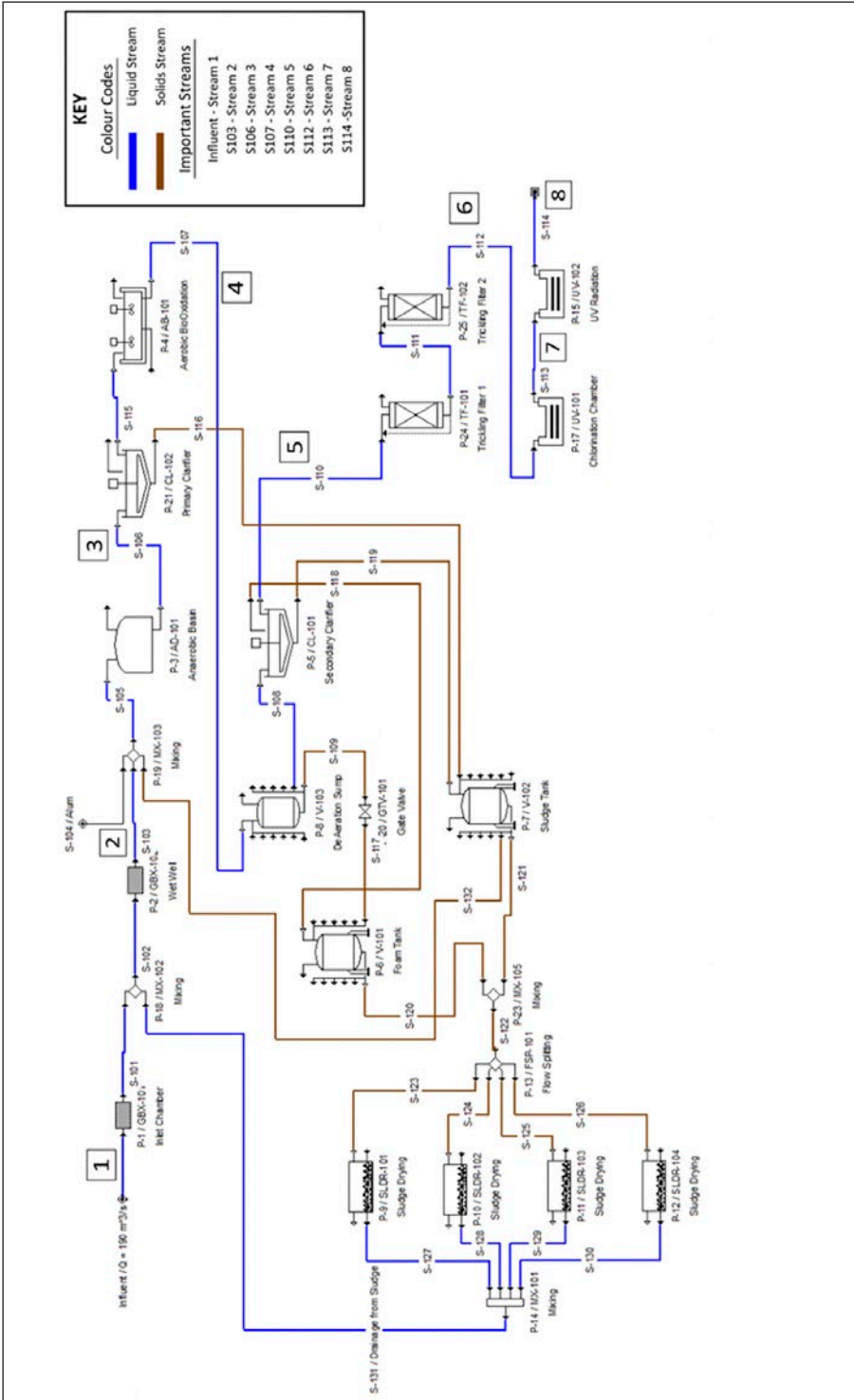




**Appendix 5:** Chlorination Chamber



**Appendix 6:** pH Colour Change



Appendix 7: Modified PFD of the Wastewater Treatment Plant A

# Evaluation of the Environmental Energetic Sustainability of a Municipality in the Republic of Cuba

DAVID A. VERDECIA TORRES  
University of Technology, Jamaica

## *Abstract*

*This paper assesses key factors that influence the environmental energy sustainability of the Municipality of Bayamo, Granma province, Republic of Cuba, particularly its energy component, which is its driving force. In the area of Energy Management, there is a lack of tools capable of quantifying the level of energy sustainability. On the other hand, the use of available renewable resources, the cleanliness of the energy consumed, the efficiency of the energy transformation systems, and the capacity for self-sufficiency in energy constitute for the factors that influence energy sustainability. A calculation procedure is proposed whereby the level of energy sustainability can be determined using a sustainability index function; this procedure was used for evaluating the energy sustainability in the municipality of Bayamo, Granma province, Republic of Cuba.*

**Keywords:** Sustainability Index, Energy Sustainability

**Corresponding author:** David A. Verdecia Torres – [david.torres@utech.edu.jm](mailto:david.torres@utech.edu.jm)

## Introduction

Since the beginning of the 20th century, the current energy model based on fossil fuel consumption has been increasingly questioned. Its limits are becoming increasingly evident, economically (high energy prices), socially (inequity and energy poverty), and environmentally (adverse implications for the environment).

With the marked tendency to increase oil consumption, together with the decrease in proven reserves, it can be concluded that in a few years, that energy model will be history and, due to the established technological structure, oil depletion will bring about an unprecedented international energy crisis. If the current energy consumption is not changed and there are no firm commitments in favour of clean sources, we will reach the point where reversing the effects will be impossible

The municipality of Bayamo, head of the province of Granma, is located south-east of the Cauto River. It is broadened to the north by the municipality of Cauto Cristo, to the south by the municipalities of Guisa and Buey Arriba, to the east by the municipality of Jiguaní and to the west by the municipalities of Yara and Río Cauto.

It has a territorial extension of 963,30 km<sup>2</sup>, which represents 11% of the total provincial area. The total population of 231,074 inhabitants represent 26.4% of the provincial total, for a density of 251.7 inhabitants/km, of which 70.9% are concentrated in the urban area and the remaining 29.1% in the rural area.

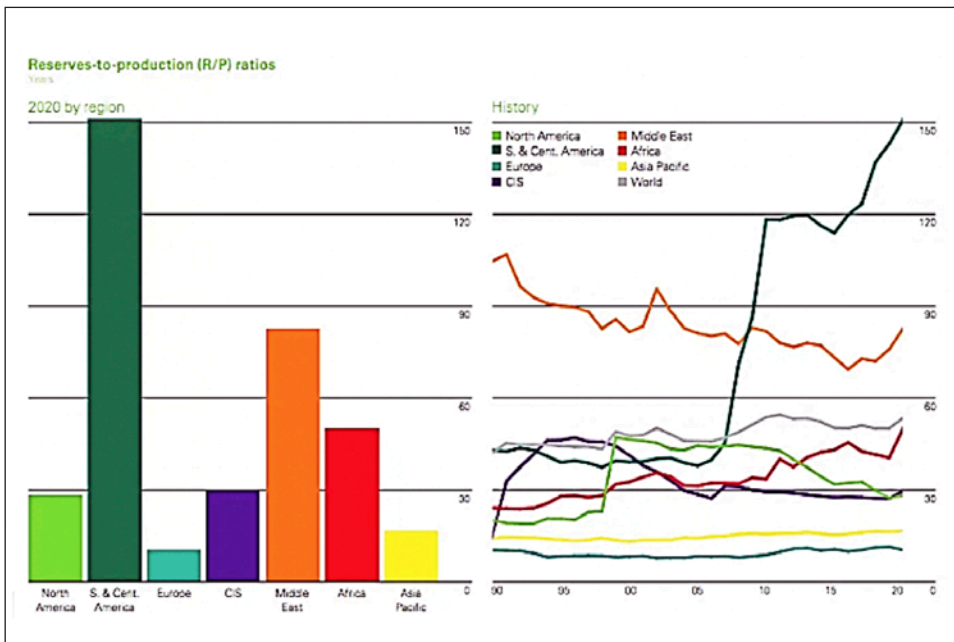


Figure 1: Global proved oil reserves.

Source ("Statistical Review of World Energy, 2021, 70th Edition,")

Some development scenarios pointed out by the International Energy Agency (IEA) show that with new policies, an increase in energy efficiency, and greater use of renewable sources, the growth of emissions can be significantly slowed down in developed countries until they are reduced by 2030 (IEA Greenhouse R&D Programme).

It is generally accepted that global sustainability has several components that can be grouped into three vectors: Environmental Sustainability, Economic Sustainability, and Social Sustainability (Elkington, 1997, Jiménez, 2000). As mentioned earlier, energy is at the core of human activity, so the achievement of energy sustainability by a social system will be the first step toward the achievement of total sustainability (Ocaña, 2008).

### Research problem

How can the Energetic-Environmental sustainability be evaluated through tools complete enough to quantify the level of energetic sustainability of Bayamo municipality in Granma province, Republic of Cuba?

### Field of action

A mathematical model to calculate the energy sustainability index of the Bayamo municipality.

### Hypothesis

Using the tools of environmental energy management, an energy sustainability indicator of the Bayamo municipality can be evaluated.

### General objective

To evaluate the environmental energy sustainability index in the Bayamo municipality.

### Specific objectives

1. To determine the factors that influence the energetic-environmental sustainability of the municipality of Bayamo.
2. To establish a procedure to quantify the level of energy-environmental sustainability of the municipality of Bayamo.

## Methodology

A methodology developed by the University of Ghent in Holland and the University of Las Villas “Martha Abreu” was used for the calculation of the indicators of energy sustainability.

For the application of the proposed procedure, the data used were divided into three groups: the physical-chemical properties of the fuels, the pollutant emission factors, and the flows of energy carriers. The physicochemical properties were taken from the study presented by the U.S. Environmental Protection Agency, in 1998. Data for pollutant emission factors were taken from EP-42 Emission Factors, U.S. Environmental Protection Agency 1998. In the case of the data on the flows of energy carriers, the Statistical Yearbook of the Republic of Cuba and the National Statistical Information System (SIEN) were used in the part corresponding to Energy and Fuels and Industry for Granma province and Bayamo municipality, as well as others obtained from the complementary statistics of the Central State Administration Bodies for 2018 and 2019.

## Indicators for Measuring Sustainability

### *Exergetic Renewability Indicator*

In the work “Illustrations towards quantifying the sustainability of technology” published by Jo Dewulf (2000), a coefficient of renewability of the energy consumed in a given system is defined. This coefficient will be taken as the basis for the definition of the so-called Exergetic Renewability Indicator ( $\alpha$ ) and will be defined by:

$$\alpha = \frac{\sum_i Br_i}{Bt} \quad (1)$$

Where:

$Br_i$ , is the consumed exergy coming from the transformation technology (i) using renewable carriers, in (PJ).

$Bt$ , is the total exergy consumed in the system under analysis, in (PJ)

$$Bt = \sum (Br_i + Bnr_i) \quad (2)$$

$Bnr_i$ , is the exergy consumed in the system from the transformation technology (i) using non-renewable carriers, in (PJ)

Substituting  $Bt$  we obtain:

$$\alpha = \sum_i \frac{Br_i}{Br_i + Bnr_i} \quad (3)$$

As interpreted from the above expression, ( $\alpha$ ) is directly proportional to the consumption of exergy from renewable carriers ( $Br$ ), benefiting from its increase. On the contrary, an increase in the consumption of exergy from non-renewable carriers ( $Bnr$ ) would cause a decrease in the value of ( $\alpha$ ).

### Indicator of cleanliness of the exergy used in the transformation systems that provide exergy to the system

The following analysis was carried out to define this indicator (Ocaña, 2006b).

$$\text{Damage}=0 \rightarrow k=1 \qquad \text{Damage}=\text{maximum} \rightarrow k=0$$

The formulation of  $\beta$  for an energy carrier, will be made according to the environmental damage caused by its use, expressing it as follows:

$$p=1-\frac{\text{Damage}}{\text{DamageMaximum}} \quad (4)$$

$$\text{Damage}=\frac{k}{k_1}-\frac{Ab_k}{k_1} \quad (5)$$

Where:

$Ab_k$ , is the number of pollutants ( $k$ ) that are abated from the waste generated by technology (i) when using the energy carrier ( $p$ ), in (kg)

$W_k$ , is the number of polluting substances ( $k$ ) produced in the process of transformation of the energy carrier ( $p$ ), in (kg)

$k$ , type of pollutant

$\phi_k$ , is the environmental damage factor.

On the other hand, the maximum damage will be calculated as:

$$\text{Damagemaximum}=\frac{k}{k_1} \quad (6)$$

The calculation of cleanliness index for an energy carrier ( $\beta_p$ ) will be calculated by the expression:

$$\beta_p = 1 - \frac{\sum_k w_k \left(1 - \frac{Ab_k}{w_k}\right) \phi_k}{\sum_k w_k \phi_k} \quad (7)$$

The factor  $B_p$  is the number of pollutants ( $k$ ) that are abated from the waste generated by technology ( $i$ ) in the subsystem when using the energy carrier ( $p$ ), in (kg).

$$\beta_k = \frac{\sum_p B_p \beta_p}{B_k} \quad (8)$$

The analysis for the case of the total system will take a very similar form:

$$\beta = \frac{\sum_i B_i \beta_i}{B_t} \quad (9)$$

The index ( $\beta$ ) will take values between 0 and 1, depending on the values of the amount abated of each of the pollutants produced. As the value of ( $Ab$ ) approaches the value of ( $W$ ) the closer to unity the value of ( $\beta$ ) will be and better the technology will be.

### Indicator of self-satisfaction with the system's exergy demand.

Therefore, an indicator that takes into account the system's ability to self-supply exergy ( $\gamma$ ) is proposed.

$$\gamma = \frac{\sum^o (B_{prop})}{B_T} \quad (10)$$

Where:

$\gamma$ , exergy self-satisfaction indicator, dimensionless.

$B_{prop}$ , exergy obtained from resources extracted from the system itself (PJ).

This term is formed by the sum of the exergy extracted from renewable (Brp)



and non-renewable carriers ( $B_{nrp}$ ) available in the system itself, according to the following equation:

$$B_{prop} = \sum_p^o (B_{rp} + B_{nrp}) \quad (11)$$

### Calculation of the Exergy Efficiency Indicator of the transformation systems that provide exergy to the system.

In order to obtain the second law efficiency value, the following equation is used:

$$\psi_i = \frac{e_s}{e_p} \eta_i \quad (12)$$

Where:

$e_s$ , specific exergy of the secondary energy carrier exiting the transformation (i).

$e_p$ , specific exergy of the primary energy carrier entering the system (i)

$\eta_i$ , first law efficiency of the technology (i).

For the case in which several secondary energy carriers are obtained in the transformation technology analysed, it will be necessary to have the totality of the input and output data to calculate, directly, the exegeric efficiency (Ocaña, 2006b).

$$\psi_i = \frac{\sum_s (e_s m_s)}{e_p m_p} \quad (13)$$

Where:

$\Psi(i)$ , exergy efficiency of technology (i), dimensionless.

$e_p$ , specific exergy of the primary energy carrier (p) entering the system, in (kJ/kg).

$e_s$ , is the specific exergy of the secondary energy carrier (p) in (kJ/kg).

$m_p$ , amount of primary energy carrier entering the transformation technology in (kg).

$m_s$ , amount of secondary energy carrier leaving the transformation technology in (kg).

Based on the specific fuel consumption ( $G$ ) expressed in kilograms of fuel consumed from the carrier ( $p$ ), per kilowatt hour produced by technology ( $i$ ) (kg/kWh), for the calculation of the exergy efficiency from ( $G$ ), the expression will be used:

$$\Psi_{(i)} = \frac{1}{e_c G_i} \quad (14)$$

Where:

$e_c$ , specific exergy of the carrier used, in (kJ/kg).

$G_i$ , the specific fuel consumption of technology ( $i$ ), in (kg/kWh)

The total exergy efficiency ( $\lambda$ ) with which the primary energy is transformed or with which the exergy contained in the carrier ( $p$ ) used is concentrated can be calculated by means of the equation (Ocaña, 2006b):

$$\lambda = \frac{\sum \Psi_{(i)} B_{(i)}}{B_T} \quad (15)$$

Where:

$\lambda$ , total exergy efficiency of the analyzed system, dimensionless.

$\Psi_{(i)}$ , exergy efficiency of technology ( $i$ ), dimensionless.

$B_{(i)}$ , exergy produced in technology ( $i$ ), (PJ).

$B_T$ , total exergy produced in technology ( $i$ ), (PJ).

### Energy-Environmental Sustainability Index

The Energy Sustainability Index will be posed as a function of  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\lambda$ .

$$I_{SE} = f(\alpha, \beta, \gamma, \lambda) \quad (16)$$

By using weight coefficients (WC), the Energy Sustainability Index is proposed to adopt the following structure:

$$ISE = \alpha + \beta + \gamma + \dots \tag{17}$$

Where:

$\sigma_\alpha$ , (WC) corresponding to the level of renewability of the exergy consumed in the system, dimensionless.

$\sigma_\beta$ , (WC) corresponding to the cleanliness of the consumed exergy, dimensionless.

$\sigma_\eta$ , (WC) corresponding to the exergy self-satisfaction of the system, dimensionless.

$\sigma_\gamma$ , (WC) corresponding to the efficiency of the energy transformation system, dimensionless.

Weighting coefficients or factor are chosen depending on several criteria, depending on what specific method is used. A common use is the Likert type of weighting coefficients or factor as shown in Table 1.

**Table 1.** Likert Scale Weighting Coefficient (WC)

Likert Scale Weighting Coefficient (WC)	
0	Totally unacceptable Performance
1	Extremely Poor Performance
2	Very Poor Performance
3	Poor Performance
4	Slightly Poor Performance
5	Acceptable Performance
6	Fairly Good Performance
7	Good Performance
8	Very Good Performance
9	Extremely Good Performance
10	Exceptionally Good Performance

## Results

To quantify the level of energy-environmental sustainability of the municipality of Bayamo we determined the Energy-Environmental Sustainability Index I SE = f (α, β, γ, λ) which is a function of different factors that influence the energetic-environmental sustainability of such municipality.

A procedure to quantify the level of energy-environmental sustainability of the municipality of Bayamo was established.

In the application of the procedure to the municipality of Bayamo, Granma province, the results shown in table (1) were obtained, where the behaviour of each of the indicators calculated for each sector of the economy was observed.

## Case analysis 2018:

### Exergetic Renewability Indicator

$$Br_i = \text{for cane baggase} = Exergy_{baggase} * Volume = 19863 \frac{kJ}{kg} * 92.17t$$

$$Br_i = 19863 \frac{kJ}{kg} * 92.17t = 19863 \frac{kJ}{kg} * 92.17 * 10^3 kg = 1830999716 kJ = 0.00183 PJ$$

$$Bnr_i = \dot{m}_c * LHV = 5066.58 \frac{kg}{s} * 10 \frac{kWh}{L} = 614131.1166 kWh = 0.002221 PJ$$

$$\alpha = \frac{Br_i}{Br_i + Bnr_i} = \frac{0.00183 PJ}{(0.00183 PJ + 0.002221 PJ)} = 0.4517$$

$$\beta_s = 1 - \frac{\sum_s w_s \left(1 - \frac{Ab_s}{w_s}\right) \phi_s}{\sum_s w_s \phi_s} = \frac{17014.3t * \left(1 - \frac{320t}{17014.3t}\right) * 0.73}{(36050t * 0.73)} = 0.54$$

$$\phi_s = 0.73 \text{ (Dewulf an al.)}$$

$$\gamma = \frac{\sum_p (B_{prop})}{B_t} = \frac{\text{(Exergy due to cane baggase and solar generation)}}{\text{(Total exergy generate in the system)}}$$

$$\gamma = \frac{\sum_p (B_{prop})}{B_t} = \frac{(0.00183PJ + 0.000118PJ)}{(0.00183PJ + 0.000118PJ + 0.002221PJ)} = 0.475$$

$$\lambda = 0.3751 \text{ (Bocanera, 2019)}$$

We can observe that the Exergetic Renewability Indicator ( $\alpha$ ) has a low value, that shows that the system is not using renewable carriers. Only bagasse is used to generate energy to the system (Municipality of Bayamo). One point to be taken into consideration for improvement is the possibility that the municipality of Bayamo can use different renewable sources to modify this indicator such as solar and wind energy.

$$\beta_s = 1 - \frac{\sum_s w_s \left(1 - \frac{Ab_s}{w_s}\right) \phi_s}{\sum_s w_s \phi_s} = \frac{17014.3t * \left(1 - \frac{320t}{17014.3t}\right) * 0.73}{(36050t * 0.73)} = 0.54$$

$$\phi_s = 0.73 \text{ (Dewulf an al.)}$$

The indicator of cleanliness of the exergy used in the municipality of Bayamo ( $\beta$ ) shows that the system is not able to decrease emission of pollutants, that is connected to the first indicator. Is the system is not using clean energy but mainly non renewables resources then some amount of emission will be sent into the atmosphere. The sustainability is related to the capacity to reduce this type of emissions.

$$\gamma = \frac{\Sigma_p(B_{prop})}{B_t} = \frac{\text{(Exergy due to cane baggase and solar generation)}}{\text{(Total exergy generate in the system)}}$$

$$\gamma = \frac{\Sigma_p(B_{prop})}{B_t} = \frac{(0.00183PJ+0.000118PJ)}{(0.00183PJ+0.000118PJ+0.002221PJ)} = 0.475$$

Sustainability is also associated with the capacity of the system of self-supplied energy. The indicator of self-satisfaction with the systems exergy demand ( $\gamma$ ) for the municipality of Bayamo shows the impossibility achieving that self-satisfaction. The municipality of Bayamo has the potential to increase this value using renewables resources, while increasing the capacity of generation using non-renewables resources but applying high efficiency technologies.

The Exergy Efficiency Indicator of the transformation systems that provide exergy to the system is the indicator used to evaluate the efficiency in the transformation of energy within the system in the (Municipality of Bayamo). The value obtained is the result of technologies with more than 30 years of use, with a deficient maintaining strategy and without a renovation of that technologies.

**Table 1.** The Behaviour of the Proposed Indicators by Sector of the Economy of Bayamo in 2018.

INDICATORS BY ECONOMIC SECTORS 2018					
2018	Industry Sector	Construction Sector	Agriculture Sector	Trade Sector	State Administration Council Sector
$\alpha$	0.4517	0	0	0	0
$\beta$	0.241	0.113	0.128	0.058	0
$\gamma$	0.475	0	0	0	0
$\lambda$	0.3751	0	0	0	0

**Table 2.** The behaviour of the proposed indicators by sector of the economy of Bayamo in 2019.

INDICATORS BY ECONOMIC SECTORS 2019					
2019	Industry Sector	Construction Sector	Agriculture Sector	Trade Sector	State Administration Council Sector
$\alpha$	0.4517	0	0	0	0
$\beta$	0.24	0.108	0.116	0.068	0
$\gamma$	0.475	0	0	0	0
$\lambda$	0.3751	0	0	0	0

**Table 3.** Sustainability Index Bayamo 2018 and 2019

Sustainability Index	
$I_{SE}$ (2018)	3.69
$I_{SE}$ (2019)	3.66

The level of energy-environmental sustainability of the municipality of Bayamo is affected by the previous indicators. The influence of each indicator is linear and related to every factor. The final value shows how far we stand in the capacity to become a municipality sustainable in an energy-environmental scenario. It also suggests the possibility of improvement starting with the use of renewable resources.

## Conclusions

It is possible to conclude that the municipality of Bayamo, in Granma province, Republic of Cuba has very few energy generation resources, only one being cane bagasse. The installed technologies have been in operation for more than 30 years, so, their efficiency is quite low. Regarding emissions, even when the established standards are met due to the obsolescence of technologies, there is a growing increase in them. All of the above is reflected in the total sustainability index.

## Future Work

1. To explore further the determination of an environmental damage factor that gives value to the environmental impact caused by the polluting substances emitted during the energy transformation processes.
2. To expand the study taking into account all sectors of the economy in the territory.
3. Continue to deepen the conditions of the model for the definition of energy matrices and their computational implementation.

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# Managing and Growing an Aerospace Multinational Corporation: A Case Study of the Embraer Company

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UFOT B. INAMETE

Florida Agriculture and Mechanical University

## *Abstract*

*The main goal of this study is to identify the key factors that have enabled Embraer to emerge as the world's largest midsize passenger jet manufacturing company despite the tough competition dynamics in the aircraft manufacturing industry. Overall, Embraer is the third largest aircraft manufacturer in the world. This study identifies some seven key strategies and about one or two other additional factors that have all combined to enable Embraer to be successful. To adequately understand the dynamics that propelled the company to great heights, this study also closely examined some of its key actions, its enduring and reoccurring activities, and its general approaches to its main challenges. The impacts of organs of the Brazilian government, especially the Brazilian Air Force and other branches of the Brazilian armed forces, are also noted in terms of the success of Embraer.*

**Keywords:** Strategic Management, Multinational Corporations, Aerospace Industry, Innovation Studies, Research and Development, Engineering Design Manufacturing and Maintenance, Global Market and Competition

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**Corresponding Author:** Ufot B. Inamete – [inamete@yahoo.com](mailto:inamete@yahoo.com)

## Introduction

Brazil, a developing country, now has Embraer, which garners global greatness and excellence in the aerospace industry (a very highly advanced technological

industry). The goal of this research was the identification of the major factors that have enabled Embraer to grow into a major aerospace manufacturing corporation in the world. Another important goal of this study was to identify ways in which other developing countries may use the knowledge generated by this study to create companies that also achieve global excellence in other very highly advanced technological industries.

Embraer, a Brazilian aircraft manufacturing corporation with its head office in Sao Jose dos Campos, in Sao Paulo State in Brazil, was founded in 1969; its full name is Empresa Brasileira Aeronautica S.A. (Brazilian Aeronautics Company) (Embraer, 2015g; Embraer, 2015h; Embraer, 2015L; Embraer, 20115n; Hemlock & Close, 2014; and Mann, 2014). The global success of Embraer resulted in the Boeing Corporation, in 2018, planning a partnership with one of the key units of Embraer (FlightGlobal.com, 2018; Hough, 2018; Pearson & Lewis, 2018).

Understanding the factors that have led to the growth of Embraer is important, due to the fact that this Brazilian aircraft manufacturing company, is now the world's largest manufacturer of midsize passenger jets, and, also, the third-largest manufacturer of all types of aircraft in the world (Embraer, 2018i, p. 1; and Hemlock & Close, 2014). Embraer has been able to have these achievements due to the fact that it is more successful than Bombardier aircraft company of Canada. Embraer has been "able to compete successfully with Canada's Bombardier which makes passenger jets in the same size category" (Mann, 2014, p. 3). Another notable fact is that, as the third largest aircraft manufacturer in the world, the only other aircraft manufacturing companies in the world bigger than Embraer are Boeing (which holds the number one position) and Airbus (which holds the number two position) (Mann, 2014, p. 1). The Boeing Corporation is based in the United States, recognized as the most technologically advanced and most powerful country in the world, and Airbus is jointly owned by investors in technologically advanced countries in Europe. Additionally, it is important to note that passenger jets manufactured by Embraer are part of the fleet of American Airlines, United Airlines, Delta Air Lines, Air Canada, Jet Blue, British Airways, Republic Airlines, American Eagle Delta Connection, United Express, US Airways Express, and many other airline companies (Mann, 2014, pp. 3, 4, and 5) in countries in all the continents of the world. Other notable facts are: Embraer "is the world's largest manufacturer of commercial jets of up to 130 seats" (Mann, 2014, p. 2); "Embraer's midsize jets are used by regional airlines all over the world" (Mann, 2014, p. 2); and Embraer "regional jets form the backbone of commuter airlines worldwide" Hemlock & Close, 2014, p. 1).

In order to enhance analytic ease and convenience, this study is divided into eight sections, which include this Introduction section. The other seven sections are The Theoretical and Conceptual Framework; The Gestation and Infancy Phase; The National Imperative; A Proper and True Corporation Emerges; The Reasons for the Success of Embraer: The Strategies of Creating Products and Product Lines that will Enable Embraer to Achieve Global Prominence; The Strategy of Growing Step by Step and to the Top; Global Indeed, In Need, and In Numbers; and Conclusions sections.

## The Theoretical and Conceptual Framework

In order to both systematically guide and anchor this study, a variant of the strategic management theoretical framework will be created. In the academic discipline of management, strategic management is both a subfield and a theoretical framework.

The strategic management theoretical framework provides excellent theoretical foundations and frameworks for understanding the reasons Embraer is one of the global giant corporations in the aerospace industry in seven fundamental ways. It provides theoretical frameworks for understanding how Embraer (1) designs and creates its strategic vision and formulates its strategic goals and policies, (2) implements its strategic goals and policies, (3) evaluates its strategic goals and policies, (4) creates strategies for minimizing weaknesses and maximizing strengths in its internal environment, (5) promotes strategies for degrading threats and optimizing opportunities in its external environment, (6) fashions functional-level strategies for its various functional units, business-level strategies for its various business units, and corporate-level strategies for the entire corporation, and (7) provides strategies that continuously advances innovation and creativity in the corporation, in order to ensure continuous new excellent product lines, and, thus, continuous growth and advancement of the corporation.

Professor Cornelis de Kluyver is one of the most eminent scholars in the area of how corporations design and create strategic visions and formulate their strategic goals and policies. His work, “Strategic Thinking: An Executive Perspective” (de Kluyver, 2000) provides theoretical frameworks for the design and creation of strategic vision and the formulation of strategic goals and policies for corporations. Jamali and Nor (2012) show how theoretical frameworks can be fashioned for strategic vision design and formulations of strategies for corporations in a specific country. Theoretical frameworks for the implementation of strategies

by corporations are also provided by Aoki (2020) and by Barrick, Thurgood, Smith, and Courtright (2015), and an example of a theoretical framework for the evaluation of strategies by corporations is provided by Plunkett, Attner & Allen (2002). There are also theoretical frameworks for strategies that corporations use to minimize weaknesses and maximize strengths in their internal environment (Banik & Charterjee 2021, Cumming & Worley 1997, and Inamete 2009-2010). The dynamics in the external environment often cause firms to worry about their future. Thus, many have provided theoretical frameworks for firms to use to create strategies that decrease threats and optimize opportunities in the external environment. Abe and Ye (2013) focus on the impacts of natural disasters, while Bandara & Karunartne (2013) focus on the impact of globalization. Knowledge of how firms can use vertical integrations to degrade threats and optimize opportunities when facing challenges of technological changes is provided by Afuah (2001). Aluko, Fatepu, and Ibitoye (2021) focus on the impact on firms of the level of political openness and the depth of democracy, in the external environment. Some of the many others who have also provided studies on the external environment are Abouzeedan (2010), Al-Gasaymeh (2020), Arora (2020), Banik and Bhaumik (2014), Daniel & Radebaugh (1992), de Blij & Muller (2008), Dutta & Punnose (2010), Gannon (2004), Inamete (1993), Inamete (2014), Misra (2012), and Sawyer & Sprinkle (2006). Examples of theoretical frameworks for functional-level strategies, business-level strategies, and corporate-level strategies for firms are provided by Alterman, Bamberger, Wang, Koopman, Belogolosky & Shi (2021), and Banik & Bhaumik (2006). In this age of high-level technology and information technology, the future of firms is closely tied to their capacities and abilities for innovation. Thus, strategies designed to ensure excellence in innovation and creativity of firms are pivotal. Professor Ikujiro Nonaka and Professor David Teece, eminent scholars in this area, in their book “Managing Industrial Knowledge: Creation, Transfer and Utilization” (Nonaka & Teece 2001), provide world-class and gold-standard theoretical frameworks for firms to use to create the most effective strategies for innovation and creativity. In addition, Annalee Saxenian, in a classic book “Regional Advantage: Regional Culture and Competition in Silicon Valley and Route 128” (Saxenian 1996), shows how regional culture impacts innovation and creativity by comparing the regional culture of Silicon Valley to the regional culture of the Boston Region of Massachusetts in the United States. Analysis of factors that account for the vibrancy of the high-technology space in Vancouver has also been provided (Wadell, 2013). Linkages of industry and academia in ways that accelerate high-technology innovations have also been

analyzed (Sengupta, 2009). Some of the many others who have also provided theoretical frameworks for strategies for innovation and creativity by firms are Atuahene & Li (2004), Ahmed & Julian (2012), Aiman-Smith & Green (2002), Al-Mubarak & Busler (2010), Business in Vancouver (2013), German American Chamber of Commerce (2014), Graham (2013), Inamete (2006), Inamete (2022), and Parkhurst (2012).

As shown in this section, strategic management theoretical frameworks provide a wide array of theoretical frameworks that deepen the understanding of the functioning of firms. These frameworks also enable a systematic understanding of all aspects of the organizational operations and outputs of firms.

### **Gestation and Infancy Phase: The National Imperative**

The history of the founding of Embraer in 1969 ties it clearly to the Government of Brazil (Embraer, 2015n; Mann, 2014, p. 1; and Rodengen, 2009). During the gestation period, when the idea of a company like Embraer was in the womb, the national goals which the government of Brazil of that period had for the future of Brazil, meant that a company like Embraer was a national imperative for the country, (The national vision the government of Brazil had for its was a country with a technologically advanced economy, advanced manufactured products, and having a major voice in world affairs) This meant that Brazil had to have a credible and viable technologically advanced industry, like an aviation industry that manufactures jet aeroplanes and sells these jet aeroplanes to other countries (Gouvea Neto, 1991a; Gouvea Neto, 1991b; and Mani, 2011). For Brazil, therefore, a company like Embraer was a national imperative.

The goals that Brazil set for itself seem to have been achieved. Today, Brazil has a relatively technologically advanced economy, while Embraer is now the largest manufacturer of mid-size passenger jet aeroplanes and the third-largest aircraft manufacturing company in the world.

### **A Proper and True Corporation Emerges**

In 1969, the backing of the government made it possible for Embraer to be created and to have a viable existence in its infancy phase. For long-term viability, Embraer had to also export its aeroplanes to other countries. Economy of scale meant that the company could not survive by selling its aeroplanes mostly in Brazil. Thus, even before it was created, Embraer was seen as a company that had to sell its

aeroplanes all over the world (Franko-Jones, 1987–1988). The efficient management of Embraer, and its ability to efficiently manufacture quality airplanes and sell them all over the world, meant that Embraer had to transition from a Brazilian Government owned company into a private company. “Embraer invested heavily in Brazil in the 1990’s to develop its regional jets, but the costs proved too much for the state-owned company nurtured under a military regime”, therefore, “in 1994, Brazil’s democratic government sold Embraer to a private group,” and this private group “revamped operations, boosted growth”, and also “lists shares on Wall Street” (Hemlock & Close, 2014, p. 2). From a private company, Embraer became a robust corporation which is now a major airplanes manufacturer in the world (Enterprise Florida, 2014; Hemlock & Close, 2014, p. 2; Klotz, 2014; Lynch, 2014; Mann, 2014, pp. 1 to 2; and Price & Berman, 2014).

### **The Reasons for the Success of Embraer: The Strategies of Creating Products, and Product Lines, that Enabled Embraer to Achieve Global Prominence**

A careful examination of Embraer shows that it is guided by certain strategies. Through examining the operations of Embraer, it can be seen that since its founding in 1969, the actions, thrusts, and operations of Embraer seem to have been guided by certain strategic thrusts.

Throughout most of its history, Embraer has relentlessly focused on manufacturing both regional jets called Embraer Regional Jets [ERJ] that have 37 to 50 seats and mid-size passenger jets called Embraer Jets [E-Jets] that have 70 to 130 seats (Embraer, 2015b, p. 1). Embraer has focused on being efficient at manufacturing very large numbers of very high-quality midsize passenger jets that many airlines, in many countries, on all continents, like to buy and use, although it does manufacture other types of aircraft. The strategy of focusing on mid-size aircraft makes more sense for Embraer as competing in jumbo jet manufacturing with Boeing and Airbus could have been too brutal and could have financially disabled Embraer.

Another factor that made Embraer focus on the manufacturing of midsize passenger jets was the deregulation of the airline industry in the United States in 1979 (Mann, 2014, 3). In the United States, “as a result of deregulation, many large airlines dropped commuter or regional routes that carried fewer passengers and were less profitable,” and “regional airlines – some of which today are offshoots of the majors filled the gap,” and these new dynamics meant that these regional

airlines “needed midsize planes to cover their routes” (Mann, 2014, p. 3). Therefore, “Embraer was able to carve out a share of the U.S. commercial airline market by successfully offering a line of commuter planes after the federal government deregulated the airline industry in 1979” (Mann, 2014, p. 3).

The second strategy of Embraer is the manufacturing of high-quality executive jets that would make Embraer a major player in the executive jets market. Embraer entered the executive jets sector in 2000 (Embraer, 2015b, p. 1; and Embraer, 2015j, p. 1). It manufactures small-size, midsize, and large-size executive jets. The full line-up of Embraer executive jet models are Phenom 100E, Phenom 300, Legacy 450, Legacy 500, Legacy 600, Legacy 650, and Lineage 1000E (Embraer, 2015b, p. 1; and Embraer, 2015j).

The third strategic thrust of Embraer is the company’s strong belief that it could also become an important player in the manufacturing of military cargo/airlift planes, which the company has named KC-390 (Embraer, 2015b, p.1; Embraer, 2015f, p. 1; and Embraer, 2015n, p. 1). In 2014, the Brazilian Air Force signed a contract with Embraer to purchase 28 Embraer KC-390 military cargo/military airlift aircraft from Embraer, and Embraer also has “purchase intentions from other countries, for a total of 32 additional” KC-390 aeroplanes (Embraer, 2015f, p. 1) Embraer KC-390 had its first flight in 2015 (Embraer, 2015n, p. 1). Embraer KC-390 is a very modern two-engine jet military cargo/military airlift aircraft that has the potential to be a significant or important player in the military cargo/military aircraft market. Embraer KC-390 will be directly competing with the leading aircraft in the military cargo/military airlift aircraft market, which is the C-130 aircraft manufactured by Lockheed Martin Corporation of the United States. This fact clearly shows that Embraer of Brazil, founded in 1969, is now a big and very technologically advanced aircraft manufacturer.

The examination of Embraer’s operation and activities has also led to the conclusion that Embraer also has a strategy that strongly focuses on scientific and technological excellence, innovation, and high-quality outputs. Therefore, the fourth strategy that this study associates with Embraer is thoroughly and robustly infusing all its aircraft engineering design activities, aircraft engineering manufacturing activities, aircraft engineering maintenance activities, aircraft engineering repair activities, and aircraft engineering overhaul activities with high-level scientific and engineering research information, knowledge, and analysis.

The examination of the actions and operations of Embraer by this study has also led to the conclusion that Embraer also has a strategy that focuses on simplicity. Thus, the fifth strategy that this study associates with Embraer is that

of consciously striving to infuse simplicity into its aircraft engineering design, manufacturing, maintenance, repair, and overhaul. The logic in this strategy is that avoiding too much complexity in aircraft engineering design, manufacturing, maintenance, repair, and overhaul, enables Embraer jets and other aeroplanes to be more durable, more reliable, more cost-saving, more efficient, and more long-lasting (all qualities that make many airline companies, organizations, and individuals, like, trust, and buy Embraer jets and other aeroplanes). On the whole, Embraer sees combining engineering excellence/innovation with engineering simplicity as resulting in excellent and high-quality aeroplanes, thereby producing a formula for great success. Therefore, Embraer states that is “actions are aimed at simplicity, agility, flexibility and safety, while constantly striving for improvement and excellence” (Embraer, 2015k, p. 1).

Multiple use strategy is another strategy of Embraer. This is the sixth strategy that this study associates with Embraer. This strategy involves Embraer manufacturing aircraft that can be used for multiple purposes. Embraer demonstrates this strategy in various types of military aeroplanes that it manufactures. For example, Embraer KC-390, which is a two-engine jet aircraft, can be used for military cargo and military personnel airlift (Embraer, 2015b, p. 1; Embraer, 2015f, p. 1; and Embraer, 2015n, p. 1). This aircraft is seen as “designed to set new standards in its class” (Embraer, 2015f, p. 1) of military cargo/military personnel airlift aircraft. It is also seen as “the most modern and complete aircraft in its category” (Embraer, 2015b, p. 1) of military cargo/military personnel airlift aircraft. Additionally, Embraer KC-390 is an aeroplane that, in future, can also be used as a civilian commercial cargo jet.

The seventh strategy that this study associates with Embraer is that of building and maintaining a very excellent and positive brand name that airlines, organizations, and individuals trust. As shown in various sections of this study, Embraer manufactures high-quality, reliable, durable, cost-serving, efficient, and long-lasting jets and aeroplanes. These qualities give customers of Embraer high-levels of satisfaction when they fly, or are flown, in Embraer planes.

As shown in the section of the study, Embraer has developed and maintained very effective and very successful strategies. It has also arranged its organizational structures and processes into streamlined business units. These dynamics have enabled Embraer to become a major global aircraft manufacturing company.



## The Strategy of Growing Step by Step and to the Top (The SST Strategy)

In reviewing the business history of Embraer, this study created and utilized the Strategy of Growing Step by Step and to the Top (the SST Strategy) theoretical framework. This study has concluded that the company adopts a unique variant of an overarching and an all-embracing growth strategy for which this study has coined a non-esoteric, non-technical, easily understood, and non-complex name. This study posits that this Step by Step and to the Top Strategy is the overarching and the all-encompassing strategy that continuously guides Embraer. This study sees the SST Strategy as involving a company at the time of its founding creating a strategic plan that involves the company first producing a product or service that it has the necessary skills, expertise, personnel, and material resources to handle, and then, step by step, gradually, producing relatively more complex products or services, in consonance with the increasing skills-sets and expertise of the company's personnel, and the increasing amount and sophistication of the company's material resources; and, also, step by step, choosing product/service types and models that enable the company to capture more and more market share, with the ultimate goal of being at the top as a leading global company in its industry. In addition, Embraer company often avoids directly competing with companies that can easily overpower it. Later, when it develops the capacity to compete with such companies, it does.

## Global Indeed, In Need, and In Numbers

This section of this study focuses on Embraer as a global aerospace multinational corporation. It focuses on Embraer as a global company. It also shows that Embraer needed the global market to be the giant company it is today (Without the global market Embraer would only be a minor company). Additionally, in terms of numbers (of its airplanes globally, and in terms of its operations and facilities in many countries), the findings further stress the global nature of Embraer.

As this study has shown, Embraer indeed, right from its early years, in all its actions, policies, and operations saw the global market as the only way it could be a viable and big aircraft manufacturing company. This approach was very logical, due to the nature of the aircraft industry. It is not possible for any aircraft manufacturing company to grow to be a significant company, if such a company only or mostly sells its airplanes in its home country. The economies of scales, as it applies to aircraft manufacturing industry, means that any air-

craft manufacturing company needs a global market in order to grow into a significant aircraft manufacturing company. Therefore, Embraer needed the global market.

## Conclusions

This study has identified the main factors that enabled Embraer to grow into a major global jet manufacturing company. The strategy of focusing on the production of regional jets and midsize passenger jets has been shown by this study to be the most important. Embraer focused on a niche market (regional jets and midsize passenger jets) which allowed for many airplanes to be sold all over the world; a market for which it had the technological capacity to produce high quality jets; and, also, a market it did not have to directly compete with the really big aircraft manufacturing companies like Boeing and Airbus that mostly focus on manufacturing and selling bigger passenger jet planes. Therefore, Embraer was able to become the world's largest manufacturer of regional jets and midsize passenger jets. It is this strategy that also enabled it to emerge as the third largest manufacturer in the world, and, therefore, become one of the world's major aircraft manufacturing companies.

The strategy of also focusing on executive jets manufacturing has also been vital. This focus has helped Embraer to expand its market share of the overall airplanes market. This decision strategy will help Embraer to maintain or advance its position among aircraft manufacturers. Similarly, the strategy of also focusing on manufacturing and selling military cargo/military personnel airlift jet airplanes will help Embraer to maintain or advance its position among aircraft manufacturing companies.

The strategy of relentlessly using excellent and advanced scientific and engineering research knowledge, and the strategy of infusing simplicity in its aircraft engineering design, manufacturing, maintenance, repair, and overhaul, have also been shown to enable Embraer to make high quality, reliable, durable, long-lasting, cost-effective, and efficient airplanes. These two strategies have enabled many to trust, like, and buy Embraer airplanes. They have also been very important factors in the growth of Embraer. Additionally, the strategy of making some of its airplanes (especially its military airplanes) to have multiple uses have also made these airplanes more sought after by the air forces of many countries, including the United States Air Force. Also, the strategy of Embraer creating a brand name that many airline companies, organizations, and individuals trust, like, and buy

have been shown to mutually reinforce the other six strategies. These dynamics, therefore, have been an important factor for the growth of Embraer.

The Step by Step and to the Top (SST) Strategy has also been shown, by this study, to be an overarching strategy that enables Embraer to successfully rise to the top, without missing a step falling down and possibly totally ceasing to exist. Embraer was able to rise step by step and to the top, in consonance with its capacity at each respective step therefore, not over-extending itself at each respective step.

The strategy of Embraer, right from its early years, focusing on the global market (being acutely aware that aircraft manufacturing companies can only grow as global companies, due to how economies of scales apply to the aircraft manufacturing industry) has also been shown to greatly help Embraer to rapidly grow into a major global manufacturing company.

Another vital factor for the growth of Embraer, to its current position, is the role of the Government of Brazil. In spite of the fact that Embraer started as a government company and was later privatized, the Government of Brazil has always been vital to the growth of Embraer in many ways. The agencies of the Government, especially the armed forces of Brazil and in the Brazilian Air Force, have always placed orders for high numbers of most models of Embraer airplanes, even before they were manufactured. Therefore, agencies of the Government of Brazil made it possible for Embraer to develop and manufacture airplanes that the world would later love to buy. Without the role of these agencies of the Government of Brazil, Embraer would not have been able to build most of the airplanes that have made Embraer to a major global aircraft manufacturing company. For example, as shown in this study, the Brazilian Air Force placed order for 28 KC-390 military cargo/military personnel airlift two-engine jet airplanes in 2014 (Embraer, 2015f, p. 1); but KC-390 only had its first flight in 2015. As has been shown, there is no way Embraer could take the colossal financial risk developing and manufacturing a very modern military cargo/military personnel airlift two-engine jet airplane that could be directly competing with C-130 military cargo/airlift airplanes made by the giant Lockheed Martin Corporation of United States, without the pre-orders of 28 KC-390 by the Brazilian Air Force. In the future KC-390 will likely grow to compete with C-130. Without the Brazilian Air Force, the chance of the KC 390 being developed and manufactured could have been very slim.

Due to all the above factors mentioned Embraer is now a global aircraft manufacturing giant. To maintain or advance its position, Embraer still needs to continue to pursue all these strategies and enabling factors.

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# Evaluation of an Alternative Industrial Work Experience Programme For Final-Year Undergraduate Engineering Students During The COVID-19 Pandemic

JUNIOR A. BENNETT

Purdue University

ARLENE MCKENZIE-CAWLEY

University of Technology, Jamaica

## *Abstract*

*The COVID-19 pandemic significantly hampered the ability of higher education institutions (HEIs) to place interns for traditional on-site work experiences and forced these institutions to quickly find alternative cooperative education arrangements for their students. This placement challenge led to the development of an innovative alternative Industrial Work Experience (IWE) programme for final-year engineering students at the University of Technology, Jamaica. The purpose of this research was to evaluate the effectiveness of the alternative IWE programme implemented during the pandemic and to explore viable alternative engineering cooperative education practices that can be implemented by HEIs in the post-pandemic era. The study used an Inductive-Simultaneous Mixed Method Investigation design with an online survey instrument consisting of 28 closed-ended questions and six open-ended questions that collected quantitative and qualitative data concurrently. A total of 67 invitations were administered by email and WhatsApp over a period of 18 days with a 43.3% (n=29) response rate. The quantitative data were analysed using descriptive and inferential statistics, the qualitative data were analysed using an inductive thematic approach. The point of integration occurred at the analysis stage. Results show that the most*

*valuable aspects of the alternative assessment were design skills (72.2%) and teamwork (38.9%). Of the respondents, 43.5% highlighted that the experience fostered collaboration and empowerment. The major challenges highlighted were a lack of exposure to the actual work environment by 55.0% of the respondents and working with team members (45.5%). Although seventy-two (72.0%) of the participants obtained employment after completing the alternative IWE, only 51.6% were employed within their respective engineering disciplines. The findings of this paper will inform HEIs, prospective interns, industry and other stakeholders of some of the advantages and disadvantages of the alternative IWE.*

**Keywords:** Cooperative Education Programme, Industrial Work Experience (IWE), Virtual Internship, Alternative Assessment, Engineering Design, Engineering Students, COVID-19 Pandemic

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**Corresponding Author:** Junior A. Bennett – [benne322@purdue.edu](mailto:benne322@purdue.edu)

## Introduction

Many final-year tertiary students whose course of study contains a mandatory Cooperative Education (Co-op Ed) or internship component were severely impacted by the COVID-19 pandemic (Park & Jones, 2021; Wong et al., 2021; Zaman et al., 2021; Pintarič & Kravanja, 2020). Industrial Work Experience (IWE) coordinators and university administrators were all involved in exploring options to reduce anxiety symptoms (Martins et al., 2022) and stress due to possible delay in graduation and uncertainty in future career plans (Chowdhury et al., 2022) (for final year students to fulfill the cooperative education requirements for their preferred graduation date). While some tertiary institutions may have waived requirements for internships during the COVID-19 pandemic, depriving students of internships has consequences, including loss of opportunity for practical experience and relevant professional connections (Wheeler & Waite, 2023). The authors think that the value of students' personal and professional development is best met with structured and properly supervised cooperative education programmes, and these should never be sacrificed because of a crisis. The pandemic impacted every sector of our society, and companies faced financial challenges and other problems. Consequently the students encountered serious problems with the lack of opportunities for internship placement (Zaman et al., 2021; Dani et al., 2020; Rodriguez, V. (2020). Cooperative Education

(Co-op. Ed.) gives interns the opportunity to apply their technical knowledge and engineering principles to solve real-life problems and equip themselves with the competencies required to enhance their business' position in a globally competitive environment (Cooperative Education, 2020) (for a temporary period of time (Grupa et al., 2020)). Co-op. Ed. remains a mandatory curriculum requirement for many tertiary programmes through project-based learning in collaboration with industry (Trotskovsky & Sabag, 2014) in spite of the pandemic.

The purpose of this research was to evaluate the effectiveness of the alternative IWE programme implemented during the June to August 2020 and 2021 COVID-19 pandemic and to explore viable alternative engineering cooperative education practices for engineering students that may be implemented in higher education institutions in the post-COVID-19-pandemic era. The findings will be beneficial to higher education administrators and academic programme managers, industry personnel, and other stakeholders in terms of cooperative education policy development, IWE management, insights, and implementation strategies for credible alternatives to on-site internship placements.

### Description of the Alternative IWE

The nature of the design-based projects used as part of the Alternative IWE assessment varied based on the topic, project scope and deliverables. A common and major requirement, regardless of project type, was designing something new. The proposed design solution required students to demonstrate creativity and innovation in meeting the technical requirements of the assigned project. Some of the fundamental deliverables for each project were:

- Gantt charts outlining team members assignment and scheduling of activities based on the project duration a minimum of 300 hours within a 6–8 weeks period. The actual project schedule was flexible and based on mutual agreement between students and supervisors.
- Detailed design and drawings of components, systems, and process layouts based on project scope and deliverables.
- Bill of quantities (BOQ). This requirement included the submission of actual estimates of key components from prospective suppliers.
- Detailed budget with estimated material, labour, and miscellaneous cost.
- Sample of a completed project based upon its type and nature of project.

## Research Questions

The research questions for the study were:

1. What is the profile of engineering students who have completed an alternative assessment during the COVID-19 pandemic as opposed to traditional work experience?
2. What level of experience was gained by the students engaged in the alternative IWE assessment during the pandemic?
3. What is the employment status of the cohort of engineering students who completed the alternative IWE assessment during the pandemic?

## Literature Review

Since the onset of the COVID-19 pandemic, many institutions across the world including local institutions, have experienced great challenges in placing students in traditional industries to pursue their on-site IWE. According to Rodriguez (2020), the COVID-19 global pandemic disrupted the internship programme and left prospective interns at the University of Houston-Clear Lake, for example, with uncertainty about meeting graduation requirements. The pandemic also forced several companies to reduce operations and discontinue their internship programme (Feldman, 2021). Consequently, the facilitation of the traditional IWE programmes was negatively affected. The Institute of Student Employers (ISE) stated that short-term student work experience, such as internships, was reduced by approximately 31% of businesses; ISE further reported that 68% of employers have cancelled work experience (Amber, 2020). It is known that almost a quarter of employers in the United States cancelled their summer internship programmes. These companies included major companies such as Yelp, Disney, Geico, American Airlines and NPR (Moreno, 2020; Lumpkin, 2020; Yaffe-Bellany, 2020, as cited by Feldman, 2021).

## Advantages and Disadvantages of Virtual Internship

A Virtual internship program is one in which interns can acquire professional experience without having to be physically present at the job location. Communication is done via email, project management tools, online meetings and a wide array of other communication apps and methods (Ahanotu, 2021).

Since the COVID-19 pandemic started, virtual internships have grown in

popularity as a credible alternative to in-person internships (Lane, 2022). Many companies and institutions have decided to facilitate their internship programme using the Project-based learning approach. The Harvard Kennedy School (2020) engaged students in Project-based learning for summer internships with financial support; the students participated in remote projects that were relevant to local government and non-profit organisation's needs. These projects were monitored by scheduled weekly meetings, with a view of fostering community engagement, enhancing students' leadership skills, and promoting the collective impact of students' work.

There are some drawbacks associated with virtual internships, as outlined by Loretto (2019), notwithstanding some of the gains previously highlighted, these include:

- possible lack of structure and support, which might hinder meaningful experience,
- interns might obtain less on-the-job training and professional guidance,
- interns will not experience the actual work environment, and
- interns will have to be strong self-motivators.

There are several advantages of virtual internships, although most employees prefer working from home, 70% of interns view virtual internship work negatively (Iacurci, 2022). Interns prefer to engage in real workplace settings that provide networking opportunities, especially for students who may have few professional contacts in industries (Park & Jones, 2021). Two of the big advantages of virtual internships are travel time and financial savings from not having to travel to the placement site (Lynch et al., 2021). According to Courtney (2021), working from home affords employees savings opportunities for transportation costs, vehicle maintenance, parking fees, and diversifying professional wardrobe attire. Virtual internships have opened opportunities for interns living in remote areas Green (2022) because some of these interns normally experience challenges commuting to and from placement sites.

### **Companies that had meaningful experiences from Virtual Internship**

Although there are some drawbacks to online internships, as outlined by Loretto (2019), there are a vast number of advantages associated with this method if properly structured and implemented. Online internships create a more dynamic workflow because of flexible scheduling and there are also more options available on the way tasks are executed (Gonzales, 2020).

There are several companies that have devised innovative ways to create virtual internship programmes that provide meaningful work experiences that empower interns. Some of these companies are:

- PepsiCo has reduced its normal 10-12-week onsite internship programme to 6 weeks but created projects that had a significant impact on the company's operation. Interns were engaged in projects that sought to increase sales, finding strategies to raise the impact of the Food for Good initiative that provides meals to communities underserved, and recommending ways for engaging in productive remote working. At the end, the interns presented their findings to corporate leaders. Furthermore, the incorporation of workshops and one-on-one mentoring provided opportunities for interns to gain exposure to different roles and functions within the organisation. (Hilgers, 2021).
- Abbott, a healthcare technology company based in Chicago, found innovative ways to connect students with their peers and the company's senior leaders by fostering video chat connections with their interns through their Abbott InternLink App. This App allowed 230 interns to post 30-second introduction videos to share with peers and employers (Hilgers, 2021). This represented one of the key components of Project-based learning which involved the use of technology tools for supporting learning (Krajcik & Blumenfeld, 2005) and active engagement of students in the process of learning (de la Torre-Neches et al., 2020).

The emphasis on implementing and maintaining a meaningful Cooperative Education structure in all degree programmes is prudent for the development of engineering graduates' leadership and practical skills. Consequently, students engaged in internships are provided with a competitive advantage for enhancing marketability to prospective employers (Lei & Yin, 2019) and a higher probability of gaining a permanent position. However, since the pandemic, many institutions across the world, including local institutions, have experienced great challenges in placing students in industries to pursue their on-site internships. The reality of the COVID-19 pandemic has propelled several tertiary institutions to provide viable options for physical placement for final-year students on track for graduation.

## Methodology

The researchers used an inductive-simultaneous mixed method design where the core component of this study was quantitative, and the supplemental component

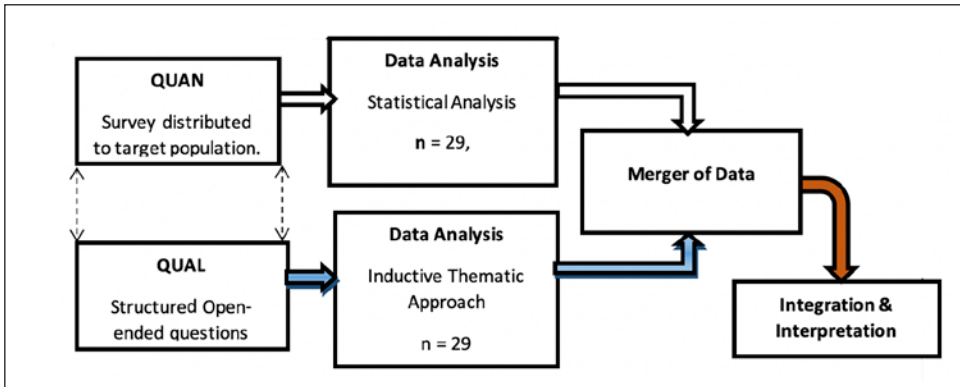


Figure 1. Inductive-simultaneous mixed method design

was qualitative (Morse & Niehaus 2009, p. 25), as detailed in Figure 1 below. An online survey instrument was emailed to all 67 engineering students who signed up for the IWE Alternative Assessment programme during the 2020/2021 COVID-19 pandemic period. A WhatsApp message containing the survey instrument link was also sent to all the participants. The assumption was that all telephone numbers were active and still belonged to the respective participants. Follow-ups were done using email and WhatsApp. According to Bista and Saleh (2017), follow-up is a method for increasing response rates. To ensure accuracy, the survey link only permitted one unedited response from each participant to be submitted.

The survey instrument was designed to include general demographic data, such as gender, age, undergraduate degree major, IWE option completed, and projected year of graduation from the selected tertiary institution. The instrument also collected information about the employment status of participants, including post-graduation employment and employment in their specialised field. The instrument consisted of a total of 28 questions, six open-ended questions and 22 closed-ended items. The closed-ended items were on the evaluation of the alternative IWE and current employment status. There were nine five-point Likert Scale statements (strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree). The six open-ended questions sought to determine respondents' feelings on the most valuable aspects of the work experience, with recommendations for improving the experience for future students, and major obstacles and challenges encountered during the experience. The quantitative data were analysed with descriptive statistical measures using Microsoft Excel and the Mann-Whitney U-Test using the [www.socscistatistics.com](http://www.socscistatistics.com) online calculator. The qualitative data were collected and analysed using the thematic inductive



approach. The quantitative and qualitative results were analysed both concurrently and independently. The point of interface occurred during the analysis of the results. Of the 67 invitations, 29 participants completed the survey administered over a period of 18 days. The response rate was 43.3%, and the average time taken by the respondents to complete the questionnaire was 20 minutes.

Participation in the study was strictly voluntary and the reporting of the results was done in such a manner to ensure confidentiality and anonymity of all respondents. The survey used Google Forms to collect the data. All email addresses that were used as unique identifiers to assist with preventing multiple participation were removed from the data set and stored in a separate password-protected file only accessible by the principal investigator prior to the analysis of results. The ethical practices recommended by Gupta (2017) in designing internet-based studies were adopted in this study. Some of the ethical practices included informed consent from participants, removal of identifiers prior to data analysis, data storage protection, and data not used for subsequent non-research purposes.

## Results and Discussion

### Profile of Engineering Students

*Research Question 1:* What is the profile of engineering students who completed the alternative assessment as opposed to traditional work experience during the COVID-19 pandemic?

Of the 29 participants in this research, 93% were males, and 7% were females. Participation in this study indicated a large gender disparity in engineering programmes. According to Engineering UK (2018), 14.5 % of workers in the field of engineering are females. There is a great need for more resources and effort by higher education institutions to attract, retain and develop more talented female engineers in order to reduce the gender disparity in the engineering profession. Strachan et al. (2018) emphasise the need for better gender balance in technology, engineering, and physical sciences fields because unconscious and inherent bias can lead to stereotyping and influence our decisions to create a more inclusive environment for all. The gender disparity where women are significantly underrepresented in engineering (EngineeringUK., 2018) is also a problem in the Caribbean. The largest age range of respondents was within the 24–26 age group, representing 69%, followed by 13.8 % for both the 27–29 and 30–32 age groups, while 3.4% was in the 33–35 age group.

Table 1 illustrates the graduates' degree major per year. The majority of respondents graduated in 2021 (44.8%), followed by 34.5% in 2020; the remaining students, constituting 20.7%, have other requirements, such as modules to redo and/or elective modules to pursue in the forthcoming academic year 2021/2022. Once these other requirements are met, then they are expected to be graduated in 2022. In 2020, the majority of 40% of participants were electrical engineering student interns, followed by industrial engineering interns of 30%, mechanical engineering interns of 20% and civil engineering interns of 10%.

In the 2021 IWE alternative assessment programme, the majority of 46.2% of participants were mechanical engineering students representing an increase of 26.2% when compared to the previous year. There were equal numbers of civil and industrial engineering interns (23.1%) and 7.7% electrical, which reflects a decrease of 32.3% when compared to the previous year. In terms of the total participants, a little over a third (34.5%) of the overall participants majored in mechanical engineering, followed by 27.6% in industrial engineering, with an equal number of civil and electrical engineering interns (17.2 %).

**Table 1.** Bachelor's degree and year Respondents graduated

Undergraduate Degree Major	Year Graduated			Total	Per cent
	2020	2021	2022 (pending)		
Chemical	0	0	1	1	3.4
Civil	1	3	1	5	17.2
Electrical	4	1	0	5	17.2
Industrial	3	3	2	8	27.6
Mechanical	2	6	2	10	34.5
<b>Total</b>	<b>10</b>	<b>13</b>	<b>6</b>	<b>29</b>	<b>100</b>

A total of 86% of the respondents selected the alternative assessment IWE option that was being supervised by university staff (lecturers and/or technologists). In terms of the residency, 58.6 % of the respondents were residing outside of the corporate area and 24.1% were staying inside the corporate area within the vicinity of the selected university, whilst 13.8% were staying with relatives or friends overseas with a minority of 3.4 % in the university residential halls.

## Evaluation of Respondents' Experience Engaged in Alternative IWE Assessment

*Research question 2:* What level of experience was gained by the students engaged in the alternative IWE assessment during the pandemic?

Table 2 summarises five (5) major reasons respondents made the decision to pursue the IWE alternative assessment. The respondents had the option to select one or multiple responses. A majority of 37.8% could not find a physical placement in an industrial environment because of the unwillingness of companies to facilitate interns during the pandemic. This problem was also noted by Wang et al. (2022), who reported that 31.8% of the postgraduate internship programmes in China were negatively affected by the Covid-19 pandemic.

Approximately 16.2 % of the respondents in this study indicated that they were afraid of contracting the COVID-19 virus, and 10.8 % reported spending time with friends and relatives overseas during the period of internship. According to Wang et al. (2022), fear is a primary contributor to anxiety and depression during the pandemic. Of the 13.5 % of respondents that had selected “other” as a reason for doing the alternative IWE assessment, the following reasons were stated: restriction due to COVID-19 spikes, school imposed it as an alternative means and the unwillingness of companies to facilitate internship. These findings concur with those support of Teng et al. (2021) who indicated that COVID-19 had disrupted internships with a significant reduction in the number of placements offered.

**Table 2.** Reasons Respondents Selected IWE Alternative Assessment

Reasons	n	Per cent
Could not find a physical placement in industry	14	43.8
Afraid of contracting the COVID-19 virus	6	12.5
Other	5	15.6
I was overseas during the period.	4	12.5
Returned home to a location not near to campus	3	9.4
<b>Total</b>	<b>32</b>	<b>100</b>

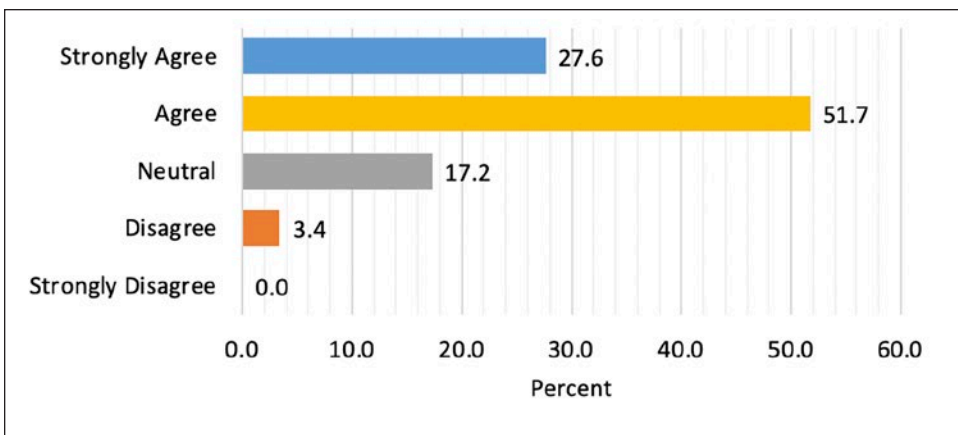
The majority of respondents (82.8%) agreed or strongly agreed that the learning objectives and project scope were clear. However, 10.3% indicated that the objectives and scope were not clear, while 6.9% responded neutrally. Almost

unanimously (96.6%), the respondents believed the workload was manageable but challenging, with the exception of 3.4% who responded neutrally. In terms of the respondents' views on the online meetings with project supervisors, a significant majority of 89.7% agreed or strongly agreed that the meetings were organised and well planned, and 10.3% responded neutrally. A majority of 89.7% agreed or strongly agreed with the statements “supervisors were available and helpful” and “supervisors provided adequate guidance and direction” All except 3.4 % disagreed with both statements, whilst 6.9% were neutral. All respondents agreed (69%) or strongly agreed (31%) that the supervisors provided adequate guidance and direction.

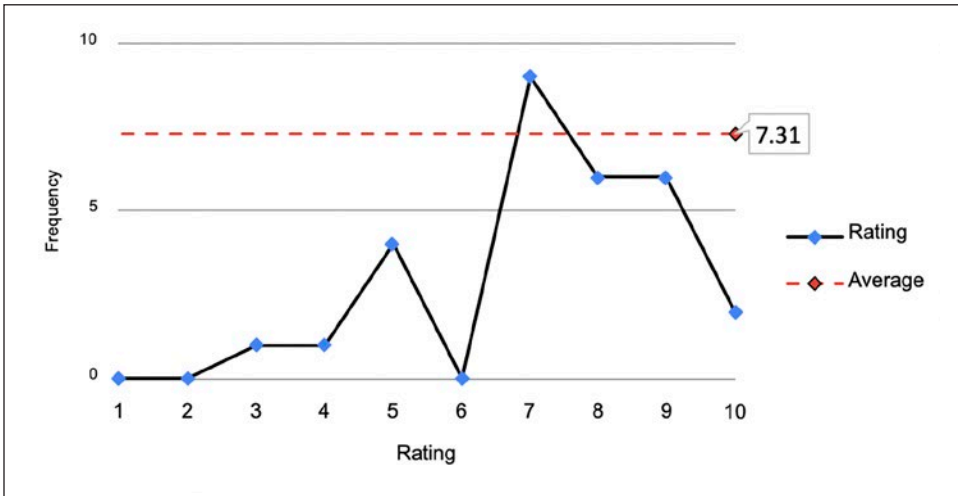
It was found that 82.8% of the respondents believed that the workload allowed all students to participate fully; a minority of 3.4% disagreed that the workload permitted all students to participate fully, and 13.8% respondents neither agreed or disagreed.

Approximately 79.3% of respondents indicated that the IWE alternative assessment exposed them to engineering relevant to industry standard, 3.4% disagreed and 17.2% neither agreed nor disagreed, as is indicated in the bar chart in figure 2.

The overall IWE experience ratings of respondents are represented in the line graph in Figure 3. The rating scale used was from 1–10, where 1 indicated a very unpleasant experience and 10 represented a superb experience. The average participant's rating score is 7.3, with a standard deviation of 1.75 in the range of 3 to 10 for the two-year period. For the 2020 IWE alternative session, the minimum rating was 3 to 6, with an average of 6.75 and a standard deviation of 1.69. For the 2021 IWE alternative session, the minimum rating was 5 when compared to 3 in



**Figure 2.** Relevance of IWE Alternative Assessment Exposure as compared to traditional Industry Experience



**Figure 3.** Respondents' rating of overall experience

the previous year; the range is 5, and the standard deviation is 1.63, representing a 3.56% reduction in standard deviation with respect to the previous year. The overall average in 2021 increased by 15.6% when compared to 2021. This percentage increase appears to suggest an improvement in the quality of the experience. Table 3 describes the scale used in the analysis; there was 12.5% acknowledged an “unpleasant” experience in 2020, but this percentage was reduced by 5.6% when compared to 2021. The modal score for 2020 was categorised as ‘excellent’ by 62.5% of the participants when compared to the 2021 modal score, categorised as ‘superb’ by 46.2%. The overall modal score for the two-year period was categorized as ‘excellent’ for 51.7% of the participants.

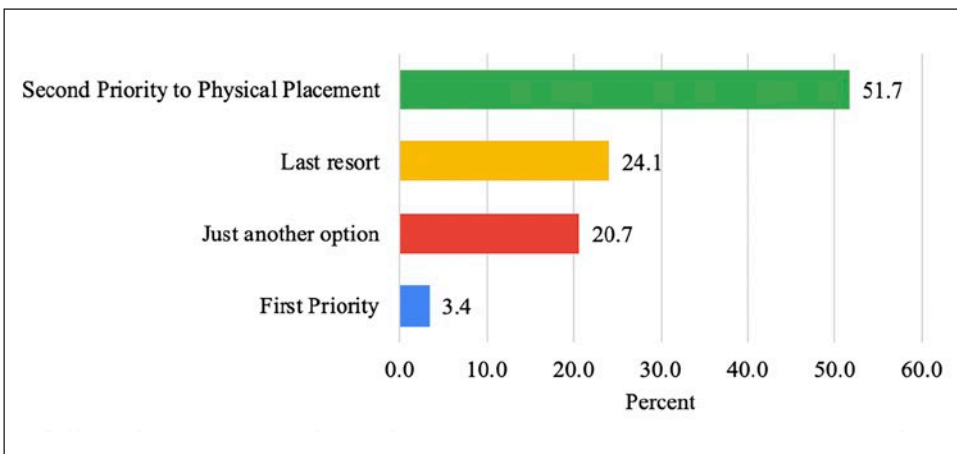
**Table 3.** Overall experience of the respondents pursuing an IWE alternative programme

Scale	Type of Experience	2020	2021	2020–2021	
		n1	n2	n	Per cent
1–2	Very unpleasant	0	0	0	0.0
3–4	Unpleasant	2	0	2	6.9
5–6	Average	2	2	4	13.8
7–8	Excellent	10	5	15	51.7
9–10	Superb	2	6	8	27.6
<b>Total</b>		<b>16</b>	<b>13</b>	<b>29</b>	<b>100</b>

### Is there a significant difference between the students' experiences in 2020 compared to 2021?

A Mann-Whitney U-Test was performed using <https://www.socscistatistics.com> online calculator with a significance level (or p-value) of 0.05 with a two-tailed hypothesis setting. The Mann-Whitney U-Test is used as the non-parametric alternative test to the independent sample t-test because the data sets are independent random samples, ordinal and skewed (Mann & Whitney, 1947). A two-tailed hypothesis setting was used because no direction was assumed. The results from the Mann-Whitney U-Test were a U-value of 57.5, a critical value of 59, a z-score of - 2.01723 and a p-value of 0.04338. Since the U-value is less than the critical value, the result is statistically significant at  $p < 0.05$ . Consequently, there was a significant difference between the student's experience in 2021 when compared with the previous year. This result further suggests that the students' experience in 2021 was better than in 2020 because the majority of the supervisors who were involved in administering the project in 2020 also continued in 2021. The experience of the supervisors made a difference. In addition, students were more comfortable working online and would have brought 2–3 semesters of online project experience through the completion of several other online classes.

Figure 4 illustrates the responses when respondents were asked about their willingness to encourage others to pursue the IWE alternative assessment option. Fifty-one-point seven per cent (51.7%) indicated they would recommend it as a second priority to on-site placement, 24.1% indicated that they would recommend



**Figure 4.** Respondents' willingness to encourage others to pursue alternative IWE.

it as a last resort, 20.7% as just another option, while only 3.4% indicated that they would suggest IWE alternative means of assessment as a priority. Although the overall experience was great, the participants would have preferred an onsite instead of a virtual placement. There is a difference of 48.3 % between respondents who would recommend alternative assessment as a first priority when compared to those who would not recommend it as a second priority. Respondents' unwillingness may be primarily due to the negatives of the experience and obstacles encountered. In contrast, the experiences associated with in-person work experiences typically provide exposure to the operations and functioning of the industrial working environment. Marsono et al. (2017) support this notion, indicating that the industrial practice of mechanical engineering students at their university aims to provide real-life work experience to better prepare them for post-graduation employment. The challenges and obstacles identified and encountered by the participants during the COVID-19 pandemic may influence their decision to recommend the IWE alternate assessment as a substitute for face-to-face placement. The major challenges encountered by participants were working with team members (45.5%) and face-to-face restrictions (13.6%), which were primarily due to World Health Organization (WHO) stipulations and local curfew measures that were employed to contain the spread of the COVID-19 pandemic. Another 13.6% of the participants indicated insufficient consultation time with the project owner. The consultation sessions were held weekly on the ZOOM platform with multiple groups during the same period. This was done to allow other team members and supervisors to critique and recommend improvements to each project where necessary.

### Employment status of respondents

*Research Question 3:* What is the employment status of the cohort of engineering students who completed the alternative IWE assessment during the pandemic?

Of the total respondents, 62% reported receiving employment within the first 18 months after completing university, while 38% obtained employment within 6 months. However, 38% were unsuccessful in obtaining employment. Of the unemployed respondents, 27.3% graduated in 2020, 63.6% in 2021, and 9.1% are pending graduation because of outstanding course(s). The rate of in-person internship placements and employment declined because of the sudden and harsh implementation of lockdown measures in the management of the COVID-19 pandemic during the initial stage (Meer & Mishra, 2021).

Of the 72% of postgraduate participants, 62% gained full-time employment, 10% part-time, and the remaining 28% were not yet employed. A little over half (51.6%) of the respondents obtained employment within the engineering field, 44.8% did not obtain employment within the engineering field, and 3.4% opted to start their own business outside of the engineering field.

### Experience gained by engineering students involved in the alternative IWE assessment

*Research Question 4:* What level of experience was gained by the student engaged in the alternative IWE assessment during the pandemic?

#### *Positives and negatives of the IWE alternative programme*

The respondents indicated that the alternative IWE assessment improved their personal empowerment and project management skills and afforded flexible work time. Of the total respondents, 43.5% highlighted that the experience fostered collaboration and empowerment, as supported by Park and Jones (2021), who found that well-planned and executed virtual internships could be an empowering learning experience. Relevant projects and flexible arrangements were the second most common view identified among 39.1% of the respondents. In addition, the development of project management skills (13.0%) and fostering creativity and innovation (8.7%) in the execution of project tasks were also identified. “The opportunity to work with other students of different engineering majors was said to be satisfying”. This view was further supported by another participant who indicated that “working with group members from different engineering programs enlightened one’s chain of thought”. Other positives mentioned by the participants were “working with some degree of autonomy” and collaboration with group members have provided an “eye-opener” as to what to expect in the real working world. In comparison to this study, Mediawati et al. (2020) found that the major skills developed during an accounting internship were willingness to learn, ability to work together, and enthusiasm.

The negatives highlighted by participants were lack of exposure to the actual work environment (55%), inadequate participation of members (35%), insufficient feedback (5%) from the supervisor and time constraints 5%. Most respondents indicated “not experiencing the practical and realistic working with a company” was a significant loss for them. “Not getting the exposure to the working world”



was also a major concern highlighted by most of the participants. Green in (2022) highlighting that the workplace environment enables casual interactions with co-workers was borne out in this observation. Green further stated that “nothing replaces face-to-face contact when it comes to observing people, work culture and group dynamics”. The lack of adequate participation of some group members and not getting all members of the team to participate equally resulted in disparities in workload was a common view among (35%) of the respondents. A few respondents were disappointed that they had taken on multiple tasks to meet deadlines and got the same ‘pass’ grade as those who did not do as much.

### *Valuable and non-valuable aspects of the alternative work experience*

Design skills were viewed as the most valuable experience, as indicated by 72.2 % of the respondents. The second most valuable experience was the application of theoretical knowledge to create relevant designed projects. This was the view of 22.2% of the respondents, who stated that “applying theoretical knowledge to real-life situations” and “applying different learned knowledge” in the development of the assigned project was most valuable. Teamwork and project management skills received a positive response rate of 38.9% and 10.1%, respectively. According to D’Angelo et al. (2011), the findings from a post-virtual internship interview revealed that “internship intern revealed that for 21 out of 45 respondents, teamwork and group collaboration activities was the most enjoyable aspect of the internship experience. Both findings highlight the importance and value of teamwork and collaboration in a virtual internship environment. One participant stated that “all aspects” of the alternative assessment were useful. These findings are in keeping with Teng et al. (2021), who found that the overall internship experience was positive for participants. They further stated that supervisors and e-interns also reported elevated levels of satisfaction and documented learning gains such as the development of technical skills and soft skills.

When respondents were asked what aspects of their work experiences were not useful or valuable, 72.2 % of the respondents stated that all aspects of the experience were valuable. A participant responded that “all aspects of the workload were useful and valuable to me as up until now I’m applying the skills [that] I have learnt and will be for the rest of my life”. Of the total number of respondents, 5.6% indicated that the only aspects not valuable to them were the grading method, not being able to build a prototype, group work, and not being able to meet face-to-face.

*Major challenges and obstacles encountered by respondents on the programme*

Among the major challenges encountered were working with team members (45.5%), face-to-face restrictions (13.6%), insufficient consultation time (13.6%) with project owners, time constraints (9.1%) and internet connectivity issues (4.5%). The National Association of Colleges and Employers (NACE, 2020) identified the following challenges to virtual internships as including: missed opportunities to understand professional workplace culture, not interacting with people in an actual work environment, lack of opportunity for professional and networking outside of the immediate office space. The findings of this study are in congruence with NACE reporting. In this study, the majority of the respondents indicated that the unavailability of team members to meet regarding the project tasks was a challenge. This failure was seemingly due to the varying personal obligations of team members and mobility restrictions, as indicated in the response: “Due to COVID-19 restrictions, a physical meet-up with group members was difficult”.

*Respondents’ recommendations for improving the quality of the IWE Alternative programme*

Despite the valuable experience highlighted by the respondents, the resumption of the face-to-face meeting was favourable among 32% of the respondents. There is a need to provide interns with projects that seek to solve current industry problems, as suggested by 24% of the respondents. The statement “Do projects relevant to our local market” was a suggestion made by a participant. These results show the need for greater academic and industry collaboration through internship (Shin et al., 2013) to enhance students’ experience. Twenty-four per cent (24%) of the participants indicated that more “consultation time” with the project owner/supervisor is required to address challenges faced by the project group. One respondent stated, “ensure students grasp an understanding of what needs to be done”. Providing the resources needed to create relevant and quality projects was suggested by 4% of the respondents. While changing the grading method was the suggestion of 8.3% of the respondents. This recommendation regarding the grading method seems to be on the basis that ‘pass’ grades do not differentiate between degrees of mediocrity or excellence on an individual basis.

## Recommendations

The researchers believe the following recommendations have the potential to increase and sustain the quality of the alternative IWE assessment for both pandemic and post-pandemic periods: This study also provides guidance on cooperative education policy guidelines, strategic and operational planning for higher education institutions, virtual internships, and future pandemic events.

1. Develop Memorandum of Understanding (MOU) with key industry stakeholders with a view to providing technical support for various industrial projects requiring internship for mutual benefits.
2. Provide a hybrid-model IWE alternative assessment that includes a minimum of 20% to 30% face-to-face meetings of team members and project supervisors.
3. Provide co-supervision of internship projects with academics and industry professionals for mentorship and professional networking.
4. Design and implement a business-centered incubator to provide students with relevant real-life work experience to create profitable, sustainable entrepreneurial ventures.
5. Partner with on-campus facilities maintenance departments/units to provide support relating to new project designs, facility upgrades, and maintenance planning and implementation.
6. Include team building and icebreaker activities with the objective of creating synergy and building trust among team members at the onset of the project and at various intervals in the project.

## Conclusion

The findings of this study will inform higher education providers and prospective interns of some of the advantages and disadvantages of pursuing an IWE alternative assessment programme. The positive major theme highlighted is collaboration and empowerment (43.5%). The lack of exposure to the actual work environment (55%) was the highest negative experience. The major challenges and obstacles highlighted were challenges of working with team members (45.5%) and face-to-face restrictions (13.6%). The most valuable aspects of the work experience to the respondents were design skills (72.2%). The overall experience rating shows a statistically significant difference between the students' experiences in 2020 when compared to 2021. A little over half (51.6%) of the respondents obtained

employment within the engineering field, while 62% were employed within the first 18 months after completing university.

The lessons learnt from the implementation of the alternative means of assessment during the COVID-19 pandemic can provide policymakers in tertiary education with an innovative approach to fulfilling the curriculum requirements for the cooperative education programme. Further study is recommended to ascertain the views of other stakeholders, such as employers, supervisors, and accreditation bodies.

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# Female Leadership Practices and their Influence on School Effectiveness in Jamaican Primary and Secondary Institutions

SHANA-GAE T. REID  
Caribbean Maritime University

## Abstract

*This study addresses the knowledge gap related to female principal leadership practices that impact school management effectiveness. The researcher explored this topic, recognising the importance of understanding leadership strategies in the current century. Participants included female principals from one high school and two primary and infant schools in Jamaica. The study employed qualitative methods, including structured face-to-face interviews and a document analysis of the schools' recent National Education Inspectorate (NEI) reports. Key findings revealed that effective schools demonstrated strong management, community and family involvement, high student standards, monitoring of teaching and learning, and a shared vision with focused goals. All principals emphasised the importance of training and professional development, particularly praising the National College for Educational Leadership (NCEL). The presence or absence of these factors determined school effectiveness. However, due to the small sample size, findings may not be fully generalisable to the broader population of women in educational leadership in Jamaica.*

**Keywords:** Female Leadership, School Leadership, Effective School, Failing School, National Education Inspectorate

**Corresponding Author:** Shana-Gae T. Reid – [mrzreid@yahoo.com](mailto:mrzreid@yahoo.com)



## Background to the Study

While schools across the world may have similar goals and objectives, the situation under which these are to be accomplished will require different strategies, skills, competencies and abilities. Kopp, MacGregor and Watson (2008) emphasised the fact that leadership effectiveness can be difficult to evaluate because of other constraining variables in the organisation. For developing countries such as Jamaica, many of the constraining variables may be very different from those in developed countries. With context being a vital factor in determining the nature and type of leadership that is exhibited by principals, it is incumbent on researchers to identify what is unique, specific and important about high-performing principals in the Jamaican public education system. Researchers can do this while bearing in mind that there are literally hundreds of factors, characteristics and behaviours which seem to be associated with effective or high-performing principals on the international landscape (Hutton, 2017).

Hutton's work focused on the characteristics, qualities and behaviours of high-performing principals in Jamaica (both males and females). This research is an extension of such and focuses solely on female leadership practices, strategies and challenges. Based on the findings provided by Hutton's research, this research will seek to find female leaders with the characteristics, qualities and behaviours mentioned.

## Scope

The role of women in leadership has been a subject of increasing interest and research in recent years. Despite historical underrepresentation in leadership positions, women have demonstrated remarkable capabilities as effective leaders across various domains. Research by Eagly and Carli (2007) suggests that women often possess transformational leadership qualities, emphasising collaboration, empathy, and relationship-building, which are essential in modern organisational settings. Furthermore, studies by Derue et al. (2011) have found that women leaders frequently exhibit inclusive leadership behaviours, fostering diverse and inclusive work environments.

According to Goswami (2021), from as far back as the first century, western women usually assumed primary responsibility for the home and for the care of the children. She was the authority figure who made the decisions and determined the discipline. If a man is present, however, he is regarded as the undisputed

head of the house. The attribution of headship to the male may well be symbolic, conforming to religious and societal norms, since the actual household decision-making is carried out by women. Male authority is usually dependent on the man's economic contribution to the household and the extent to which the family depends on this contribution (Leo-Rhynie, 1993). Though evidence suggests that the proportion of women in management is increasing, doubts about women's leadership skills still exist (Still, 2008). It was, therefore, important to examine female leadership and school effectiveness.

### **Research Problem**

There was a need to investigate the relationship between female leadership and school effectiveness in Jamaican schools to better understand how female leaders contribute to school effectiveness and to identify leadership practices and strategies that can be used to enhance learning outcomes for all students. The aim of the research was to explore female leadership practices and their influence on school effectiveness in Jamaican primary and secondary schools. This research also addresses a gap in current research and contributes to the development of strategies to enhance educational outcomes within the Jamaican educational context.

### **Purpose Statement**

The purpose of this research was to examine female principal leadership practices that are effective and ineffective in improving school management.

### **Significance**

The findings of this study could make female principals aware of best and worst practices to respectively use and avoid in their bid to become effective leaders and improve school management. There is evidence that women have the qualifications and work experience to take on responsibilities at the highest level. The challenge, however, is the slow pace in achieving a critical mass of women in top jobs with power worldwide (Wirth, 2002). If the pace at which they take on those positions of responsibility is to be accelerated, research needs to shift its focus from what is happening and why it might be happening to identify those factors that account for the success of those women who have risen to positions of power and influence.

This study's findings will also be of use to School Boards in the selection process and or professional development for female principals. The findings could enable the School Board to help female principals identify gaps between their own qualifications and the criteria used for the selection process. Additionally, the research could be of use in isolating those factors which can be changed and activities that can be developed to fill the gaps. The findings could also influence School Boards to acknowledge the importance of their role as stakeholders and the actions they can take to help their school acquire or maintain school effectiveness.

### Research Questions

1. What are the elements that represent effective school management?
2. What leadership practices of female principals are considered effective in improving school management?
3. What are the challenges that female principals face that detract from their schools' effectiveness?
4. Do the challenges female principals face detract from their effectiveness in improving school management?
5. What strategies can be employed by female principals to improve the effectiveness of their schools?
6. What specific female leadership practices are perceived as ineffective in school management?

### Literature Review

“Schools all over the world are constantly being assessed both formally and informally to deduce if they are successful or failing (effective or ineffective)” (The Organisation for Economic Co-operation and Development (OECD), n.d.). According to Lezotte (1991), unique characteristics of the majority of effective schools are correlated with student success. An effective school is also described by T.Reynolds, a retired female principal in Jamaica (personal communication, November 2, 2016), as one where relevant sections of administrative theories, such as the synergistic and transformational theories, are applied in such a way to support the vision of the school; to manifest the schools' mission; achieve the schools' goals that must be linked to the Ministry of Educations' strategic goals; and to formulate SMART (specific, measurable, attainable, relevant, time framed) objectives in order to measure progress. Bergeson (2007) identified nine (9)

characteristics of a successful school which are placed under three broad categories: goals and aspirations, processes and actions, and, support and capacity building.

In Jamaica, the NEI was established by the government to assess the standards attained by the students in our primary and secondary schools at key points in their education. Additionally, the inspectors are also tasked with reporting on how well the students perform or improve, as they progress through their school and learning life. The NEI also makes recommendations to support improvement in the quality of the provision and outcomes for all learners. They assess and report on different standards, one of which is the quality of leadership and management of the learning environment in the school or learning institution. Resulting from the assessment after assessing schools, the NEI judges if a school as effective or ineffective. The researcher accessed the readily available NEI reports online, and used those reports as the basis for selecting schools were that considered as being effectively led by female leaders.

Grissom et al. (2021) posit that four behaviours of effective principals are : engaging in instructionally focused instruction, building a productive school climate, facilitating collaboration and professional learning community, and managing personnel and resources strategically. In a qualitative study by Lopez and Roofe (2023), they examined how school principals in Jamaica make sense of their leadership practices and how they use this knowledge to respond to their school contexts and shifting socio-cultural dynamics. Using a narrative interview approach, data was collected from 13 high school principals. The findings presented in this article indicate that a) high school principals in Jamaica theorised their leadership approaches drawing on various leadership paradigms; b) high school principals perceived their leadership as inextricably linked to the community context of the school; c) the importance of building relationships with members of the community; and d) the importance of leadership preparation and development to their work as school principals.

## Gender Leadership

In a study by Eagly et al. (1995), it was noted that women adopted participative styles of leadership and were more often transformational leaders than men, who more commonly adopted directive, transactional styles. Women in management positions tend to demonstrate the importance of communication, cooperation, affiliation, and nurturing more than do men in the same positions. The study

also showed men as more goal- and task-oriented and less relationship- and process-focused than women (Eagly 1995). This research hopes to fill the gap for this century about the way women lead.

Additionally, according to a 2023 article by the American Psychological Association, decades of psychological research confirm that when women are empowered to take on leadership positions, the effects can be metamorphic for everyone. Female leaders demonstrate more transformational leadership styles, according to a landmark 1992 meta-analysis of 61 studies led by Eagly (1995). They are more likely to epitomise what is good in the organisation and inspire people to go along with its mission than are men. Women are now seen as equally, or more, competent than men (Eagly, 1995). The study included data from 16 nationally representative public opinion polls involving more than 30,000 U.S. adults from 1946 to 2018. The researchers looked at three types of traits – communion (compassion, sensitivity), agency (ambition, aggression), and competence (intelligence, creativity) – and whether participants thought each trait was truer of women or men or equally true of both.

On the other hand, the results from research done by Samo et al. (2019) show that female leaders are considered less fit for leadership roles, resulting in a reluctance in followership, a gap in communication and ineffective performance. Detractors also tend to believe that women are less fit for pressure, resulting in a lack of trust and intergroup conflict. Another stereotype that emerged from the results is that women are considered less fit for professionalism and more engaged in personal expectations, resulting in adverse effects on tasks and miscommunications. In addition, a study by Johnson et al. (2008) suggested that sensitivity was more strongly associated with female leadership, whereas masculinity, strength, and tyranny were more strongly associated with male leadership. However, for female leaders to be perceived as effective they needed to demonstrate both sensitivity and strength, although male leaders only needed to demonstrate strength. If either was not observed, both female and male leaders were deemed ineffective. Grissom et al. (2021) noted that gender has an impact on turnover, especially for teachers who identify as male, since they are more likely to leave if their principal identifies as female. Their report also stated that teachers report a higher level of satisfaction when they work with a principal who shares their gender identity. However, there is no evidence that the principals' gender identity has an impact on student outcomes or school effectiveness.

## Methodology

Because Interpretivists seek subjective views of individuals (Cantrell, 1993), this paradigm was appropriate for the study as it enabled the researcher to enter and grasp the subjective meaning and beliefs of female principals rather than imposing the views of the world on them. Merriam (1998) posits that qualitative research is exploratory and inductive and emphasises processes rather than ends and that there is no predetermined hypothesis, no treatment, and no restrictions on the end-product. In keeping with this paradigm, the researcher did not manipulate the variables or administer treatment.

According to Creswell (2013), qualitative researchers collect data themselves by examining documents (document analysis), observing behaviour, and/or interviewing participants. The qualitative method of data collection was deemed most suitable for this research because the analysis of data allowed the researcher to have an in-depth understanding of the complex factors that influence the leadership behaviours of female principals. Precisely, it involved an examination of the lived experiences of and the interpretation of these lived experiences for these reasons. This research design employed methodologies including interviewing selected female principals and examining school records from the National Education Inspectorate (NEI) reports.

A document analysis was done that focused on NEI reports, aiming to identify elements of effective school management according to NEI standards. The examination included both the schools' NEI reports and previous relevant research. Additionally, the researcher conducted structured interviews, guided by McLeod (2014), using a fixed set of closed questions. The standardised order of questions ensured consistency. These interviews were tape-recorded for accuracy during transcription. Detailed notes were taken during interviews, emphasising areas requiring in-depth knowledge. Each interview lasted approximately one hour and thirty minutes, based on principal availability. The comprehensive approach allowed for rigorous exploration of effective school management.

## Sampling

The researcher selected three female principals (whose NEI reports described their leadership as being effective) to participate in the study. Two female principals from primary and infant schools and one principal from a high school in Jamaica were asked to participate. Pseudonyms have been used to refer to each school

principal in order to ensure autonomy. Shelome Guy is a principal at a primary school. She has been in education for nine years and a principal for three years. Debbie Richards is a principal at a primary and infant school. She has been in education for 27 years and a principal for 14 years. Iona Cameron is a principal at a high school. She has been in education for 38 years and a principal for 20 years. The researcher was guided by Morse (2000, p. 1) in the selection and decided to use three female principals because of the quality of the available data, the scope of the study, the nature of the topic, the amount of useful information that could be obtained from each participant, and the qualitative method and study design that would be used.

The researcher used purposive convenience sampling. Purposeful sampling is a technique widely used in qualitative research for the identification and selection of information-rich cases for the most effective use of limited resources (Patton, 2002). This involves identifying and selecting individuals or groups of individuals who are especially knowledgeable about or experienced with a phenomenon of interest (Creswell & Plano Clark, 2011). In addition to knowledge and experience, Bernard (2002) and Spradley (1979) note the importance of availability and willingness to participate, and the ability to communicate experiences and opinions in an articulate, expressive, and reflective manner. Convenience sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher.

## Data Collection Procedures

Firstly, ethical approval was requested from the University of the West Indies Ethics Committee. After approval was granted, a letter was written to the three school principals requesting their participation in the study. The letter contained details of the research including a proposal of dates for the data collection, and after consent was granted, a memo was subsequently sent to them confirming the dates for collecting data. Thereafter, the qualitative data was collected by way of one face-to-face tape-recorded interview with each principal in their office. Document analysis was also conducted.

## Document Analysis

The researcher conducted a document analysis of the NEI reports to gain more insight into question one, which sought to identify the elements that represent effective school management in the respective schools according to NEI standards.

The document analysis of other research was done to make better connections between the researchers' findings and those of other researchers and to prove, refute, and or produce new developments.

## Interview

All interviews were tape-recorded, which assisted the researcher in making accurate transcriptions afterwards. Additionally, the researcher took notes while guiding the participants into areas needing more in-depth knowledge or to related areas that appear to be a priority for the subject. The interviews lasted for an hour and thirty minutes and depended upon the availability of the principals. Each interview was structured. The questions were asked in a set or standardised order. The researcher was guided by Mcleod (2014) who posits that structured interviews are easy to replicate as a fixed set of closed questions are used, as well as easy to test for reliability.

## Data Analysis

The researcher labelled or coded the data so that similarities and differences in responses from all principals could be recognised. This was important in identifying important findings and making themes. The researcher used basic-level data analysis, which is a descriptive account of the data. Higher-level data analysis was also used, which is a more interpretive analysis of what was said or done, as well as what was stated or implied. Additionally, categories were created from the interview findings and document analysis, and the Principals' insight on each category was narrated, discussed and also displayed in tables. A connection was also made between the interview findings and the NEI report findings to prove, refute or identify any new development on the topic.

The constant comparative method was used, which is a process in which any newly collected data is compared with previous by collected. This is a continuous ongoing procedure because theories can be formed, enhanced, confirmed, or even discounted as a result of any new data that may emerge from the study. To strengthen the credibility of the research, the researcher used the strategy of member checking. After transcribing the interviews, the researcher gave the transcripts to the respondents to see if the notes reflected their ideas accurately. Also, at the end of each interview, a summary was given to the respondents to see if the data was accurate.



The researcher avoided research bias by not only discussing the results that placed the participants in a favourable light, withholding important results, or casting the results in a favourable light to the participants' or researchers' inclinations and disassociating names from responses during the recording process. Additionally, the researcher used pseudonyms for individuals and places to protect the identities of participants.

### **Ethical Consideration**

In this research, the ethical process began with obtaining approval from the University of the West Indies Ethics Committee. Female participants leading effective schools received personalised letters, interview agendas and timeframes were discussed, and the use of tape recorders for accuracy. To ensure validity, rich descriptions conveyed findings, including any negative or discrepant information. Peer debriefing enhanced accuracy, and the researcher reflected on potential bias. For reliability, transcripts were carefully checked for transcription errors. Participants verified the accuracy of notes, and summaries were shared after each interview. Data protection involved minimising personal information, using pseudonyms, secure storage, and the use of approved devices. An honest disclosure of results concluded the study.

### **Results**

The researcher labelled the data so that similarities and differences in responses from all principals can be recognised. The researcher highlighted important findings, created themes, and used the constant comparative method, in which newly collected data was compared with previous data that was collected.

*Research Question 1: What are the elements that represent effective school management?*

**Table 1:** Principals’ Feedback on the Elements Denotating Effective School Management

No.	Element of Effectiveness	Principals		
		Principal Iona Cameron Years in Education – 38 Years as Principal – 20 School – Secondary/ High	Principal Shelome Guy Years in Education – 9 Years as Principal – 3 School – Primary	Principal Debbie Richards Years in Education – 27 Years as Principa I – 14 School – Primary and Infant
1	Planning and Organizing	Effective planning/ be a planner/ “visionary Effective staff deployment”	Ensuring that the entire school is on the same page in terms of curriculum proposed by the ministry  Knowing the importance of aligning school goals with that of the Ministry of Education	Setting high standards for the students and school  Being results driven  Having feasible goals
2	Stakeholder Involvement	Stakeholders involvement	Stakeholders involvement	Stakeholders involvement
3	Leadership	Effective Communication with those within and outside of school/ including other Principals	Confidence in abilities	Strong leadership
4	Training		Adequate training	

**Table 2:** Summary of the Elements Denoting Effective School Management based on the Principals' NEI reports.

No.	Element of Effectiveness in NEI report	Principals		
		Principal Iona Cameron	Principal Shelome Guy	Principal Debbie Richards
1	Planning and Organizing	<p>focused goals</p> <p>Frequent monitoring of teaching and learning</p> <p>Assessments used to inform planning</p>	<p>Frequent monitoring of teaching and learning</p> <p>Assessments used to inform planning</p>	<p>Frequent monitoring of teaching and learning</p> <p>Assessments used to inform planning</p>
2	Stakeholder Involvement	<p>High community and family involvement</p>	<p>High community and family involvement</p>	<p>shared vision,</p> <p>High community and family involvement</p>
3	Leadership	<p>Effective Management (Leader and school board)</p> <p>High standards for students</p>	<p>Effective Management (Leader and school board)</p> <p>High standards for students</p>	<p>Good monitoring of all aspects of school,</p> <p>Effective Management (Leader and school board)</p> <p>High standards for students</p>

*Research Question 2: What are the Female Principal Leadership Practices That are Considered Effective in Improving School Management?*

**Table 3:** Principals’ Feedback on the Female Principal Leadership Practices that are Considered Effective in Improving School Management

No.	Practices Effective in Improving School Management	Principals		
		Principal Iona Cameron	Principal Shelome Guy	Principal Debbie Richards
1	Effective School Leadership			<p>Making changes quickly when necessary</p> <p>Effective staff deployment</p> <p>Frequently monitoring teaching and learning and everything that goes on in a school</p>
2	Collaboration and Communication		Good communication skills/ Communicating (with those within your school and also other principals)	
3	Training	Training in leadership ( <b>further training with NCEL-</b> National College for Educational Leadership)	<b>Adequate training</b> for leader and all members of staff	Training in leadership ( <b>further training with NCEL-</b> National College for Educational Leadership)

*Research Question 3: What Challenges do Female Principals Face that Detract from their Schools' Effectiveness?*

**Table 4:** Principals' feedback regarding Challenges Female Principals Face that Detract from their Schools' Effectiveness.

No.	Challenges that Detract from their Schools' Effectiveness	Principals		
		Principal Iona Cameron	Principal Shelome Guy	Principal Debbie Richards
1	Financial	Small Grants from the Ministry of Education Lack of Sponsorships	Insufficient funds sponsorships not granted and those same companies sponsored all boys schools with male Principals (implying gender bias)	
2	Collaboration and Communication		Resistance to change (lack of cooperation with new principal)	Lack of collaborated support Resistance to change (lack of cooperation with new principal)
3	Staff Morale			Staff did not have confidence in the school and the leadership because the school was labelled as failing for so many years before being currently deemed effective

*Research Question 4: What Challenges Do Female Principals Face That Detract from Their Effectiveness in Improving School Management?*

**Table 5:** Principals’ Feedback on the Challenges Female Principals Face That Detract from Their Effectiveness in Improving School Management

No.	Challenges that Detract from their Effectiveness in Improving School Management	Principals		
		Principal Iona Cameron	Principal Shelome Guy	Principal Debbie Richards
1	Collaboration and Communication		Lack of cooperation from <b>middle managers</b> (Heads of Departments)	Lack of total support from <b>all staff</b>
2	Staff Morale			Lack of confidence and trust in the staff  Choosing the right people to drive certain aspects (indecisiveness with staff deployment)

*Research Question 5: What Strategies can be employed by Female Principals to Improve the Effectiveness of their School?*

**Table 6:** Principals' feedback regarding the Strategies that can be Employed by Female Principals to Improve the Effectiveness of their School

No	Strategies that can be Employed by Female Principals to Improve the Effectiveness of their School	Effective Principals		
		Principal Iona Cameron	Principal Shelome Guy	Principal Debbie Richards
1	Collaboration and Communication	Using best practices (strategies) from other effective schools Collaboration with staff and other principals  Communicating with neighbouring schools	Using best practices (strategies) from other effective schools	
2	Capacity Building		Leadership training (mention of NCEL training) Do action research	Act in a way that commands respect to get the necessary support to affect your vision

*Research Question 6: What Specific Leadership Practices are Perceived as Ineffective in School Management?*

**Table 7:** Principals’ Feedback on Specific Leadership Practices Perceived as Ineffective in School Management

No.	Leadership Practices that are perceived as Ineffective in School Management	Effective Principals		
		Principal Iona Cameron	Principal Shelome Guy	Principal Debbie Richards
1	Financial	Not hosting fundraising events/ enough fundraising events since small grants are received from the MOE and there is a lack of external sponsorship		
2	Collaboration and Communication		Not having any activities/ methodologies/ strategies in place to help the staff to transition from one principal to the next	Not communicating effectively, efficiently and consistently with staff and all stakeholders
3	Staff Morale		Not having any strategies in place to boost staff morale	Not having a plan to aid in boosting staff morale

**Discussion**

*Research Question 1: What are the Elements that Represent Effective School Management?*

Lad (2000) suggested that female principals excel in various aspects of school leadership, including the ability to communicate school goals, supervise and evaluate instruction, coordinate curriculum, maintain high visibility, and promote professional development. While this research could not definitively prove women’s superiority, it did demonstrate that female leaders exhibit these qualities, contributing to effective schools. Similarly, interviews revealed that effective school



management involves elements such as having clear goals, effective communication, monitoring teaching and learning, and adequate staff training. These align with Bergeeson's (2007) nine characteristics of effective schools, reinforcing the importance of these practices.

## **NEI Document Analysis – The Elements that Represent Effective School Management**

### *NEI Report Document Analysis – Principal Iona Cameron*

The most recent NEI report for Principal Iona Cameron stated:

The school is well-managed by an efficient Principal and a committed Senior Management Team (SMT) who have ensured the maintenance of good student achievements. The consistent evaluation of school performance is used to establish goals and inform plans for improvement. The School Board provides guidance and support, and interactions with parents and the community are exceptionally high (National Education Inspectorate Report Issued 2014).

The school evaluation aligned with the principals interview, indicating effective management, high standards, and student achievements. Frequent monitoring of teaching and learning, focused goals, active school board support, and exceptional family and community involvement contributed to the school's effectiveness. The National Education Institute (NEI) recommended enhancing teacher reflection and monitoring instruction to improve overall effectiveness.

### *NEI Report Document Analysis – Principal Shelome Guy*

The most recent NEI report for Principal Shelome Guy stated:

The Board and senior management team are harmonised in their efforts to accomplish the goals of the school. There are effective systems in place for self-evaluation and school improvement planning. The parents, alumni and other stakeholder groups are also involved at both the strategic and operational levels of the school. However, only some middle managers perform their duties effectively to uphold the standards (National Education Inspectorate Inspection Date 2014).

The effectiveness of the school was linked to collaborative efforts among school management, regular evaluations, and cooperation among stakeholders. However, a few middle managers exhibited reluctance to collaborate, impacting school effectiveness at times. The inspectorate's recommendation emphasised ongoing capacity building for middle leadership and other teachers with responsibili-

ties. This focus aims to address gaps in instructional leadership and standards monitoring.

### *NEI Report Document Analysis – Principal Debbie Richards*

The most recent NEI report for Principal Debbie Richards stated:

The Principal displays strong leadership qualities and senior management shares a common vision to achieve and maintain academic excellence. Their documentation system provides excellent records for an effective assessment of the school's performance and a framework for planning and development. The committed Board of Governors provides efficient guidance and support. Community relations, especially interactions with parents, are excellent (National Education Inspectorate Report Issued 2014).

The effectiveness of this school primarily stems from robust leadership, a shared vision, rigorous academic standards, comprehensive monitoring, and active engagement of all stakeholders. The inspectorate's recommendation emphasises that senior leadership should uphold excellent standards and enhance teaching quality through stimulating strategies tailored to diverse learning styles and abilities. Additionally, promoting greater participation in national sports competitions is encouraged to foster holistic student development.

### *Research Question 2 – What are the Female Principal Leadership Practices that are Considered Effective in Improving School Management?*

Research question two sought to find out the female principal leadership practices that are considered effective in improving school management. The interviews revealed that the principals themselves considered the following practices principals as effective in improving school management: proper training, respecting others, building relationships, making changes efficiently, effectively deploying staff, monitoring teaching and learning frequently and communicating with staff and neighbouring schools. These were in keeping with Grissom et al. (2021), who posit that the four behaviours of effective principals are: engaging in instructional-focused instruction, building a productive school climate, facilitating collaboration and professional learning community, and managing personnel and resources strategically. Lopez and Roofe (2023) also noted that building relationships with stakeholders is crucial in school effectiveness along with leaders supporting and nurturing staff.

*Research Question 3 – What Challenges do Female Principals Face that Detract from their Schools’ Effectiveness?*

The challenges that affect school effectiveness are influenced by many factors, both internal and external. Some of the challenges highlighted during the interview by the principals are limited resources, lack of sponsorships, gender bias, and resistance to change. For example, Principals Cameron and Guy shared that they received small grants from the Ministry of Education, which were insufficient to cover the costs of improving the quality of education. They also shared that their school struggles to find sponsors who are willing to support their programs and activities. Principal Richards shared that some major sponsors seem to be more willing to assist all-boys schools with male principals because, after declining to assist her school, they have gone on to assist male principals who lead all-boys schools. Furthermore, Richards shared that her school encountered -resistance to change from its staff, who did not have confidence in the school and the leadership, because the school was labelled as failing for so many years before being currently deemed effective. The latter is similar to a notion shared by Samo et al. (2019) that there is sometimes a reluctance in followership for female leaders, especially when they have failed previously. The above-mentioned challenges detracted from the school’s ability to achieve its goals and meet the needs of its students.

*Research Question 4 – What Challenges Do Female Principals Face That Detract from Their Effectiveness in Improving School Management?*

One of the main goals of school management is to improve the quality of education and the performance of students. However, there are many challenges that detract from the effectiveness of school management. Principal Guy noted a lack of cooperation from middle managers such as Heads of Departments. She shared that middle managers are responsible for leading and supervising their departments, and they are expected to work in alignment with the school’s vision and mission. However, some middle managers resist or oppose the changes and initiatives proposed by the school management and/or fail to communicate and collaborate with other departments. This creates conflict, confusion, and inefficiency in the school system. In accordance with Bergeson’s (2007) postulation, without collaboration, communication, and support for staff, schools will not be effective.

Principal Richards recounted a lack of total support from all staff: All staff

members, including teachers, administrators, and support staff, play a vital role in the school's success. They need to be motivated, engaged, and committed to the school's goals and values. However, some staff members lack the necessary skills, knowledge, or resources to perform their tasks effectively, or they feel dissatisfied, frustrated, or burned out by their work. This affects the quality of their work and their relationship with students and colleagues. She also shared that a lack of confidence and trust in the staff can undermine the staff's confidence, autonomy, and creativity and reduce their loyalty and commitment to the school.

Likewise, not choosing the right people to drive certain aspects (indecisiveness with staff deployment) can detract from effectiveness in improving school management. Principal Richards agrees school management should assign the right people to the right roles and tasks based on their skills, talents, and preferences; however, in the past, she had difficulty in identifying and utilising the strengths and potentials of the staff and hesitated or delayed in making decisions about staff deployment. That resulted in mismatched, underutilised, or overburdened staff and lowered the productivity and morale of the school. Those challenges negatively affected the school's performance, reputation, and culture, and ultimately, the learning outcomes and well-being of the students. This result was in keeping with the characteristics shared by Bergeson (2007).

*Research Question 5 – What Strategies can be employed by Female Principals to Improve the Effectiveness of their School?*

Principals Cameron and Guy shared that one of the strategies needed to improve school effectiveness is to use best practices from other effective schools. This means learning from the successes and challenges of other schools and adapting them to the specific context and needs of one's own school. Another strategy shared by Principal Cameron is to collaborate with staff and other principals, communicating with neighbouring schools to share ideas, resources, and feedback. This would foster a culture of teamwork, trust, and continuous improvement. A third strategy employed by Principal Guy is to engage in leadership training provided by the National College for Educational Leadership (NCEL). This provides relevant and quality training for school leaders at all levels and helps school leaders develop their skills, knowledge, and competencies to lead their schools effectively. A fourth strategy shared by Principal Guy is to conduct action research, which involves identifying a problem, collecting and analysing data, implementing a solution, and evaluating the results. This can help school leaders make informed decisions based on evidence and best practices. Principal Richards suggested that

acting in a way that commands respect where necessary support to implement one's vision. This means being respectful, ethical, and professional, as well as being clear, consistent, and confident in communicating one's vision and goals for the school, as posited by Bergeson (2007) and Lezotte (1991). These strategies the principal suggested can help school leaders improve their school effectiveness and enhance student learning and achievement.

*Research Question 6 – What Specific Leadership Practices are Perceived as Ineffective in School Management?*

Principals Cameron and Guy agreed that some leadership practices can be detrimental to the school's performance and reputation. For example, not hosting fundraising events or enough fundraising events can limit the school's financial resources and opportunities, especially where the grants from the Ministry of Education are insufficient and there is a lack of external sponsorship. Another ineffective leadership practice suggested by Guy was not having any activities, methodologies or strategies in place to help the staff transition from one principal to the next. This can create confusion, uncertainty and resistance among the staff, who may not feel comfortable or confident with the new leader. Furthermore, Principal Richards said that not communicating effectively, efficiently and consistently with staff and all stakeholders can lead to misunderstandings, conflicts and dissatisfaction. Finally, Guy and Richards shared that not having any strategies or plans in place to boost staff morale can result in low motivation, engagement and productivity among the staff, who may feel unappreciated, undervalued and unsupported. Therefore, it is important for school leaders to avoid these ineffective leadership practices and adopt more positive and proactive ones. Some of the practices in tandem with effective leadership are those postulated by (Lopez & Roofe, 2023; Grissom et al., 2021; Samo et al., 2019; Bergeson, 2007; and Lezotte, 1991). These authors suggest: building relationships with all stakeholders, supporting and nurturing staff, and communicating and collaborating effectively to ensure student success and school effectiveness.

## Conclusion

Based on the findings of this research, schools that have high levels of collaboration, communication, frequent monitoring of teaching and learning, clear goals, high expectations for students and staff, and relevant staff development/ training are usually effective. The participants in this study all lead effective schools according

to their NEI reports, and they placed a lot of emphasis on those areas identified above. Additionally, it can be concluded that the absence of the aforementioned areas can cause school ineffectiveness. Furthermore, if each strategy is practised in isolation, it might not yield the same results as it did for the participants in the study. They noted that even after receiving the necessary training, a lack of collaboration/ cooperation, communication, collaboration, staff morale, and insufficient funds detracted from school effectiveness at some point, and they then had to shift focus to improve that area.

Characteristics (such as high levels of the abovementioned findings) of the majority of effective schools are correlated with student success. Because of this, these characteristics are called correlates by researchers (Lezotte, 1991). This comment by Lezotte is arguable since only one participant mentioned the success of students once in a one-hour and thirty-minute interview. However, all that is done in a school is correlated with students doing well because that is the mission of a school.

## Implications and Recommendations

School leaders and teachers should foster a culture of collaboration and communication among themselves and with other stakeholders, such as parents, students, and community members. This can enhance the quality of teaching and learning, as well as the sense of belonging and trust in the school. Also, school leaders and teachers should use data and evidence to inform their decisions and actions, and to monitor and evaluate their progress and impact. This can help them identify strengths and weaknesses, set realistic and challenging goals, and implement effective strategies and interventions. Furthermore, they should have high expectations for themselves and their students and provide them with the necessary support and feedback to achieve their potential. This can motivate and challenge them to strive for excellence and continuous improvement. They should also engage in relevant and ongoing professional development and training, aligned with the school's vision and goals. This can help them update their knowledge and skills, adopt best practices, and innovate their pedagogy and curriculum.

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# Online or Face-to-Face Modality: Students' Preferred Instructional Modality for French and Spanish after the COVID-19 Pandemic in Jamaica

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**MYLÈNE R. FERRIERA**

Caribbean Maritime University

**GEORGE A. FERRIERA**

University of Technology, Jamaica

## **Abstract**

*The COVID-19 pandemic was an unwelcome and unprecedented event that forced educational institutions to deliver classes entirely online. The aim of this research is to evaluate students' online learning experience during the COVID-19 pandemic and their preferred instructional modality for foreign languages at the tertiary level in post-pandemic Jamaica. A mixed method was employed by way of an online questionnaire sent to students studying French or Spanish as an elective in five tertiary institutions in Jamaica. The results from one hundred and five responses revealed a preference for the online modality, with home comfort and cost being the top reasons given; a correlation was also noted between the kinaesthetic learning style and a preference for the face-to-face modality. The results provide invaluable information that will serve to assist the policymakers of tertiary institutions in their post-pandemic decision-making when selecting their teaching modality to improve their student population. If tertiary institutions decide to embrace the online modality, the students may lose out on university experience and socialisation. Research of this nature has not been conducted with foreign language students in tertiary institutions in Jamaica, as far as the authors are aware. Therefore, it will be valuable to tertiary institutions in developing the best approach to language learning after the COVID-19 pandemic in Jamaica. The findings may be extended to other developing countries with similar socio-economic circumstances.*

**Keywords:** Online, Face-To-Face, Instructional Modality, Learning Styles, Foreign Languages, Students' Preferences

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**Corresponding Author:** Mylène R. Ferriera – [mferriera@faculty.cmu.edu.jm](mailto:mferriera@faculty.cmu.edu.jm)

## Introduction

In March 2020, the Coronavirus was declared a pandemic by the World Health Organisation (2020), and this unprecedented event forced Jamaican educational institutions to urgently find creative ways to deliver classes to enable the continuation of children's education whilst preventing the spread of the virus. The available technological infrastructure in Jamaica facilitated the opportunity for teaching and learning to be swiftly moved from the physical to the virtual space. While what we commonly refer to as face-to-face or online are only two of a number of what are considered instructional modalities (East Stroudsburg University of Pennsylvania (n.d.), Hodges et al. (2020) refer to the online instructional modality used during the COVID-19 lock-down as Emergency Remote Teaching (ERT). He defines it as "a temporary shift of instructional delivery due to crisis circumstances", as opposed to the online modality where courses are carefully planned and designed. The Jamaican tertiary institutions were able to respond quickly to the ERT demands to ensure that they continued to fulfil the mission of ensuring that students covered the syllabi required to complete their studies. However, for the purpose of this study, we will continue to use the term online modality, a term understood by the students as the delivery of classes online.

This sudden transition from face-to-face to online classes resulted in challenges for teachers and students not only in Jamaica but also across the world, including developed countries such as the United States (Huck & Zhang, 2021), Japan (Dizon & Thanyawatpokin, 2021) and Jordan (Al-Awawdeh & Alshtaiwi, 2020), as they had to adapt to new communication systems and get-up to speed in the use of various platforms rapidly and efficiently. After two years of battling the pandemic, the world has seen an abrupt decline in the COVID-19 virus, and most countries have now returned to face-to-face learning with a sense of normality. In Jamaica, the majority of classes at the tertiary level are face-to-face, except at one university, and a blended modality for some is being used. In fact, the educational institutions in Jamaica are signalling that the online modality is here to stay, at least in part.

According to Husain (2015), however, a foreign language (FL) is “not a content-based” subject but “skill-based”, and because foreign language students were forced into a remote learning environment for nearly two years, it is important to find out how the online modality impacted the teaching and learning of foreign language students. To the best of our knowledge, research of this nature has not been carried out at the tertiary level in the Caribbean. Prior to the COVID-19 pandemic, students were used to a total face-to-face instructional modality, and the online transition at university was, therefore, new to them. It is against that backdrop that this research aims to evaluate undergraduate students’ learning experience, having gone through two years online (due to COVID-19) and, as a consequence, their preferred instructional modality for learning a foreign language at the tertiary level. The result will provide invaluable information for the teaching and learning policy of foreign languages in post-pandemic Jamaica.

## Literature Review

The pandemic resulted in a wide range of research on the online teaching and learning modality, not because it was new but because it was the only option available at the time of the COVID-19 crisis. Researchers were interested in the challenges that teachers and students faced when they had to transition online (Huck & Zhang, 2021), the advantages and disadvantages of the online modality, and how to deal with future crises (Dhawan, 2020). During the pandemic, the effectiveness of the online modality rested on three main elements; the accessibility to the Internet, the preparedness of the teachers and the readiness of students. The move from face-to-face to fully online also meant a shift from teacher-centred to student-centred approaches that affected the teaching strategy (Gherhes et al., 2021). The question as to whether language learning is compatible with the online modality and its likely impact, therefore, becomes important and requires greater consideration.

## Pre-pandemic Online Modality

The combination of learning with technology is not new since it started in the 60s as computer-assisted learning and increased in popularity with the wide use of the Internet (Bezhovski, 2016). Often called eLearning, it was an educational option used by those who could not study face-to-face for various reasons. Language learning was also done by Computer Assisted Language Learning

(CALL), a system that promoted learner autonomy and, therefore, required that students be ready and able to use the system effectively (Mutlu & Eröz-Tuğa , 2013). Rawashdeh et al. (2021) reported convenience as being the main advantage based on pre-pandemic research, with lack of interaction along with cheating and plagiarism as the main disadvantages. On the other hand, Nguyen (2015) found that the online modality is almost as effective as face-to-face.

### **Pre-pandemic foreign language teaching and learning**

Before the pandemic, most students were used to the traditional way of teaching and learning in a physical space, where the lecturer and the students were required to be in the same space at the same time, engaged in face-to-face activities. Doghonadze (2021) highlights the importance of the “live interaction” between the lecturers and the students and the “body language mimics” as well as “eye contact” used to help the learners understand. All these are indeed important considerations when learning a foreign language, but this face-to-face interaction was completely removed to be replaced by purely ERT because of the pandemic.

### **Online Modality during the Pandemic**

The pandemic gave rise to more research on the online modality, as it was the only means for teaching and learning and no longer an option. Much of this research focused on its advantages and disadvantages. However, on the whole, the online modality is well-rated and, in some ways, considered better than face-to-face classes, even in subjects like dentistry (Zheng, Bender, & Lyon, 2021). Law (2021) considered flexibility and convenience as the main benefits of online modality with the connectivity issue being the main disadvantage, especially for students in remote areas, as stated by Muthuprasad et al. (2021) who reported the use of recorded classes as a benefit to many students who could learn anywhere, anytime.

Even though the online modality was forced on teachers, it opened a gate of opportunities for the use of technology, compelled them to develop their skills as virtual educators and encouraged collaboration with colleagues. However, Lazaga and Madrigal (2021) also warned against the consequences linked to the online modality, the main ones being a lack of motivation and the development of laziness among students.

## Online Modality for Foreign Languages during the Pandemic

Teaching foreign languages online had its challenges, as did most subjects, but the literature points to the fact that it was manageable and some benefits emerged. While the online modality lacks the incorporation of “a more personal experience”, greater interaction and face-to-face elements for successful online language learning (Katz, 2021), it facilitated a decrease in anxiety in the foreign language class. According to Pakpahan and Gultom (2020), and (Tao, 2022), Foreign Language Speaking Anxiety is a feeling experienced by students who are afraid of speaking the target language in front of the class. Their research shows that this feeling decreases when the class is online because the students do not face the teacher or their peers. As a result, they do not feel scared or stressed. This was confirmed by a study in Indonesia, which revealed that the online modality was beneficial to 48.41% of university students as they felt less anxious as compared to 60.96% of them when in the face-to-face class. The online modality created a “non-threatening situation” (Rahmati & Ajeng, 2021), and was very helpful for introverted students in particular.

Many studies revealed that, apart from the technical difficulties, the success of the online modality rests with the teacher (Sharma & Alvi, 2021; Gopal et al., 2021). Xhaferi and Xhaferi (2020) believe that regardless of the teaching modality, the onus is on the teachers to improve their practices, to make the environment conducive to learning and on the students to display some self-motivation, autonomy and time management for successful learning to occur.

## Preference for Face-to-Face Classes

The traditional way of face-to-face teaching and learning is normally perceived as an effective modality, particularly for the learning of languages where interaction is the key to successful communication in the target language. It is therefore not surprising that researchers such as Gherhes et al. (2021) point to the university students’ preference for face-to-face, which highlights the importance of interaction and signals such as body language and facial expressions that are used when teaching a language. Ruiz-Alonso-Bartol et al. (2022) reported that students’ perception of the face-to-face modality was more conducive to learning. According to Gastaldi and Grimaldi (2021), even though the sudden shift to online classes for foreign languages at their university in Argentina was seen as successful, 50% of their students expressed a preference for face-to-face classes. The lack of

interaction that is needed for learning languages was the main factor reported for their preference. This is echoed by a similar study at a Czech university where Klimova (2021) found that despite the fact that 47 % of the students considered the online modality effective, they would still welcome face-to-face classes. Poor internet connectivity, lack of interaction, and delayed response time were some of the reasons given for being willing to go back to the face-to-face classroom. The researcher added that students preferred printed material as they could highlight the text to better aid their retention of information. One year after the pandemic, a university in Indonesia reported the same findings, where 83 % preferred the face-to-face modality (Hasanah, 2021). The lack of effectiveness, boredom and internet difficulties also accounted for some of the reasons for not preferring online classes.

### **The Case of Jamaica**

Because of the spread of the Coronavirus pandemic in 2020, the Jamaican government suspended all face-to-face teaching and learning and moved all classes in the educational system online. This meant that all schools and universities had to use online platforms to deliver their classes, with very little time for adequate training of the teachers. Consequently, learners and educators faced serious challenges. As a developing country, Jamaica experienced much greater difficulties with the online modality. Even when the technology was working, the challenge for young Jamaican students was to get and maintain online connectivity during their online classes (Williams, 2021). Blackman (2021) raised the issue of inequity in access to technology in Jamaica during the pandemic, greatly affecting students from low-income households in particular.

The results of Golding and Jackson's (2020) research on the level of satisfaction of Jamaican High school students with the online modality during the emergency measures showed that students had mixed emotions. The survey, it must be noted, could only capture those who had the online facilities.

Studies to date show that each country has its own specificity, and preferences vary from one country to another. Different linguistic, socio-economic and technological issues could affect students' learning outcomes and modality preference, hence the reason for conducting this study with Jamaican students at the tertiary level to determine their instructional modality preference for foreign languages in particular.

## Learning Style

Though this research is focused on simply determining students' preference for one of two teaching modalities, in order to capture any influence of students' learning style on their preference for a particular teaching and learning modality, a question related to their learning style was included in the study. Learning styles are general approaches to learning (Wong & Nunan, 2011) or "the manner or fashion how someone acquires, attains, retains and uses imagination to attain skills or information" (Hussain, 2017). While many theories on learning styles exist and include emotional, sociological, physiological and psychological stimuli which affect learning (Dunn & Dunn, 1978); the experiential learning cycle (Kolb, 1984), Fleming (2001), on the other hand, considers the Visual, Auditory, Reading/Writing and Kinaesthetic aspects in his VARK model. The authors considered the VARK Model the most suitable based on its simplicity in satisfying the research objective of getting accurate responses from the students on their teaching/learning modality preference for French and Spanish.

## Methodology

The results were obtained by way of a questionnaire completed by 105 undergraduate students in five tertiary institutions in Jamaica. It was an online questionnaire generated by Google form in April 2022, and the data were collected in late May 2022. The authors made the lecturers and the respondents aware that the survey was anonymous and its completion voluntary and confidential as stated at the top of the form. The questionnaire comprised a mixture of twelve single multiple-choice, two open-ended, seven rating scales and two yes or no questions. The respondents also had an opportunity to express their opinion on the teaching and learning modalities at the end of the questionnaire, as shown in Table 1, which summarises the questions.

The SPSS statistical software package (Statistical Product and Services Solutions Version 25), was employed for descriptive and inferential statistical analysis of the results with a 95 % confidence interval and a 5 % margin of error applied. A t-test analysis was employed to determine if there is a statistical significant difference between the means of males and females who prefer the online delivery modality & students' preference in relation to the online versus face-to-face modality.

**Table 1.** A summary of the questions included in the questionnaire

Areas targeted	Elements to be selected by respondents
Devices used online	Computer/laptop/ tablet/phone/none
Services used online	Home/public WIFI/data/other
Learning space	At a table/desk/bed/floor/other
Learning styles based on VARK Model	Visual/auditory/reading/kinaesthetic
Online learning language experience	Poor/average/good/very good/excellent
Contributing factors for the experience	Time-efficiency/cost efficiency/home comfort/ personality suitability/ connectivity/adaptability/teaching strategies/learning/learning environment/atmosphere/excessive screen time
Online oral participation	Poor/average/good/very good/excellent
Contributing factors	Preference for faces/no need to show face/limited interaction/different ambiance/lecturer skills/face-to-face teaching strategies preferences/ more opportunities to participate/microphone problems
Feelings to transitioning online in 2020	Happy/reluctant/did not mind
Feelings have changed in 2022	Yes/no
Subjects not conducive to online learning	Open question
Learning modality preference going forward	Face-to-face / online
Opportunities for additional comments from the respondents	Free response from students

## Participants

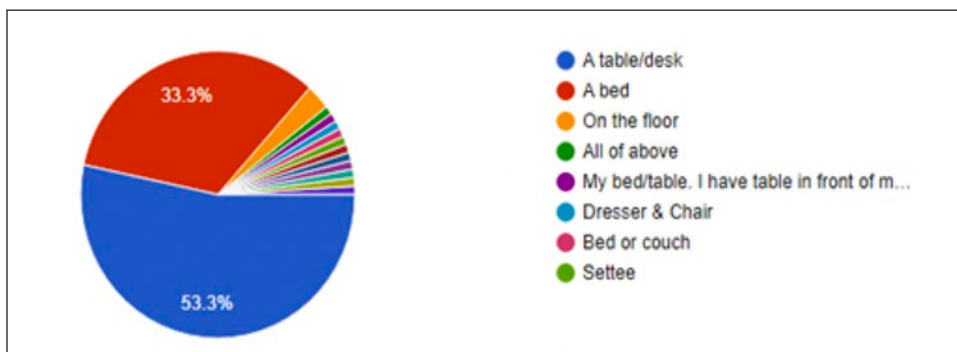
One hundred and five responses (71.4% females and 28.6% males), 68.6 % French and 31.4 % Spanish students from five tertiary institutions in Jamaica who were studying the languages as an elective completed the questionnaire. Among the respondents, 45.7 % were in Year 1, 22.9 % in Year 2 and 31.4 % in Year 3 and 4 of their respective undergraduate programmes. The sample size of French and Spanish students in the survey, however, is not a true representation of the actual number studying those languages since more students choose Spanish as an elective in Jamaica. Year 1 students who had just started university were doing so in an online modality with their respective tertiary institution, unlike the Year 3 or 4 students who already had a university face-to-face experience prior to



COVID-19. However, they were included because they represented the majority of our French/Spanish learners. Since they are not majoring in those subjects, the students are usually given the opportunity to choose a foreign language elective in the first year of their studies.

## Results

The results suggest that in 2022, students were well prepared and equipped for their online classes: 86.7 % of the respondents used a laptop for their classes, and the remaining used either their laptop or smartphone. Wi-Fi connectivity was used by 94.3% of the students to access their lectures online, approximately 5% used data, and no student used public WiFi. Figure 1 shows positions from which students accessed their online classes.



**Figure 1:** Spaces where students accessed their online classes

Whilst 53.3 % of the students used a table or desk when accessing their classes, 33.3 % accessed their classes from their beds and the remainder from places such as the floor, the dresser and armchair, couches or settees. The online modality, therefore, allowed students the flexibility and freedom to follow their classes according to their home circumstances and/or comfort; this type of flexibility is absent in a face-to-face class. Figures 2A and 2B show students' responses to the question of their preferred learning style.

Figure 2A reveals that the largest percentage of the students preferred the visual learning style, whilst Figure 2B shows 41.4 % of both male and female students as visual learners. This is contrary to research conducted by Payaprom & Payaprom (2020) in Thailand, which indicated that most of their students were kinaesthetic learners. Twenty-one (21) per cent of males and 12 % of females

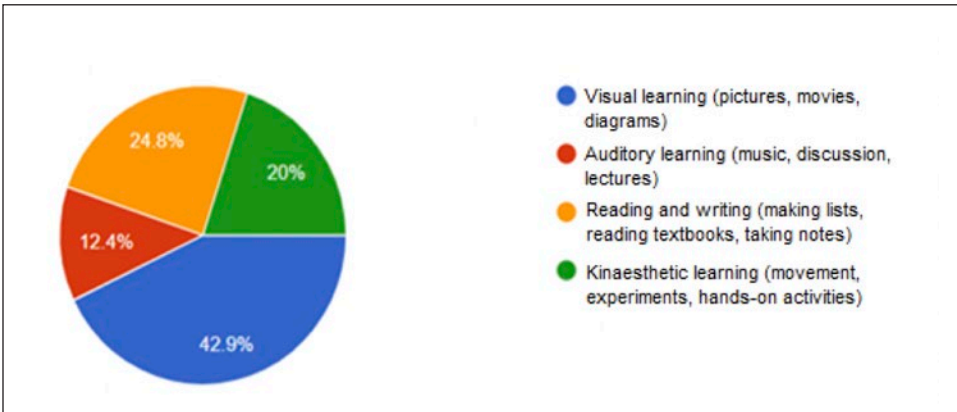


Figure 2A: Surveyed group learner types

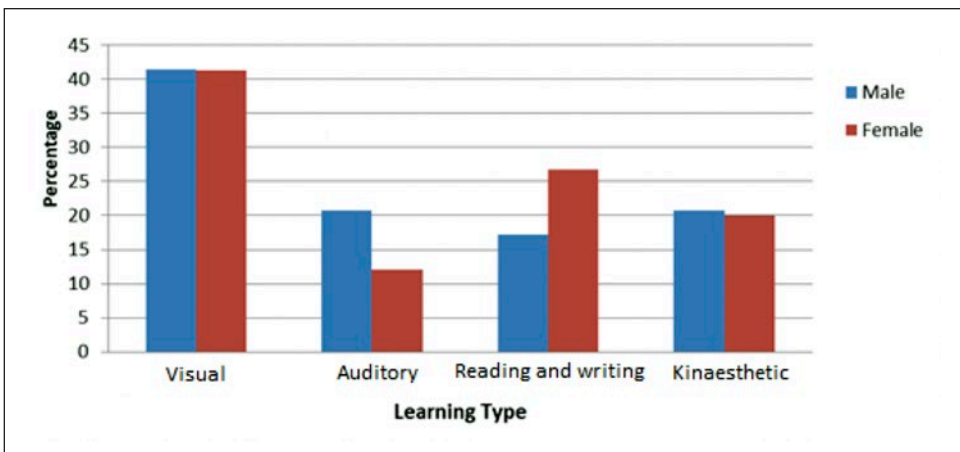
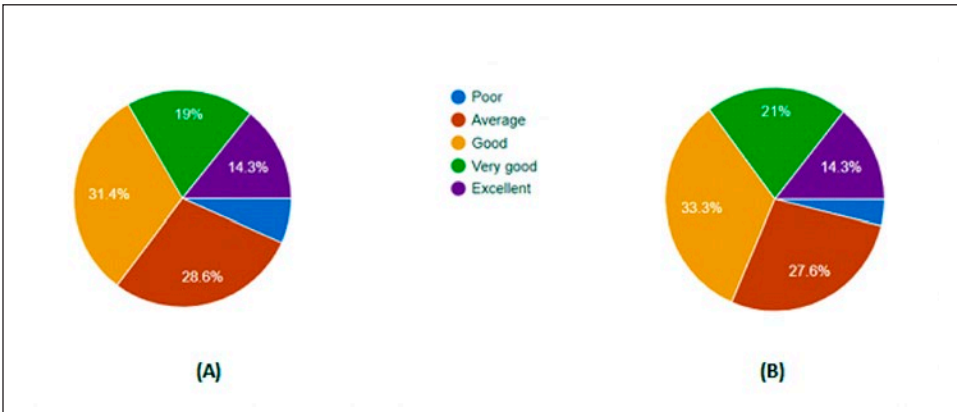


Figure 2B: Normalised values of learning types by gender

considered themselves auditory learners, 17 % of males and 27 % of females are reading and writing learners and 21% of males and 20 % of females reported being kinaesthetic learners. Apart from the visual where they are equal, the results for the Jamaican students show that males are more auditory and kinaesthetic learners when compared with female students.

Figure 3A: Students’ foreign language online learning experience; Figure 3B: Students’ participation in the online foreign language classes. Students reported the following range of experience in learning a foreign language online: poor (6.7 %), average (28.6 %), good (31.4 %), very good (19 %) and excellent (14.3 %). Of the students who reported their participation in the online foreign language classes, 60 % rated their participation as average to good and 33.3 % being very



Figures 3A and B show students' responses regarding their experience and participation in their online language classes, respectively.

good to excellent, meaning that more than 60 % had good to excellent levels of participation. For both online experience and participation, students were also asked to provide a rating from 1 to 10 for the contributing factors. Figures 4 and 5 illustrate their responses.

The respondents who expressed a preference for foreign language online classes gave their main reason as home comfort, followed by cost efficiency and suitability for their personality. The questionnaire's additional comments from the respondents provide far greater insight into the thinking and reasoning for the students' answers, where cost was the major driver in their preferring the online teaching

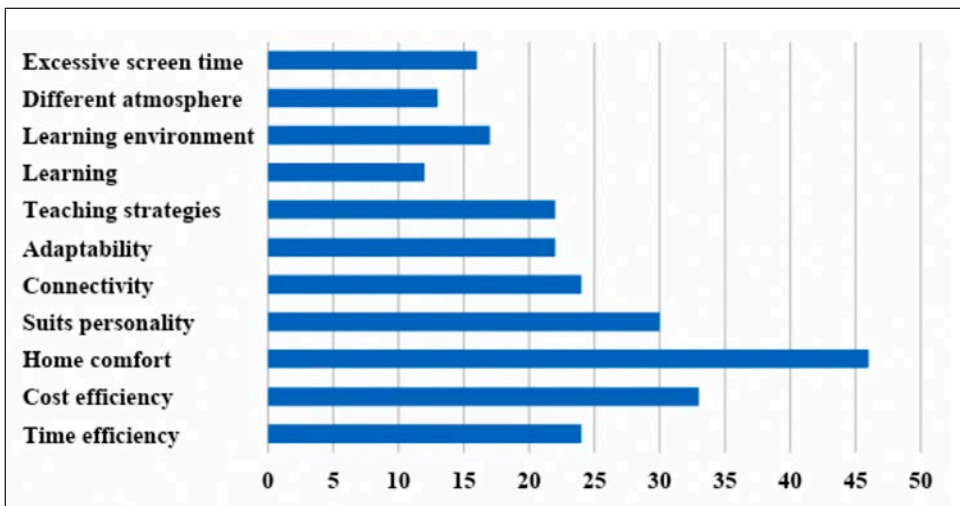


Figure 4: Factors Contributing to Students' Foreign Language Online Experience

modality. The fact that cost was cited as one major factor in choosing the online modality, with only 32.7 % choosing the face-to-face modality, was not surprising given that Jamaica is a developing nation with many of the students coming from modest backgrounds. Home comfort, which is the top reason, is also linked to cost efficiency since the students would save money on public transport, clothes or uniforms, boarding and food. Some of the comments below substantiate this assertion, given by students for choosing the online learning modality: *direct me to my studies. For me, it is much more desirable than the online platform*”.

The factors which the students rated the highest for contributing to their online participation are presented in Figure 5.

Of the students who were able to participate, 33.3 % attributed their participation to the lecturer’s skills and 27.6 % to the fact they did not need to be seen, which could explain why 21.9 % of the students participated more. Another very important issue that must be given greater consideration with future online teaching is the request by educators for students to be on camera during their lessons. Sometimes, this sensitive matter of having their cameras on could increase students’ anxiety and reduce participation levels. This sentiment is expressed in the following way by one student: *“The teacher was forcing us to turn on the cameras and was yelling all the time, and that made my anxiety worse, and that made me not want to come to class or interact”*. The usual request for students to turn on their cameras whilst in class could make those students who live in modest environments uncomfortable and contribute to elevated anxiety levels, as according to one student, *“it forced students to expose their background”*. Based on these comments, tertiary institutions need to address the use of the camera

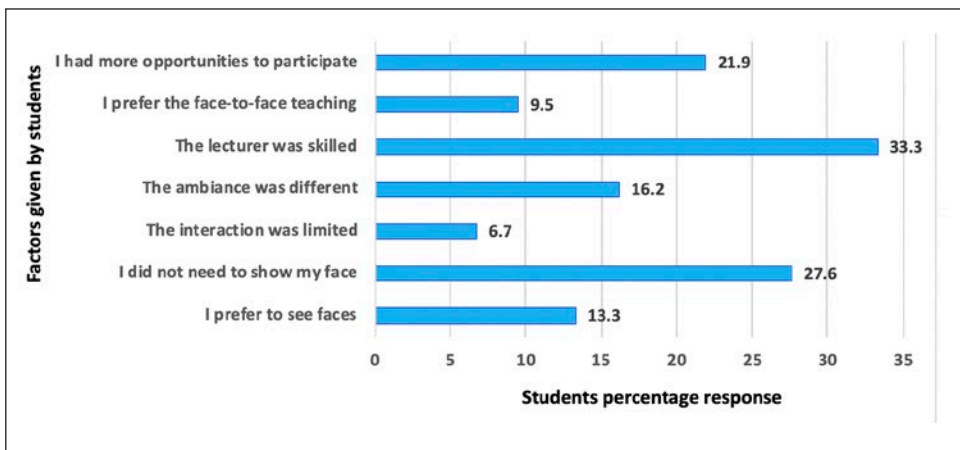


Figure 5: Students’ Rating of Their Participation in Online Classes

and ensure that all lecturers who deliver their classes online are made aware of this sensitive issue.

Figures 6A and B show students' responses when asked to rate their feelings about moving to online classes because of the pandemic.

Responses illustrated in Figure 6A show that whilst 21.9 % of the respondents were reluctant, 48.6 % did not mind moving online, and 29.5% were happy, which means that more than 78 % of the students either did not mind or were happy to have their classes delivered online. In regards to year and gender (Figure 6B), 40.4%, 33.3% and 26.5% of female students in Years 1, 2, 3, and 4, respectively, did not mind having their classes move online, compared to 4.3 %, 16.7 % and 20.6 %

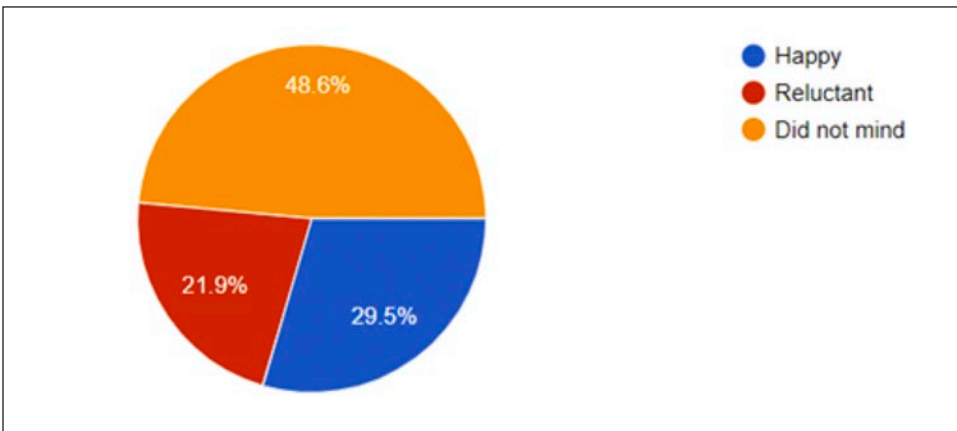


Figure 6A: Students' Feelings about the Transition to Online Classes

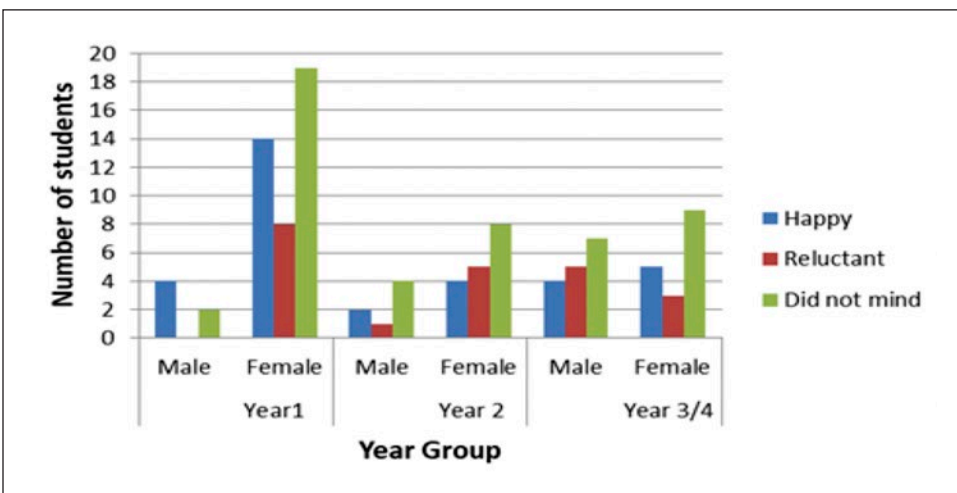


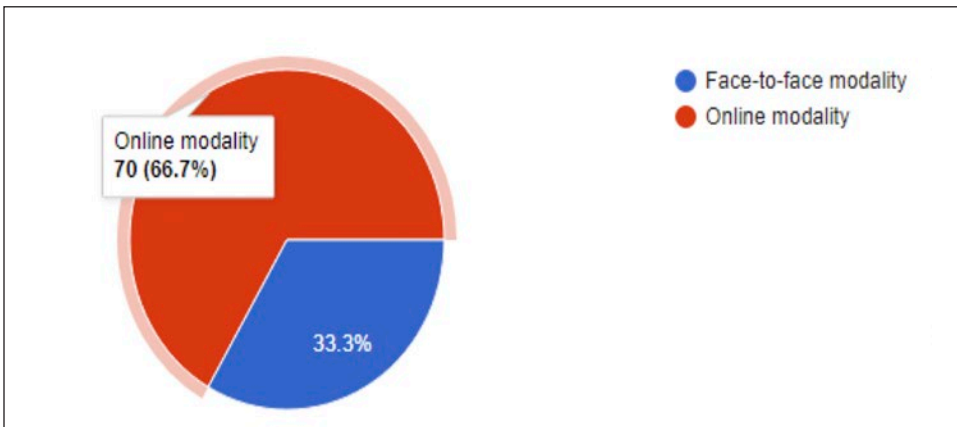
Figure 6B: Students' Feelings about Moving to Online Learning, by Year and Gender

for male students respectively. The greatest reluctance to moving classes online was among the female students in year 1(17%). This might be explained by the fact that Year 1 students would have been experiencing going to university for the first time, having just left high school where an online teaching modality would have been novel, new and unusual. This was, therefore, simply a continuation of the same. However, no male students in Year 1 showed any reluctance.

Students were asked whether or not their views about moving online for classes had changed. Two years after the online move, the results show that the majority of the students’ initial feelings about going fully online remain the same. Only 24.8 % of the students have a less favourable view of moving to the online modality. This might be attributed to the fact that lecturers had become more used to the online modality, had developed teaching strategies for their classes, and are able to deliver better sessions. One student had the following comment: *“The novel approaches in the delivery of classes used by many of the French teachers must be commended”*. One question regarding the subjects that they considered challenging with the online modality received responses in five categories: Maritime subjects, Math-related subjects, French, Spanish and practical subjects, as shown in Table 2.

**Table 2.** Subjects Students found challenging when delivered online

	Maritime subjects	Maths subjects	Foreign Languages	Practical subjects	Other
Subjects found challenging online	Tariff classification, Cruise shipping Management/ Warehouse Operations/ Logistics Management/ Marketing / Financial Management/ Commercial Shipping	Maths Accounts Calculations Statistics Maths related subject	French Spanish	Science Labs Chemistry Biology P.E IT Hands on subjects with practicals/ Television Production Practical classes	Communication studio Essay subjects Translation conversation classes
Percentage of students selecting those subjects	21.1%	31.1%	14.4%	25.6%	3.4%



**Figure 7:** Students' Preferred Teaching Modality Going Forward

According to the respondents, whereas Math-related and practical subjects, in particular, are not conducive to being taught online, 85.6 % of the respondents felt that language-related subjects are much better suited for online delivery.

Students indicated their preferred teaching modality going forward. The results are shown in Figure 7.

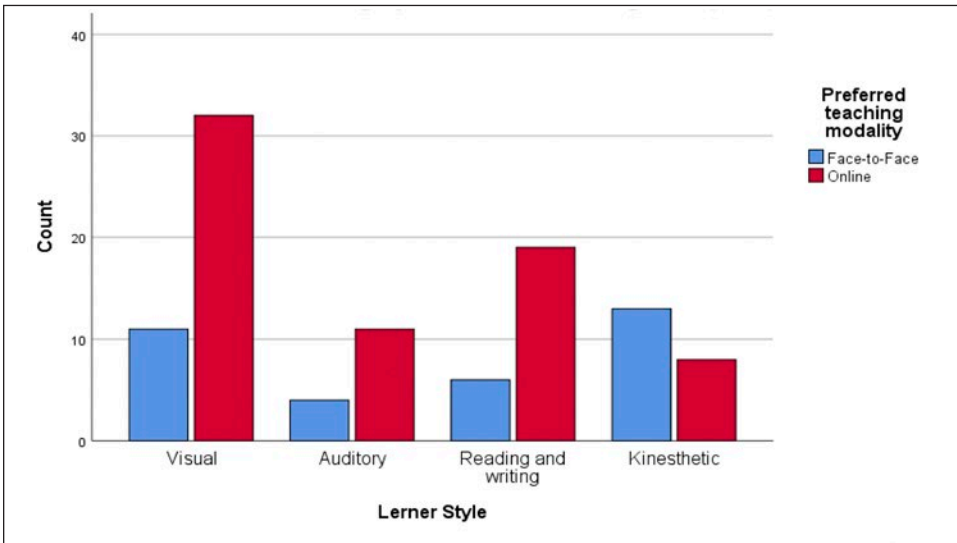
The majority of the students prefer the online modality going forward, with only 33.3% electing to return to face-to-face classes. The results show that the odds of choosing the online modality are 2.17 times greater for females in the 19-26 years age group, with a statistically significant difference of ( $p < 0.05$ , 95%; CI: 1.11–9.7).

The relationship between students' learning styles and preferred teaching modality was also examined; Figure 8 presents the results.

Given a choice, more of the respondents would choose the online teaching modality going forward, with the greatest advocacy (> 50 %) coming from the Visual (30.7%) and Reading and Writing (18.3%) groups (Figure 8). With the auditory learners (10.6 %) and the kinaesthetic learners (7.7 %), more than 66% of the students preferred the online modality.

After two years of COVID-19, students have developed a marked preference for the online teaching and learning modality. Independent sample t-test shows a significant difference between the students' preference for online when compared to face-to-face learning ( $p = 0.020$ ,  $t = 2.356$ ,  $df = 102$ ), with 67.3% of students preferring to be online.

A summary of the advantages and disadvantages of face-to-face versus online instructional modalities, as students see it, is shown in Table 3.



**Figure 8:** Students' learning style and teaching modality preference

**Table 3:** Advantages and disadvantages of online and face-to-face modalities

ADVANTAGES	
Online	Face-to-face
Cost-effective	Greater interaction with peers and lecturers
Helps underprivileged students	All subjects work well face-to-face
Home comfort	Classroom comfort
Can be dressed casually	Facilitates the university experience
Time-saving	–
Less tired (can sleep longer)	–
Lack of anxiety from students – more participation	–
DISADVANTAGES	
Online	Face-to-face
Lacks interaction and socialisation	More expensive – travel, rent/boarding costs
Practical, hands-on subjects do not work well online	Privileges those from a wealthy background
	Time spent travelling
	More tired because of travel



It is clear from the results that the students can see more advantages with the online as compared with the Face-to-face modality. The majority of the university students surveyed prefer online classes for learning a foreign language. Many see the online modality as an opportunity to work whilst studying to finance their degree. This may otherwise have been challenging in regard to face-to-face classes.

## Discussion

The COVID-19 pandemic was an unwelcome and unprecedented event; however, the fact that educational institutions were forced to find creative ways to deliver classes invariably pushed educators into utilising the online space for the delivery of courses at the tertiary level. Despite the benefit of the face-to-face modality, the results show that the majority of students are in favour of the online modality. We remain cautious since the highest number came from the Year 1 students who had not experienced the university face-to-face modality. Of the 46 % of Year 1 students, 32 % of them preferred the online modality. It is difficult to ascertain if a face-to-face experience at their university would have influenced the results. Nevertheless, 20 % of the Year 3/4 cohort still preferred the online modality even though they had experienced both modalities. This finding is contrary to Pierre, Trotman and Garbutt's (2021) study in which greater satisfaction levels were detected among Year 5 Medical students at the University of the West Indies. It is possible that the response given depends on the age and experience of the students in managing their learning.

The study revealed that financial factors were assigned greater priority by students than the learning outcome. This raises the question of the value they place on the actual knowledge and skills acquired in completing a degree. It is important to recognize that Jamaica is a low-income developing country with no social security support and no free tertiary education. Therefore, most underprivileged students have to work in order to fund their own studies, which might explain the reasons why more than two-thirds (66.7 %) of them prefer the online modality. However, there may be other reasons for preferring online which may have been missed; for example, the fact that COVID-19 affected people's livelihood. Many self-employed people were unable to work during the confinements, and many students were faced with bills to pay to help their families. This may change if those choosing the online option underperform in their studies. Another reason may lie in the fact that, after two years, the lecturers improved their online teaching strategies and would be more confident.

According to the results, the students consider that language classes could be delivered online unlike Math-related or practical subjects. Some students pointed out that the idea of being able to create breakout rooms facilitates sufficient interactions in a language class. The onus is, therefore, on the lecturer to work on the delivery of successful online classes, a belief shared by Sharma and Alvi (2021) and Gopal et al. (2021). The students' experience will greatly depend on the lecturer's skills in making the online environment conducive to their learning. The findings show that lecturers will also have to consider whether it is necessary for students to have their cameras on during online classes, which could cause some levels of anxiety among some students. However, for language classes where non-verbal communication is important, students could be asked to put on their cameras on with a virtual background as provided by the video conferencing platforms.

Regarding COVID-19's impact on tertiary institutions, these results may represent valuable information for them as they might have seen the benefits of a large decrease in their utility (*water, electricity, cooling and lighting*) costs whilst lecturers delivered classes to students online and from home during the pandemic. Such cost-saving realisation may be one factor that greatly influences the decision on future education-delivery modality. It is very likely that a blended approach to teaching and learning will be employed going forward. However, if this is to be the case, education providers in their decision-making regarding the best post-COVID-19 teaching modality for their students, as well as professional training for their lecturing staff, will need to overcome the difficulties revealed by the study. The results showed that more training will need to be provided for the lecturers to improve their skills in utilising the technologies, not only for delivering their content but also for their assessment strategies in preventing online cheating, as raised by Balbay and Erkan (2021). As indicated by a student, "*I did not like online school because I was not familiar with it. Neither were the lecturers, so there were a lot of inconsistencies on both sides*"; educators must be provided with appropriate training to empower them to be creative in their delivery in order to hold the students' attention and interest.

In terms of language learning, this study found that some students had a much better learning experience as the online modality reduces language anxiety. Since most students were visual learners, sharing documents in the virtual classroom was useful. Nevertheless, a blended approach might be the way to go for the non-practical subjects that can be delivered online. Such an approach would enable students to work in order to pay for their studies while receiving some

face-to-face tutoring at agreed times in their courses. Another possibility would be that the theory component of the course remains online and the practical aspect is delivered face-to-face, thus providing opportunities for some invaluable and necessary interactions. This could lead to greater student numbers registering for courses. Students are clearly interested in the modality that facilitates their lifestyle and socio-economic situation. For students with limited monetary resources, the online modality should offer greater accessibility. To guarantee the integrity of the assessment process however, institutions which choose to employ a purely online modality, where necessary, may opt to have the assessment components of their courses being done face-to-face.

With an online learning approach modality only, additional assistance to facilitate students favouring the kinaesthetic learning style will be required if they, too, are to realise their full potential. Given the fact that tertiary-level students are also considered customers in Jamaica, this research will inform and assist education providers in their decision-making concerning the best teaching modality for their students and professional training for their lecturing staff.

### Limitation of the study

The study did not consider the respondents' economic background, age, gender, learning assessment, or teaching methods. It would have been interesting to see if there is a correlation between the respondents' backgrounds as well as demographics and their learning modality preferences.

### Conclusion

The majority of Jamaican students who study foreign languages seem to prefer the online modality as it is more convenient, more affordable and enables them to participate more by not showing their living environment whilst helping them to achieve their educational goals more easily. The high percentage of first-year students selecting the online option might be due to the fact that they had not yet had a face-to-face learning experience at the tertiary level. Their opinion could change with the resumption of face-to-face delivery. The results have shown that the students' financial status will continue to be the main factor for most of them choosing the online over the face-to-face modality for learning in Jamaica. Rethinking how language learning is facilitated in small, developing, low-income island states like Jamaica is required, and a shift in teaching modality will be

necessary. Going forward, therefore, a blended approach with a mixed education delivery modality of part face-to-face and part online at the tertiary level that will provide accessibility and flexibility to the widest student population possible is likely to be the best option. This will also facilitate cost savings for both students and educational institutions. It will provide quality learning experiences and satisfaction to a wider student population while enabling tertiary institutions to attract more students from further a-field, leading to greater numbers. Being able to work to pay the tuition fees in order to achieve a degree was given a higher priority value than the actual learning by the students surveyed. Tertiary institutions, therefore, in their education succession planning, will need to give great consideration to the type of support they might provide to students should they opt for online delivery. Thus, going forward, universities will need to take into account students' demographic and socio-economic background in deciding on their subject delivery modalities, keeping in mind that some of the usual university experience might be sacrificed.

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# Systematic Review of a Specialised Stem Course of Study Based on Industry Relevance and Sustainability

TIEGA HARRIS KIDD, ANDREA M. WILKINS DALY AND  
SONIA A. RICHARDS-MALCOLM  
University of Technology, Jamaica

## Abstract

*Higher educational institutions play a key role in the implementation of education and training courses that are sustainable. Therefore, these institutions, through their quality assurance system, must review their curricula every three to five years. This paper reports the results of a systematic review of three graduating classes of a specialised undergraduate STEM course of study based on industry needs; a cross-sectional survey was undertaken to evaluate its relevance and sustainability for the pharmaceutical, cosmetic, and nutraceutical industries in Jamaica. The survey captured the views of stakeholders including currently enrolled students, graduates and their employment status, and industry partners/employers who engaged these graduates during and after their industrial experience. The findings showed that the destination of most of the graduates was in their related fields, ranging from the private sector, government, and academic institutions. While the industry partners all agreed that the graduates were work-ready and stood to impact the pharmaceutical industry positively, most of the participants identified a set of modules that were the least impactful on their overall training. Moreover, while industry experiences were important and necessary, the limitation to sites in the pharmaceutical industry was concerning. Therefore, to keep unique STEM courses of study viable and sustainable, stakeholders must seek to retain students by increasing support and creating learning environments where students feel valued and included to develop the requisite skills and remain relevant and resilient in a changing pharmaceutical industry.*



**Keywords:** *Systematic Curriculum Review, STEM Course of Study, Higher Education, Pharmaceutical Industry*

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**Corresponding Author:** Sonia A. Richards Malcolm – [soanrichmalcolm@utech.edu.jm](mailto:soanrichmalcolm@utech.edu.jm)

## Introduction

The quality and delivery of any course of study, especially in the tertiary landscape, need ongoing curriculum evaluation and review for relevance and sustainability. This type of course review aids in ascertaining the strength of the course of study, including the identification of modules to be changed, reconsidered, or developed to enhance student learning and engagement and student satisfaction with the course of study. According to McNay et al. (2009), a review of courses of study maintains the professional standard related to key stakeholders, not only current students but also the industry.

Due to the needs of the industry, almost a decade ago (2014), an undergraduate Science, Technology, Engineering and Mathematics (STEM) course of study was developed to equip stakeholders with specialised knowledge to design, manufacture, formulate pharmaceutical /cosmetic /nutraceutical products guided by quality assurance, regulatory practices to ensure good manufacturing practise and consistent and quality outcomes. This work-ready and industry-driven course of study was thought to be essential as universities and higher institutions ensure that educational policies align with the societies' needs and prerequisites (Nodooshan, 2022). In November 2018, the course of study produced its first graduating cohort.

Through their quality assurance arm, most tertiary institutions stipulate that a course of study should undergo curriculum review every three to five years (UTech Ja., 2016). The academic unit conducted a two-year systematic curriculum review to obtain insight and gather data from key stakeholders (currently enrolled students, graduates, academic staff, and industry partners). The data obtained were used to determine the continuous relevance and sustainability of this unique course of study to the pharmaceutical industry in Jamaica.

## Literature Review

For any citizenry and a sustainable country, the availability and access to quality higher education play a vital role in developing work-ready graduates for their respective professions and the industry at large. The pharmaceutical industry

is renowned worldwide and has also played a substantive role in discovering, developing, and producing drugs for use as medications, vaccines, cosmeceuticals, and nutraceuticals.

Advancing higher education contributes not only to the employment of individuals but also to the social development, health and well-being of the country's population (Kilpatrick et al., 2011). This was corroborated by Rengifurwarin et al. (2018) and Syam et al. (2018), who indicated that higher education is the future of nations, allowing its people to prepare for better lives through research, technology, innovation and entrepreneurial undertakings.

More importantly, various universities, especially public universities, rely mainly on government subventions and subsidies to be funded. In turn, they contribute to sustainable development and require pivoting to remain relevant where applicable to meet the needs of all its stakeholders without compromising future generation needs; therefore, industry-need courses of study are inevitable (Kurniawati & Wurjaningrum, 2021).

According to Jorge et al. (2015), sustainable development, considered by Siahaan et al. (2019) as an innovative idea in most universities, can be achieved through teaching, research and transmitting knowledge to the citizens. This continuous improvement allows for engaging externally, utilising advisory committees, and external examiners while experimenting broadly and changing willingly based on the needs of our stakeholders. These needs are centred on good customer service, academic advisement and a robust curriculum (Aznar Minguet et al., 2011).

## Methodology

The research design employed for reviewing the course of study was a cross-sectional survey. It captured the views of various stakeholders (currently enrolled students, graduates, and industry partners) over two years. A systematic review was conducted to document the employment status of the three graduating cohorts (2018, 2019 and 2020). However, the views of industry partners (employers) who engaged these graduates during their practicum experience were assessed only for the 2018 cohort.

For the curriculum review conducted in 2020, a cross-sectional survey of currently enrolled students and graduates was conducted using specifically designed questionnaires. The survey was conducted over a two-week period in July 2020. Therefore, the views of the graduating cohort of 2020 were captured as currently enrolled students.

The survey utilised for currently enrolled students consisted of the following three (3) overarching themes: (i) general information, (ii) views on the curriculum and their practicum experience and (iii) recommendations to guide the continuous improvement of the course of study.

The survey utilised for graduates consisted of the following four (4) overarching themes: (i) general information, (ii) destination of graduates/work experience, (iii) views on the curriculum and their practicum experience, (iv) recommendations to guide the continuous improvement of the course of study including future-plans about their field of study.

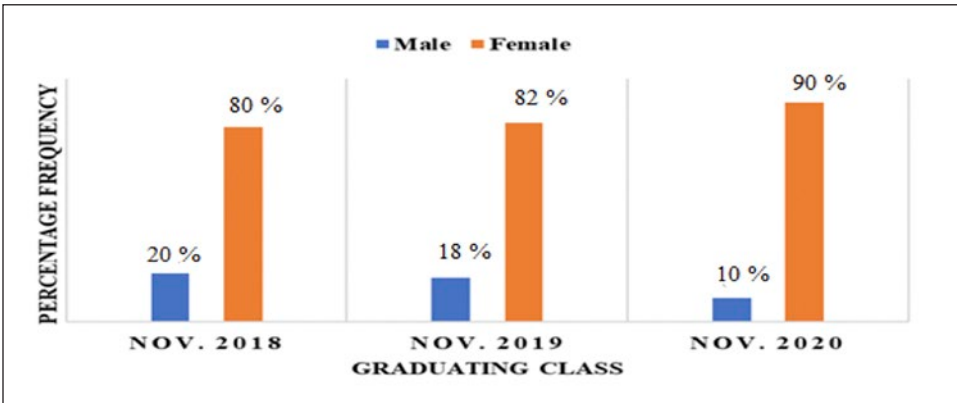
## Results

The survey involved 73 participants: 31 graduates of three graduating classes, 2018, 2019 and 2020) and 42 currently enrolled students, as shown in Table 1.

**Table 1:** Total number of graduates per graduating class and students currently enrolled in the Course of Study

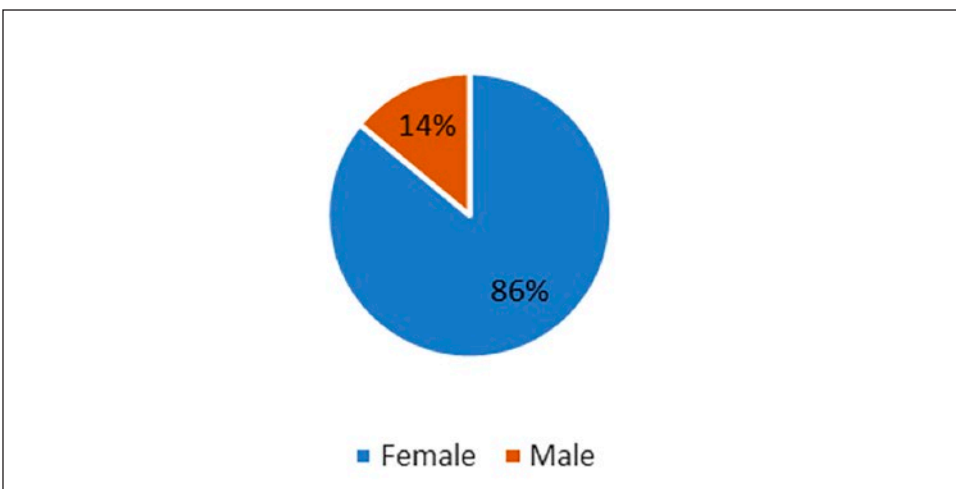
Graduating Class	n
November 2018	10
November 2019	11
November 2020	10
Subtotal (Count)	31
Currently Enrolled Students	n
Level 1	8
Level 2	8
Level 3	7
Level 4	19
Subtotal (Count)	42
<b>Total</b>	<b>73</b>

The number of males graduating from the course of study was 2 (20 %) in 2018, 2 (18 %) in 2019, and 1 (10 %) in 2020. The females represented 8 (80 %) in 2018, 9 (82 %) in 2019, and 9 (90 %) in 2020, as shown in Figure 1.



**Figure 1:** Sex of the Graduating Class for the Undergraduate STEM course of study

At the time of the survey, approximately 42 students were actively enrolled (registered and attending classes) in the course of study, as shown in Table 1. Thirty-five (35) of the 42 students participated in the survey, resulting in a response rate of 83.3 % among the currently enrolled students. Among the 35 currently enrolled students, 30 (86 %) females and 5 (14 %) males ranged from the age group of 19 to 26, as shown in Figure 2.



**Figure 2:** Sex of Participants currently enrolled in the course of study

Of the 31 graduates who participated in the study, the majority (17, 55 %) were employed by the private sector, gaining experience in a related industry. The remaining 14 (45 %) were evenly distributed among government, university, unrelated fields, and unemployed, as shown in Table 2.

**Table 2:** Destination of Graduates (Graduating Class 2018,2019 and 2020) who participated in the study

Destination of Graduates	Count (%)	Comments
Government (Public Service)	2 (6.4 %)	High School (Lab Technician): Analytical Lab for drug registration in the Region (Caribbean)
Private Sector (Related Field)	17 (54.8 %)	Pharmaceutical (Manufacturing & Distribution); Cosmetic and Personal Care Industry; Cleaning and Household Chemicals; Medical Marijuana
Research/University	3 (9.7 %)	Employed in higher education facilities (Lab Technologist for Medical School; Community College)
Other Occupatwions (Employed; Unrelated field)	3 (9.7 %)	Employed, however, in an unrelated field
Unemployed (Unable to secure a stable job)	3 (9.7 %)	Graduates expressed that they were interviewed for prospective jobs in the area; however, with the ongoing pandemic (COVID-19), companies have closed down or suspended expansion projects related to their field of study.
Pursuing additional courses of study	3 (9.7 %)	Two graduates wished to pursue a similar STEM course in the same academic unit (one was currently enrolled, and one started in August 2022). Master of Business and Science, USA, with specialisation in cosmetics and personal care products Master of Business Administration (MBA)
	<b>Total = 31</b>	

As shown in Table 3, both the graduates and the enrolled students indicated that the modules Medical Physics, Academic Writing I, Introduction to Psychology, and Academic Writing II had the least impact on their overall training.

**Table 3:** Combined views of Graduates and Currently Enrolled Students on modules thought to be least impactful on their overall training

Modules	Currently Enrolled Students (CES)		Graduates	
	Frequency	Percent (%)	Frequency	Percent (%)
Academic Writing I CES: N = 35 Graduate N = 18	15	40 %	2	11 %
Introduction to Psychology CES: N = 35 Graduate N = 18	12	34 %	6	33 %
Medical Physics CES: N = 34 Graduate N = 18	16	47 %	6	33 %
Academic Writing II CES: N = 27 Graduate N = 18	10	37 %	2	11 %
Engineering Physics CES: N = 14 Graduate N = 18	5	36 %	3	17 %

The exact views of the participants relating to the industry (practicum) experiences were recorded verbatim and are documented in Table 4. These included their feedback on the limitations to only the sites in the pharmaceutical industry and restricting the eligibility of students based on mandatory passes as in specific modules for placement in the industry.

**Table 4:** Views of students and graduates of Industry Experience and Externship

Industry Experience (5 Weeks)
<ul style="list-style-type: none"> <li>I believe there are more industries that can be explored but we are limiting ourselves to the Pharmaceutical.[sic] Other options can be considered, such as the Paint Industry, Bauxite Industry, Chemical Industry, Cement Industry, Tea Industry, Ice cream and Food Industry, etc.</li> <li>Students should not be restricted to passing certain modules to do the Industry Experience.</li> <li>The Industry Experience was amazing for me as it was our [sic] first exposure to the working world, and[sic] so it was an eye opener[sic]. An immense amount of knowledge was gained, which[sic] even [sic]provided[sic] more insight and understanding on[sic] things I later learnt in class. So I[sic] believe [sic]it is at the perfect time in the course.</li> <li>Seeing the sheer efforts[sic]it takes to run a small business.</li> </ul>

### Industry Externship (15 Weeks)

- More placement sites are needed that is [sic] not limited to Pharmaceutical[sic].
- Possible sites – CARPHA: Medicines Quality Control and Surveillance Department, the Department of Government Chemist, LASCO Manufacturing, Barco Caribbean Limited, Berger Paints, Jamaica Flour Mill, Jamaica Teas. Seprod, Nestle, J Wray & Nephew, Jacana (marijuana industry) and Bureau of Standards.
- Furthermore, I believe that the Externship should be for a longer[sic] period so that students can gain more experience in different areas and facilities.
- This was a great learning experience. We got to experience manufacturing as well as non-manufacturing sites, so a wide range of knowledge was garnered.
- The manufacture-based companies provided an all-rounded experience.
- The Industry Externship was very impactful and eye-opening. It allowed me to understand the in's[sic] and out's [sic] as well as what goes behind the scenes in the production and development of products.

## Industry Partners (Employers; Practicum Preceptors) Perception of Graduates

Industry partners were satisfied with the graduates and externs from the course of study. Their feedback included [sic] being very impressed with the students' wealth of knowledge, adaptability, and eagerness to learn new skills and solve problems within the work setting, as shown in Table 5.

**Table 5:** Views of Industry Partners that employed graduates of the undergraduate STEM course of study

- Learns quickly and are [sic] able to adapt.
- Very satisfied. These students always bring a level of creativity and technical expertise. They also develop products that are market-ready [sic].
- Awesome. We hired a graduate as a quality control manager.
- The graduates and externs demonstrate exemplary work attitudes. They fit into my team perfectly. They communicate well with customers.
- I am very impressed with the wealth of knowledge of the students and how they are [sic] able [sic] to [sic] integrate within the work setting to solve problems.
- Very satisfied.
- They are always eager to learn new skills and absorb new information.

## Discussion

In this undergraduate STEM course of study review, it was observed that for the three cohorts, 2018, 2019 and 2020, the majority of the students were females (over 80%) in comparison to the males, which was sometimes less than 10%. This result is consistent with the findings that men are generally underrepresented in tertiary education (Stoet & Geary, 2020).

Concerning the destination of graduates, the majority, 21 (68%), were employed in their related field. The fields in which most of the graduates were employed were private sector 17(55%), government sector 2 (6.4%) and academic institutions 2 (6.4%). The authors are confident that the graduates are positively impacting the manufacturing sector, which is important for national economic growth. The companies in which the graduates were employed ranged from manufacturing and distribution to the cosmetic and personal care industry, household chemicals, nutraceuticals, and the emerging legal medicinal cannabis market.

Further evaluation showed that 6 (19%) graduates were unemployed or not employed in their related field. Importantly, the impact of the COVID-19 pandemic on employment opportunities globally cannot be ignored, as interviews with the graduates revealed that some were interviewed for jobs, however, companies had to postpone their projects and the employment process.

Notably, identifying any module that needs to be changed, repositioned or re-evaluated was a part of any curriculum review. The feedback from both students and graduates about the modules that seemed to be least impactful on their overall training were: (i) Medical Physics), (ii) Academic Writing 1, (iii) Introduction to Psychology, and (iv) Academic Writing II. These were core general modules done by all undergraduate students pursuing at least a Diploma course of study at the institution.

Moreover, students expressed concerns about the industry (practicum) experiences. One of the main concerns was the limitations to sites in the pharmaceutical industry only. It is critical that institutions address the concerns of their students. The researchers corroborate the statement mentioned by Gale (2010) in an article by Ellis et al. (2010), stating that student retention can be increased by providing student support and creating learning environments where students feel valued and included.

Stakeholder involvement and feedback in any higher education institution are fundamental as this serves to guide the curriculum, as cited by Johnson (2001) in Curriculum Development: Teacher Involvement in Curriculum Development



(Alsubaie, (2016). The external stakeholders of the course of study were industry partners, which included employers and the practicum preceptors who supervised the students throughout the study. All the industry partners surveyed expressed being very satisfied with the students and graduates from the course of study. They were particularly impressed with the depth of knowledge of the industry displayed by both the students and the graduates. This feedback indicates that the students (prospective graduates) and graduates are work-ready and stand ready to impact the industry positively.

In conclusion, sustainable development posited by Larrán Jorge et al. (2015) and Siahaan et al. (2019) corroborates with Munna (2021) that sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Most universities can achieve this innovative idea through teaching, research and experiential learning. The review provided formal and informal learning and strategic opportunities for the course of study. These strategic opportunities could assist stakeholders in developing the requisite knowledge, skills, attitudes, and values for the maintenance of quality and sustainability of similar STEM courses of study based on industry relevance through the engagement of external stakeholders, including utilising advisory committees and external examiners while prepared to pivot as the needs arise. These strategic opportunities must be centred on excellent customer service, timely academic advisement and robust curriculum to remain relevant and resilient in a changing environment, especially in tertiary education and the STEM-based industry.

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# The Effectiveness of the Transition and Placement Process to a Special Education Institution For Children With Special Needs From an Early Intervention Programme (EIP) in Jamaica

CAROL HUTCHINSON AND ANDREA PUSEY-MURRAY  
University of Technology, Jamaica

## *Abstract*

*This study investigated the responsibilities and roles of parents/caregivers, professionals, and paraprofessionals in promoting the education and welfare needs of children with disabilities in Jamaica. The methodology was qualitative and employed the judgmental sampling technique. Participants selected were spokespersons of the intervention programme studied. Data for the study were collected through face-to-face interviews and focus groups. The face-to-face interviews were done among four Community Development Officers (CDO), three teachers, and one administrative staff, and a focus group discussion with six parents of children with special needs who are or were beneficiaries of the transitional process. The qualitative data were analysed thematically. The findings of this study will help to improve policies and programmes targeting families and their children with disabilities.*

**Keywords:** Disabilities, Special Needs, Transitioning Programmes

**Corresponding Author:** Carol Hutchinson – [chutchinson@utech.edu.jm](mailto:chutchinson@utech.edu.jm)

## Introduction

There are several types of disability, however, the most common types are intellectual, physical, visual, hearing/deaf, learning disabilities, and autism spectrum disorder. Malone and Gallagher (2009) emphasised that at certain points during transitioning, parents of children with disabilities experience some major challenges. This occurs during the early childhood years, for example, discharge from hospital to home, entry to early intervention programs, movement from early intervention to preschool programs, and movement from preschool to kindergarten. Kandel and Merrick (2003) outlined that parents, upon receiving the diagnosis of their child's development or disabilities, experience a range of emotions such as shock, grief, and anger, which is like receiving the news of someone who has died. This affects parents' emotional state of mind, and the period of parenting and taking care of their children may be overbearing. Therefore, Woodman (2014) suggests that children with developmental disabilities will experience a difference from parents growing a typical child.

Breiner et al. (2016) highlighted the many challenges parents experience with the care and support of their young children who are either born with or develop special needs in their early life. Parents may identify their child's uniqueness and their need for special attention, and they often seek assistance from programmes to help or support them in assisting with their child's delays.

Meredith (2013) reported that out of the more than 4,000 students diagnosed with special needs in Jamaica, there are about 300 with special needs who are served in the Ministry of Education.

This study sought to investigate the effectiveness of the transition and placement process from an Early Intervention Programme (EIP) to a Special Education Institution in Jamaica for children with special needs. Early stimulation programmes are not very popular and have not gained enough publicity and awareness within society.

## Research Questions

1. What are the services provided and skills catered to in an early intervention programme in Jamaica?
2. How does the Administrative Office assist staff in addressing the transitional needs of children for special education?
3. What are the strategies applied during the process of transition for children with special needs?

## Methodology

A qualitative study design was employed for this research. Creswell (2014) stated that qualitative methods will relate to wording and reflection images which will present distinctive steps in analysing data and will illustrate different designs (p. 232).

Data for the study were collected through face-to-face interviews and a focus group discussion. The face-to-face interviews were done among four Community Development Officers (CDO), three teachers, and one administrative staff, and a focus group discussion was conducted with six parents of children with special needs who are or were beneficiaries of the transitional process. The qualitative data were analysed thematically. The judgemental sampling method is a type of non-probability sampling technique in which the sample members are chosen only on the basis of the researcher's knowledge and judgment. From the collection of data from interviewees, the data were analysed for each research question. Hence, numerous themes emerged, and each research question was analysed based on the theme that surfaced.

## Results and Discussion

### Presentation of Demographic Data

**Table 1.** Demographic Summary of the Participants Interviewed

Interviewee	Position	Years of Service	Gender	Age range
Focus Group Discussion	Parents of children with special needs		5 females and 1 male	
Teacher 1	Full time	1–5 years	Female	19–29 years
Teacher 2	Full time	11–16 years	Female	41–51 years
Teacher 3	Full time	11–16 years	Female	over 52 years
Community Development Officer 1	Full time	11–16 years	Female	30–40 years
Community Development Officer 2	Full time	17 years and over	Female	over 52 years
Community Development Officer 3	Full time	17 years and over	Female	30–40 years
Community Development Officer 3	Full time	17 years and over	Female	41–51 years
Director a previous Community Development Officer	Full time	17 years and over	Female	52 years and over

For the focus group discussion, there were six parents of children with special needs (children with disabilities). There were five females and one male. The face-to-face interviews consisted of three teachers; all three teachers were full-time staff.

## Research Question # 1 – What are the services provided and skills catered to at an early intervention programme in Jamaica?

### *Theme one: Knowledge of Goals*

Early intervention programs offer services for education and therapy to families of young children with developmental problems. Services for vision, hearing, nursing care, supported technology, occupational therapy, speech therapy, and physiotherapy are provided by the intervention program. The natural habitat of a child is typically their home or a day-care facility where evaluations take place (Tomasello et al., 2010). The teachers' and community development officers' responses highlighted the goals of the programme, the delivery of skills, and the engagement of events.

“The children received stimulation activities and therapy for motor skills and cognitive skills. Early intervention to gain their rightful place in society reaching their optimum desired goals. The agency provided early intervention for children zero to six years with developmental delays to enable them to become more adaptive to society as best as possible, they are also assessed as we try maximising children's self-help skills to their potential to become independent”.

### *Theme two: Delivery of Skills*

There were three teachers and four community development officers. All seven participants stated that the children obtained physiotherapy, which was the most common intervention plan utilised. During the focus discussion, a parent spoke about the improvement in her child's walking. Another parent highlighted that “the speech therapy received enabled children to talk and control their drooling, toileting independently, as well as other stimulation activities and the regular home visit programme offered by ESP”. According to Stanberry and Raskind (2009), assistive technology (AT) is available to help children with a wide range of disabilities, from cognitive impairment to physical handicap. Using technology to promote learning is a great method for many children. Furthermore, people with

learning disabilities (LD) do better when they are allowed to use their capabilities (strengths) to compensate for their impairments (challenges).

According to the Australian Parenting Research Centre (2023), there are three practical strategies for teaching skills to children with disabilities:

1. Instructions: teaching by telling.
2. Modelling: teaching by showing.
3. Teaching step by step.

When determining which skills to teach your child, selecting the appropriate strategy can enhance their learning process. Concentrating on teaching one skill at a time is likely to result in more effective learning for your child. For instance, a child with cerebral palsy may expend significant physical and mental effort to maintain an upright sitting position, making it challenging for them to absorb additional information or skills while seated.

#### *Theme three: Parents and their children's involvement in social activities*

There were three teachers and four community development officers who shared the events that children were engaged in, which included sports day activities (these included both parents and children), fundraising events for equipment, and other social events at the school such as Jamaica Day, Bandana Day, Hat and Tie Day, Christmas Treat Graduation and other recreational activities. There are also workshops and social events for parents. Students who have disabilities spend more time with their peers, which benefits regular students as well because they gain an understanding of these individuals who are an integral part of society (Bavh et al., 2020; Demirci et al., 2018; WHO, 2018; McCoy et al., 2016; Adair et al., 2015). A growing number of people are becoming interested in and involved in health-related concerns, adapted physical activity, social rehabilitation, and integration of people with disabilities (WHO, 2017). Liu et al. (2010), McKay et al. (2015), and Sullivan, Masters-Glidden (2014) have found that participating in physical education lessons alongside a student with a disability fosters positive attitudes toward including students with impairments.

#### *Theme four: Causes of Disability*

When the six parents were asked about the cause of their child's disability, the following responses were garnered: "I was told by health professionals that there was nothing to say, told there is nothing specific that cause Autism"; another stated

that, “they are still researching, the doctor suggested that toxin from smelting pot through inhalation while mother is pregnant, may have caused brain damage to children more so in the Kingston 11, 12 & 13 area where there is a smelting zone”.

Children’s growth is influenced by a variety of biological and environmental factors, some of which protect and encourage development while others endanger it (United Nations, 2015). Children diagnosed early as having developmental delays may be more frequently exposed to risk factors that could harm their survival and development, such as poverty, stigma and discrimination, poor caregiver interactions, institutionalization, violence, abuse, and neglect, as well as restricted access to services and programs (Sellier, et al. 2020). Pregnant women living in poverty may have poor health, limited nutrition, and be exposed to chemicals and pollutants, all of which can have a direct impact on fetal development. Children from low-income families are more likely to experience developmental delays than children from higher socioeconomic backgrounds because they are exposed to a broader range of dangers (Olusanya et al., 2010).

Even though disabilities can affect any family, poverty and disabilities are closely related: poverty can both cause and contribute to disabilities (United Nations, 2015; Kakooza-Mwesige et al., 2017; Gladstone, 2010). These include insufficient nutrition, poor sanitation and hygiene, infection and illness exposure, a lack of access to health care, insufficient housing or homelessness, insufficient childcare, exposure to violence, neglect, and abuse, increased maternal stress and depression, institutionalization, and insufficient stimulation (Sellier et al, 2020; Day, 2011).

#### *Theme five: Referral*

Two parents from the focus group discussions stated that their child was referred to ESP because their child was diagnosed with a disability. Of the other four parents, one was recommended by a doctor, one heard about the programme, one was referred to ESP from a Children’s Hospital and the other because of regular ear infections.

Evaluation is a necessary first step in the special education process for child with disability(ies). Before a child can receive special education and related services for the first time, he or she must undergo a comprehensive and individual first evaluation to determine whether the child has a disability and is qualified for special education. Before this evaluation can take place, informed parental consent must be had. “Evaluating School-Aged Children for Disability (2022) noted that the Individuals with Disabilities Education Act (IDEA) mandates that a child undergoes an initial evaluation before receiving special education and related services.



### *Theme six: Methods of Interventions*

The administrative staff outlined that ESP operated two programmes. Firstly, a center-based programme that included the developmental assessment of children who exhibited delays in their developmental milestones received interventions such as physiotherapy, counselling, speech therapy, clinical review, and evaluation. Secondly, community-based rehabilitation measures took the special intervention programme into various communities such as residential, private homes, day-care/nurseries, places of safety, and basic schools where the officers work directly with the children at the community level. The Jamaica Council for Persons with Disabilities (JCPD) is in charge of putting policies and programs in place for people with disabilities. The Council present mandate is to promote the rights and preservation of persons with disabilities (PwDs) while enabling their educational, social, and economic development. The Council aims to empower people with disabilities by encouraging independence via training and development. The Council collaborates closely with other government and non-government organisations to promote the quality of life and independence of people with disabilities in Jamaica. (Ministry of Labour and Social Security, 2018).

### *Theme seven: Programme Benefits*

At the community level, the administrative staff explained that the programme took the intervention to the children and their families. It focused on the development of children, family education, community education, disseminating information to the community about inclusion in activities, how to treat and include them in community activities and relieving the stress of bringing the children to the centre.

Jamaica Information Service (2006), in an article, pointed out that hundreds of special needs children across the island benefited from support through the Early Stimulation Programme (ESP) last year. The intervention included the provision of developmental assistance, stimulation and therapy, assistive aids, and educational support.

### *Theme eight: Types of Disability and Support Needs*

The Administrative staff outlined that there were different types of disability served at (ESP) These are “children with Down’s Syndrome, cognitive impairment/ intellectual disabilities, cerebral palsy, low vision, autism, attention deficit

hyperactive disorder, physical disability, hearing, multiple disabilities and speech. However, they are in need of financial assistance, money for transportation, and medical bills. They need food and pampers, and some are placed on the PATH\* programme. They could also benefit from another socio-economic empowerment programme”. [\*Programme for Advancement through Health and Education – a social protection initiative in Jamaica that is aimed at providing financial assistance and support to the country’s most vulnerable populations]

*Theme nine: Involvement, Challenges and Benefits*

The interview with the administrative staff disclosed that “ESP is very involved as children and parents are prepared for transitioning, although sometimes it brings sadness and heartache. Whenever there is a submission to the School of Hope for placement, parents ask for the children to be placed at the closest location to their home or workplace. After transitioning to the chosen school, parents return to ESP and say there is nowhere like ESP”. On the other hand, some challenges were highlighted, such as “having two or three assessments to see where their child is at, parents experiencing difficulties getting time off from work; transportation can be a problem and insufficient funds”. Nevertheless, one benefit is admission and placement and to see the child soar to higher education”.

Parents of children with disabilities responded to skills that are catered to at the early intervention programme regardless of the different types of disabilities. Children receive early intervention programmes such as center-based programmes, for example, developmental assessments, community-based rehabilitation, and child development (such as a special basic school). The administrative staff stated that “ESP beneficial service encompasses the child’s development, the family, and the community along with higher education. ESP is very involved in the preparation for transition. On the other hand, emotions are spiked by parents just having their children move on. Notwithstanding, there can be challenges whenever parents have to take time off from work to partake in different assessments, along with transportation and money problems”

## Research question # 2 – “How does the Administrative Office assist staff in addressing the transitional needs of children with the need for special education?”

### *Theme one: Administrative Assistance in Transitioning*

The Teachers and Community Development Officers responded by stating that “There are parental supports; for example, the agency conducts workshops and provides therapists such as Occupational Therapist, Speech Therapist, Special Education, Physiotherapist, and Psychologist, and children are also given individual attention”.

One teacher stated that she visits the school chosen when children are transitioning from a special education basic school that caters to children zero to six years to ensure continuity. One teacher responded, “We try to encourage children to keep on track”. Another teacher also responded that “there is a holistic approach to teach up to grade one proficiency test exit profile to cover all major topics from Basic to Primary or Preparatory school before leaving”. Therefore, if the School of Hope is unable to place children, they get assistance from the Government for Psycho-Educational Assessment, and the children may be asked to remain for a longer period.

Barbour and Scully (2011) argued, as Confucius did, that some educators are resolute in pursuing a predetermined curriculum to conduct occasional assessments to show what the child has mastered. This is the academic component of a traditional programme, “where No Child Left Behind” (NCLB) legislation supports this vision. To stimulate interest and promote learning, educators need to build on children’s prior knowledge.

### *Theme two: Supporting Changeover Requirements*

Some of the Teachers and Community Development Officers responded to the support parents of children living with disability received. These included relating to their transitional needs, including psychological intervention, nutritional advice, offering realistic expectations, financial/funding, counselling for parents, workshops and parent support groups, as well as engaging the PATH programme for assistance.

Consequently, the participants agreed that the office is very involved with parents as they receive assessment, placement, and other services for their children. One teacher stated that “The program is the only government pre-school

for children with disabilities 0–6 years. When there is a transition to move on to the special education school for higher learning, we visit before, during, and after placement. There is also a connection with social programmes”.

Nevertheless, most participants responded that parents experience some challenges and barriers in addressing transition such as: “financial issues, transportation, parents in denial, inadequate support from father. Sometimes there is not enough resources. Some parents reside in remote areas; parents are unemployed and lack motivation”.

The Sam Sharpe Teachers’ College (SSTC) in Granville, St. James, has also partnered with the Kiwanis Club of Montego Freeport to provide support and training services for parents and caregivers of children with learning and intellectual disabilities. They have launched a parent support group and training series, which will better equip parents to care for their special needs children (Earle, 2022).

### *Theme three: Transition Processes*

Parents collaboratively agreed that the transition processes were smooth, and children were registered like regular schools. One parent’s concern was that “The challenge with one of the special schools is that the waiting list and time to process is lengthy”. Another highlighted that “it is expensive to leave the special education basic school for children with special needs and said private is costly”. All parents concurred that they were more comfortable with Special Education centres and chose those over regular school because in the regular school there will not be enough patience and love for the children. They were nevertheless satisfied with the transition process.

### *Theme Four: Opportunities*

The administrative staff stated, “At the community level, the programme takes the intervention to children and families; it focuses on the child’s development, family education, community education, disseminate information to the community about inclusion in activities, how to treat and include them in community activities and relieve the stress of bringing the child to the Centre”. In addition to addressing the transition needs, the respondent also stated that it is made easier for them to receive benefits from the Government, for example, Programme Advancement Through Health & Education (PATH) or to be admitted to another special education school.

*Theme five: Government Support and Policy Direction*

The administrative staff stated, “Although the Government gives support to infrastructure, centres are established, in terms of staff remuneration, they also assist with therapy/treatment, they assist with equipment and adaptive aids and transportation from the Jamaica Urban Transit Company (JUTC). I think the agency is somewhat empowered; the parent support group cater to other parents, and they appeal to the public; their next step is to approach the Ministry of Education for the next action, and the Ministry of Labour and Social Security commented that they are doing a good job. Even with school placement, children are denied school placement because of the Disability Act, which is still pending to be enacted, and also, Daycare personnel are not trained”.

It is evident from the responses from the administrative staff that the agency provided support such as Occupational Therapist, Speech Therapist, Special Education, Physiotherapist and Psychologist. The children were given individual attention. There is an assessment process before placement, and if the child is eligible for higher education, the site would be visited before, during and after placement.

Parents of children with disabilities stated that the Administrative Office assisted in addressing the transition needs of parents and their children to special education. Parents also reported that they were beneficiaries of community-based programmes, such as home visits, and stated that the “Transition to a special school is smooth which takes the form of the usual registration for the child at the school placed or enrolled”. Parents were also quite satisfied; however, they expressed concerns with placements to other higher education institutions and showed a preference for special education over regular schools.

**Research question # 3: What are the strategies applied during the process of transition for children with special needs?**

*Theme one: Planning Stages and Basic Needs*

Teachers and community development officers mentioned that sports and other social events were useful as ways to aid in the process of transitioning. Proper nutrition, personal hygiene, appropriate adaptive aids, and devices are also discussed with parents. Parents were also encouraged to either continue or apply for the social net programmes, for example, the Programme of Advancement

Through Health and Education (PATH) and make recommendations for further referrals if needed.

*Theme two: Admission and Placement*

The administrative staff revealed that a registration form is used in transitioning once the child is registered with ESP. The child transitions to the basic school-level special education for children three to six years based on the relevant Assessment forms and re-evaluation of children (Clinician-Artifacts) to ensure pre-requisite skills readiness and prepare the child. One Administrative Staff pointed out that, “sometimes parents are worried that they are going to the unknown, so support and reassurance is provided. Also, we do follow-up via telephone and home visits or school visits to see how a child is settling into school. Another staff hastily interjected, “We also have an open-door policy where parents can come back to us if there is a problem, so together, we can fix it”.

Odom and Woolery (2003) stated that an essential belief of early intervention and special education is that families and homes with the exception of those where there is abuse are the primary nurturing surrounding for infants and toddlers living with disabilities. The functional hypothesis is that children with special needs living with their families and participating in everyday community life are more likely to be comparable to their siblings and age-related peers than if they lived in residential homes with other persons with disabilities. The important thing about an early stimulation/intervention programme is that it motivates the parents to keep their child in a family home. On the other hand, raising a child with disabilities is often more challenging than nurturing a child without disabilities (p. 166).

Some of the processes that are in place for Jamaica children with special needs to transition are their sporting events, other social activities such as, child month activities, community visits, Christmas treats, and parent social nutritional needs, and possible financial support from telecommunications company Digicel that provides a range of communication and data services and the parent ministry at the Ministry of Labour and Social Security which will assist in facilitating their activities of daily living for example, their self-help skills to be more independent as much as possible.

## Recommendations

### Recommendations for practice

Jamaica has come a long way with addressing disabilities in achieving equality but still has a far way to go. In Jamaica, the Disability Act 2014 came into effect on February 14, 2022, enabling the protection of the rights of persons with disabilities. Policymakers must give parents of children with disabilities/special needs an opportunity to speak out and make action a reality. There is a long waiting list of persons with disabilities who need to access psychological assessment. Parents and children will benefit immensely from the provision of this service which will lead to easier placement in schools and help them to gain knowledge through education by building on their intellectual skills to become more functional in society.

The Government should increase financial assistance to families and people with disabilities so they will be able to address and manage their socioeconomic issues and balance their lives. Once the child is diagnosed with a disability the PATH programme should mechanically alert the Beneficiary Identification System (BIS) and generate a red flag to indicate the individual needs of that specific child from a database from the Jamaica Council for Persons with Disabilities. From experience growing a child with disabilities is very expensive and parents need all the support that is available. The statistics given by the administrative staff regarding the waiting list are alarming, so, there is a need for more developmental screening and assessment to be undertaken by the government led agencies.

Teachers and day care workers should be mandated to successfully complete an introductory course on children with exceptionalities regardless of the discipline, as children with disabilities or special needs are a part of society. The government must increase the number of government-run nurseries and basic schools in each parish to accommodate children with disabilities or special needs adapting the ESP model as early identification leads to early intervention and early stimulation.

In every parish, the government must provide early intervention for infants and toddlers. All departments of education must be responsible for special education. Practice must result from a range of psychologists and education theories in unity. Service providers and caregivers must promote strong evidence-based practice for the development of infants and young children with disabilities and their families (Odom & Woolery, 2003 p. 164).

## Recommendations for Further Research

There is a need to conduct further studies on how to:

1. Improve special education for children with disabilities/special needs in the regular school system and
2. Extend or expand the transitioning process from special education to pre-vocational and vocational skills area for example, HEART/NTA.

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# Effects of First-Time Parenting on The Quality of Marriage

SHORNA MCGHIE AND SHAUN WRIGHT  
International University of the Caribbean

SONIA A. RICHARDS-MALCOLM  
University of Technology, Jamaica

## *Abstract*

*This quantitative correlational study examined the relationship between married couples who experienced first-time parenting and the effects on the quality of their existing marriage. The findings demonstrated that transitioning to parenthood does not always affect marriages negatively. The findings revealed that older first-time parents who were married for longer periods and were financially able to manage their financial demands during parenting and marriage enjoyed a more shared understanding of relationship responsibilities and the goals that help to safeguard satisfying marriages than younger parents who struggled financially. Moreover, first-time parents who developed strategies to maintain intimacy after childbirth enhanced the quality of the marriage and improved the chances of stability and sustainability of their marriage. The success strategies involved partners knowing the love language of each other, listening and spending quality time together, feeling appreciated, open and honest with each other, sharing common values and waiting for some time before adding a child to the marriage. The majority of the participants' children were older than five years. Other factors that influenced positive transition to parenthood included spousal support and support from family and friends. However, the majority of the participants received support from their spouses and indicated that the level of intimacy remained high even after the birth of their first child.*

**Keywords:** *First-Time Parenting, Quality of Marriage, Relationship, Marital Satisfaction, Adaptation to Change*

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**Corresponding Author:** Sonia Richards Malcolm – [soanrichmalcolm@utech.edu.jm](mailto:soanrichmalcolm@utech.edu.jm)

## Introduction

Couples are married for several reasons. Notwithstanding the reasons, becoming married and having children are desired and sought after by most adults. According to Carr et al. (2014), one of the benefits of marriage is that it has a protective effect on physical and emotional well-being. Kepler (2015) explained that these effects depend on marriage quality and superb relationships. However, challenging marriages put individuals at risk for both emotional and psychological ill-health. Moreover, poor relationships and failed marriages result in instability in the family, the economy, and society (Anderson, 2014).

Marriage and divorce trends have always been important to the stability of any country. Stevenson & Wolfers (2007) suggested that a decline in marriage rates and a significant increase in divorce rates have shown long-term effects on children of the respective union by decreasing future competencies, family relationships, education, emotional well-being, and earning power.

On the other hand, Gravningen et al. (2017) supported the argument that marriage declined with an increase in common-law relationships, resulting in these relationships not leading to marriage. Couples have reported several factors for marital dissatisfaction. Some factors include lack of communication, growing apart, not getting enough attention, balancing home and work responsibilities, infidelity and domestic violence, financial issues, and child-rearing concerns (Karney, 2010). Marital satisfaction is critical to the sustainability of marriage (Gravningen et al., 2017). It is purported that 49% of children in Jamaica are born into visiting unions, 36% in common-law unions, and 15% in married unions (Gray et al., 2015). Furthermore, by the time the children of these various unions reached the age of six years old, 40% of their parents had no relationship. Equally, these common-law relationships decreased to 28%, visiting relationships decreased to 6%, and marriages increased to 22%. To put it differently, as some of the children in marriage unions achieved their sixteenth birthday, non-existing relationships among married parents rose to 63%. In comparison, common-law relationships decreased to 10%, marriage increased to 26%, with a few visiting relationships remaining for almost 17% of these unions. The male in the home was

now a stepfather or the mother's partner. Interestingly, other relatives, including grandparents, functioned as a mother figure for approximately 10% and a father figure for nearly 6% of the children in these unions, respectively(Gray et al., 2015).

In the final analysis, parenting is life-changing, mainly when introducing the first child into the relationship. For some, parenting brings families closer together, as the new role creates a unique bond between two people. However, the couple must learn to adapt to adding this new individual to the family and should expect new routines and demands in their already busy lives. As such, this study determined whether a relationship including intimacy exists between couples who experienced first-time parenting and to what extent the adaptation to change affects the quality of the existing marriages after the birth of their first child.

## Literature Review

Caring for a newborn can be a demanding and overwhelming experience that affects intimacy and the quality of relationships. In the initial stages of the new baby's entry into the family, the woman must adapt to physiologic changes during the postpartum period. These include fluctuations in hormonal levels that may result in feelings of fatigue, mood swings, and depression (Doss et al., 2009). There may be lingering effects of surgical interventions during the process of delivery, such as episiotomies that result in persistent pain and, particularly, discomfort during sexual intercourse (Fischman et al., 1986; Hardy (2019). The father now competes with the new baby for the mother's attention and struggles with feelings of loss and jealousy. The demanding infant's need for attention is heightened more than previously imagined. Modifications in the usual mode of operations for the couple occur, including loss of independence, privacy, and spontaneity (Gipple, 2016).

Spending quality time together is essential in a marriage. As couples have challenges in adjusting to new roles as parents versus sexual partners, there is an increased likelihood of the couple neglecting each other (Leal et al., 2012). Moreover, many parents are unprepared for this caring period's physical and psychological changes. To the inexperienced parent, the transition to this new role provokes fear, anxiety, and confusion, mainly when situations do not occur as anticipated (Ahlborg, 2005 & Fischman et al., 1986). There is limited time spent nurturing the marital relationship as the main focus of the couple is the new addition to the family, resulting in a reduced desire for intimacy and sex

(Leal et al., 2012). In and of itself, limited time spent together by these couples can negatively affect the quality of a marriage.

In addition, while child-rearing can be rewarding and satisfying, the experience can often be overwhelming, demanding and a frustrating responsibility, particularly in the event of providing care for children with behavioural and disciplinary problems or special needs. This leads to the microcosm of high parental stress levels, and poor parenting is one of the contributing factors to the high incidence of crime and violence in Jamaica (Gentles, 2014).

Therefore, all parents should be afforded the necessary support to function effectively. This all bodes well for a positive and well-run citizenry. Moreover, a stable family unit with two parents enhances the likelihood of effective parenting. Likewise, couples must develop the ability to address problems effectively and learn to overlook the imperfections of the other partner. Therefore, continuous strategies to strengthen marriages, such as marital educational programmes, effective communication, and problem-solving skills, are critical coping mechanisms of any marriage (Karney, 2010).

## Methodology

### Research Design

This study used a correlational design. A correlational research design measures the strength and degree between independent and dependent variables to determine whether a relationship exists without implying possible cause-and-effect outcomes.

### Study Location

Study participants were located in the parishes of Kingston, St. Andrew, and St. Catherine, Jamaica. Kingston is the capital of Jamaica and lies on the south eastern end of the island, with a population of 89,000 people. Likewise, the parish of St. Andrew, situated southeast of the island and lying north, west, and east of Kingston, has a population of 573,369 persons. The parish of St. Catherine, with a population of 518,345 persons, is located on the island's south coast between the parishes of St. Andrew to the east, Clarendon to the west and St. Ann and St. Mary to the north.

## Population

The Google Forms online tools platform was used to survey the participating individuals. The eligibility criteria for participating individuals in the study included (a) married couples and (b) parenting their first child only. To ensure random selection of the representative sample frame, the categorisation of participants included the following demographics: (a) age, (b) gender, (c) level of income, (d) length of marriage, (e) age of baby to meet the requirements of this research study.

## Inclusion Criteria

Males and females who were currently married and living together in the parishes of Kingston, St. Andrew, and St. Catherine and were biological parents of one child.

## Exclusion Criteria

Males and Females who were not currently (married) and not living together in Kingston, St. Andrew, and St. Catherine and who were not the biological parents of one child were excluded.

## Sampling Procedure

The purposive and snowball sampling techniques were the most suitable recruitment methods for selecting participants for this research. Therefore, the researchers selected individuals who met the inclusion criteria to participate in the study. Additionally, participants recommended other individuals who met the inclusion criteria and were willing and available to participate in the study.

## Sample Size

A sample size of 150 eligible participants was selected. Data obtained from the Swallowfield Chapel and other affiliated Marriage Ministries revealed that 150 married couples lived in the parishes of Kingston, St. Andrew, and St. Catherine. 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 50% response distribution and a population size of 150. The sample size generated from the calculator was 109. However, a census approach allowed for data generalisation and the necessary attempts to collect data from 150 eligible participants.

## Data Collection Instrument

The study utilised a structured questionnaire instrument comprising 25 questions targeting the demographic, intimacy, relationship satisfaction, and the couples' adjustment to the changes resulting from parenting.

An e-mail correspondence included the link to access the online Google Form sent to each eligible participant based on the inclusion criteria to participate in the study. Included in the correspondence was the informed consent statement with detailed information about the study's guidelines, instructions, and survey questions were also included. The participants were requested to complete the questionnaire via the link provided. This was an indication that they agreed to participate in the study.

## Validity and Reliability

Before conducting the data collection, the instrument was pre-tested, and feedback was obtained. The necessary adjustments were made regarding any ambiguity found in the questionnaire and to ensure the validity and reliability of the study.

## Data Analysis

The Statistical Package for Social Sciences (SPSS) software, version 24.0. was used to analyse the data. Descriptive statistics, correlations, and crosstabulation analyses were used to determine the significance of the study's data.

## Ethical Approval and Consideration

The institution's Research Ethics Committee approved the study. All ethical principles and standards were adhered to, including the consideration of the rights of the participants, their anonymity, confidentiality and privacy during and after the study. All participants were informed of their rights at the beginning and throughout the study and assumed that they could withdraw from the research at any time without being penalised. Participants were never asked to include their names, signatures, photographs, or other identifiers. Only the researchers had access to the raw data. All questionnaires containing related data were kept in a password-protected electronic folder. No incentive was offered to the participants, and their participation was voluntary. Implied consent was obtained once the participant attempted the questionnaire.



## Results

Of the 150 eligible individuals who could participate in this study, only 85 individuals actually participated. This has a participation return rate of (85, 56.7%) participation of eligible individuals. Of the 85 eligible individuals who participated in this study, 21 (24.7%) were males and 64 (75.3%) females respectively. Most participants (70, 82.4%) were in the 26–45 age group. In comparison, 13 (15.3%) participants were in the 46–55 age group. A significant number (40, 47.1%) of the participants were married between 11 and 20 years, while 31 (36.5%) were married between 5 and 10 years (Table 1).

**Table 1:** Age Group and Marriage Period of Participants

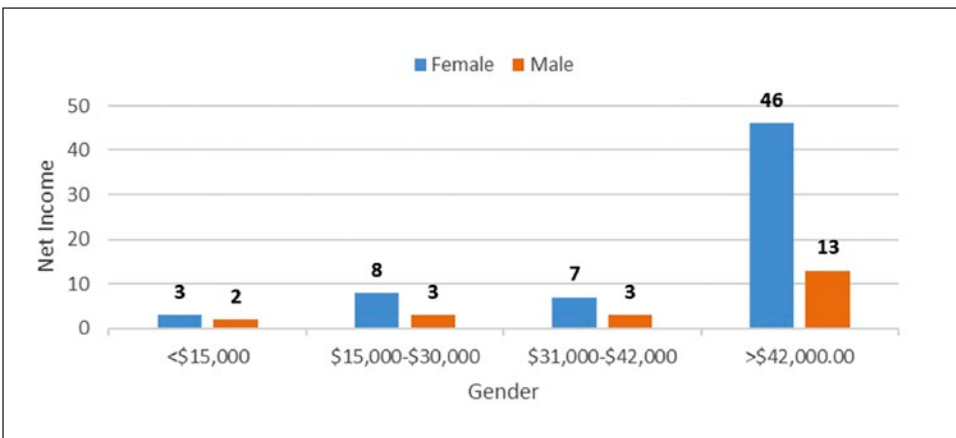
Age Group	n (%)
26–35	27 (31.8)
36–45	43 (50.6)
46–55	13 (15.3)
>55	2 (2.4)
<b>Total</b>	<b>85 (100.0)</b>
Marriage Period (Years)	n (%)
<5	10 (11.8)
5–10	31 (36.5)
11–20	40 (47.1)
21–30	3 (3.5)
> 30	1 (1.0)
<b>Total</b>	<b>85 (100.0)</b>

Each participant was a first-time parent and had only one child. The majority, 53 (62.4%) of participants' children were older than five years, while 12 (14.1%) of the children were either in the 1–2 or 3–4 age groups. In addition, a significant number of 59 (69.4%) of the participants had a net income of greater than \$42,000.00 per week, compared to 11 (12.9%) of the participants, who had an income between \$15,000.00 and \$30,000.00 per week and 10 (11.8%) of the participants had an income between \$31,000.00 and \$42,000.00 per week respectively (Table 2).

**Table 2:** Age Group of Participants' Children and Participants' Net Income per week

Age Group of Participant's Child	n (%)
0–6 months	4 (4.7)
7–11 months	4 (4.7)
1–2 years	12 (14.1)
3–4 years	12 (14.1)
>5 years	53 (62.4)
<b>Total</b>	<b>85 (100.0)</b>
Net Income of Participants (per week)	n (%)
<\$15000	5 (5.9)
\$15000–30000	11 (12.9)
\$31000–42000	10 (11.8)
>\$42000	59 (69.4)
<b>Total</b>	<b>85 (100)</b>

Among the 21 males who participated in the study, 13 (61.9%) had a net income of greater than \$42,000.00 per week, while 2 (9.5%) of 21 males received a net income of less than \$15,000.00 per week and 6 (28.6%) received a net income of between \$15,000.00 and \$42, 000.00. In comparison, among the 64 females who took part in the study, 46 (71.9%) received a net income of greater than \$42,000.00 per week, while 3 (4.7%) received a net income of less than \$15,000.00 per week and 15 (23.4%) received a net income of between \$15,000.00 to \$42, 000.00 respectively (Figure 1).



**Figure 1:** Net Income of Participants by Gender

The majority (51, 60%) of the participants indicated that they were often honest during communication and shared their true feelings with their partner while 22 (25.9%) indicated they were always honest and shared their true feelings with their partner. Moreover, among the participants, 53, 62.4% indicated that they often listened to each other during conversations, compared to 17, 20.0% and 12,14.1% who indicated that they listened to each other sometimes or always, respectively (Table 3).

**Table 3.** Indication of Participants' feelings and listening behaviours during communication with spouse

<b>Honesty and True Feelings</b>	<b>Spouse, n (%)</b>
Always	22 (25.9)
Most Times	51 (60.0)
Sometimes	12 (14.1)
Total	85 (100)
<b>Listening</b>	<b>Spouse, n(%)</b>
Always	12 (14.1)
Most Times	53 (62.4)
Sometimes	17 (20.0)
Rarely	3 (3.5)
<b>Total</b>	<b>85 (100)</b>

Regarding the financial contribution in the relationship, a significant number of the participants indicated that they always (64, 75.3%) contributed compared to 12, 14.1% of participants, who indicated that they contributed financially most times. In addition, most participants indicated that most times (51,60.0%), good decisions were made mutually between partners about their financial matters. Additionally, 10,11.8% of the participants indicated that they always made good financial decisions compared to 22,25.9% of the participants who indicated that only sometimes were good decisions made (Table 4).

**Table 4:** Participants' Financial Contribution and good financial decision making in the relationship

<b>Financial Contribution</b>	<b>Participants, n (%)</b>
Always	64 (75.3)
Most Times	12 (14.1)
Sometimes	6 (7.1)
Rarely	2 (2.4)
Never	1 (1.2)
<b>Total</b>	<b>85 (100)</b>
<b>Good Financial Decision</b>	<b>Participants, n (%)</b>
Always	10 (11.8)
Most Times	51 (60.0)
Sometimes	22 (25.9)
Rarely	2 (2.4)
<b>Total</b>	<b>85 (100)</b>

The participants indicated that after the birth of their first child, sex remained a pleasurable experience most times (45, 52.9%), compared to (24,28.2%) who indicated that the sexual experience was always pleasurable. Additionally, most participants (75, 88.3%) indicated that they felt appreciated either always or most times by their spouse, while (10, 11.8%) felt appreciated sometimes (Table 5).

**Table 5:** Sexual experience after Childbirth and feeling appreciated by their spouse

<b>Pleasurable Sexual Experience after Childbirth</b>	<b>Participants, n (%)</b>
Always	24 (28.2)
Most Times	45 (52.9)
Sometimes	15 (17.6)
Rarely	1 (1.2)
<b>Total</b>	<b>85 (100)</b>
<b>Feeling Appreciated by Spouse</b>	<b>Participants, n (%)</b>
Always	35 (41.2)
Most Times	40 (47.1)
Sometimes	10 (11.8)
<b>Total</b>	<b>85 (100)</b>

A positive correlation of .378 (significance of .000 and statistically significant at the 0.01 level) was identified among participants spending quality time together and the appreciation of their feelings during the period. This means that as more quality time is spent among participants, the appreciation of each other increases (Table 6).

**Table 6:** Correlations between Quality Time and Feeling Appreciated by Spouse

			Quality time	Appreciated by spouse
Spearman's rho	Quality time	Correlation Coefficient	1.000	.378**
		Sig. (2-tailed)	.	.000
		n	85	85
	Feels Appreciated spouse	Correlation Coefficient	.378**	1.000
		Sig. (2-tailed)	.000	.
		n	85	85

\*\*Correlation is significant at the 0.01 level (2-tailed).

Similarly, the participants indicated that as they became more physically affectionate to their partner, the sexual experience became more pleasurable between them. This was identified by a positive correlation of .263 (p-value of 0.15 and was statistically significant at the 0.05 level (see Table 7)).

**Table 7:** Correlation between Sexual Experience and Physical Affection among participants

		Sexual experience	Physical affection
Sexual experience	Pearson Correlation	1	.263*
	Sig. (2-tailed)		.015
	n	85	85
Physical affection	Pearson Correlation	.263*	1
	Sig. (2-tailed)	.015	
	n	85	85

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

Meeting original expectations, feeling appreciated by their spouse and spending quality time with each other showed a positive correlation and were all statistically significant at the 0.01 level among participants in the study. This means

that expectations during the relationships were achieved when participants spent quality time and appreciated each other. Notably, meeting original expectations and appreciation by spouses regarding their relationship showed the highest correlation of .616 compared to the quality time spent by participants and the appreciation by their spouses with a correlation of .378. In the same way, the relationship meeting the original expectation and quality time showed a correlation of .349 (Table 8).

**Table 8:** Correlations with Relationship Expectations, Feeling Appreciated by Spouse and Spending Quality Time with Spouse

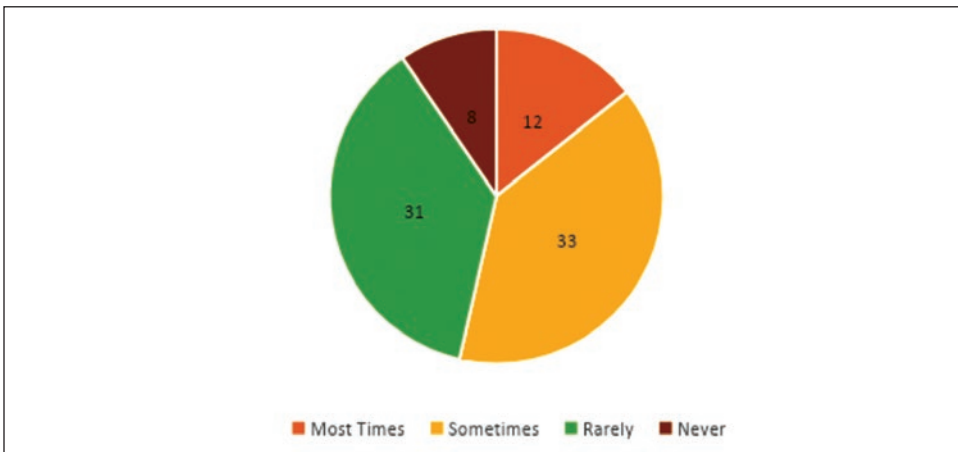
			Original expectation	Appreciated by spouse	Quality time
Spearman's rho	Relationship meeting the original expectation	Correlation Coefficient	1.000	.616**	.349**
		Sig. (2-tailed)	85.	.000	.001
		n		85	85
	Appreciated spouse	Correlation Coefficient	.616**	1.000	.378**
		Sig. (2-tailed)	.000	.	.000
		n	85	85	85
	Quality time	Correlation Coefficient	.349**	.378**	1.000
		Sig. (2-tailed)	.001	.000	.
		n	85	85	85

\*\*Correlation is significant at the 0.01 level (2-tailed).

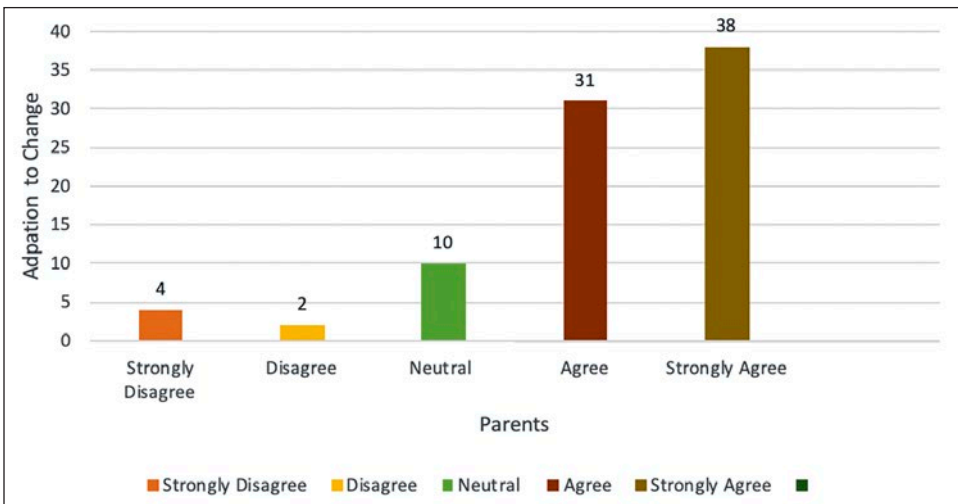
Participants indicated that 31, 36.5% rarely managed conflicts and avoided issues. This was compared to 33,38.8 % of the participants, who indicated they spent some time, while 12 14.1% indicated that they managed conflicts and avoided issues most times. On the contrary, 8, 9.4% never managed their conflicts and avoided the issues in their relationship (Figure 2).

Support and coping strategies are necessary ingredients in the role of new parenting. The majority (69,81.2%) of the participants either agreed or strongly agreed that support from families and friends positively contributed to adjusting to change and the new parenting role. In comparison, 6,7.1% disagreed or strongly disagreed, and 10 (11.8%) were unsure that the change was related to support from families and friends (Figure 3).

Of the 21 males that participated in the study, 5,23.8% either agreed or strongly



**Figure 2:** Managing Conflicts and Avoiding Issues among Participants



**Figure 3:** Factors Affecting First Time Parents to Change

agreed that parenting workshops positively contributed to their adjustment to the new role as parents. In contrast, 3,14.3% disagreed or strongly disagreed, and 13,61.9% were neutral about this contribution. Similarly, among the 64 females who participated, 15,23.7% agreed or strongly agreed that parenting workshops positively contributed to the adjustment to the new role as parents. In contrast, 18,28.2% disagreed or strongly disagreed, and 31,48.4% were neutral to this change.

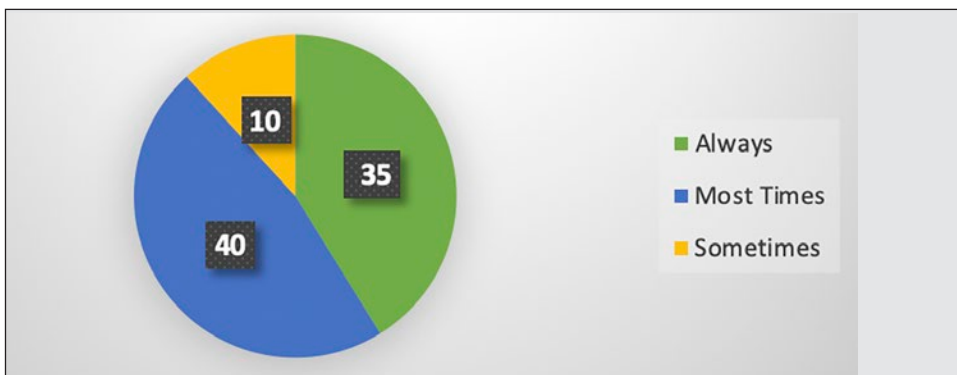
Similarly, among the 21 males who participated in the study, 10,47.6% agreed or strongly agreed that work conditions positively contributed to the adjustment to the new role as parents. In contrast, 4,19.1% disagreed, and 7,33.3% were neutral.

Furthermore, of the 64 females that participated in the study, 20,31.2% either agreed or strongly agreed that work conditions positively contributed to the adjustment to the new role as parents. In contrast, 15,23.4% disagreed or strongly disagreed and 28, 43.8% were neutral (Table 9).

**Table 9:** Workshop and work conditions by gender using crosstabulation analysis

Workshop by Gender	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)	Total n (%)
Male	1 (4.8)	2 (9.5)	13 (61.9)	3 (14.3)	2 (9.5)	21(100)
Female	9 (14.1)	9(14.1)	31(48.4)	12(18.8)	3 (4.9)	64(100)
<b>Total</b>	10 (11.8)	11(12.9)	44(51.8)	15(17.6)	5(5.9)	85 (100)
Work Conditions by Gender	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)	Total n (%)
Male	0 (0.0)	4 (19.1)	7 (33.3)	7 (33.3)	3 (14.3)	21 (100)
Female	6 (9.4)	10 (15.6)	28 (43.8)	15 (23.4)	5(7.8)	64 (100)
<b>Total</b>	6 (7.0)	14(16.5)	35(41.2)	22(25.9)	8(9.4)	85(100)

All participants agreed they were happy with the role as a new first-time parent. The majority (40,47.0%) of the participants indicated they were primarily happy compared to 35,41.2% who said they were always happy and 10,11.8% who were sometimes happy (Figure 4).



**Figure 4 :** Happiness with the role of parenting



Among the 75 participants who agreed they were always happy, 61 (81.3%) indicated that this happiness resulted from family support, compared to 14 (18.7%) who disagreed. In contrast, among the 61 participants who agreed that family support positively contributed to the adjustment to first-time parenting, 20 (32.8%) agreed that parenting workshops positively contributed to the adjustment to the new role as first-time parents, compared to 41 (67.2%) who disagreed (Table 10).

**Table 10:** Contribution to happiness among participants new role by family and parenting workshop

Contribution to happiness in their new role by Family Support	Participants, n (%)
Strongly agree	61(81.3)
Disagree	14 (18.7)
<b>Total</b>	<b>75 (100)</b>
Contribution to happiness in their new role by Parenting Workshop	Participants, n (%)
Strongly Agree	20(32.8)
Disagree	41 (67.2)
<b>Total</b>	<b>61 (100)</b>

Among the 85 participants in the study, 71 (83.5%) either agreed or strongly agreed that they received support from their spouse to carry out their parental role, while 7 (8.2%) participants did not proffer a response. Similarly, 75 (88.2%) of the 85 participants were either happy always (42.4%) or, most times (45.8%), happy with the new parental role, while 10 (11.8%) were happy sometimes (Table 11).

**Table 11.** Spousal Support and Parental Role Using Cross Tabulation

	Spousal Support	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)	Total n (%)
<b>Parental Role</b>	<b>Always</b>	1(2.8)	3(8.3)	6(16.7)	15(41.7)	11(30.6)	36(100)
	<b>Most times</b>	3 (7.7)	0(0.0)	1(2.6)	18(46.2)	17(43.6)	39(100)
	<b>Sometimes</b>	0(0.0)	0(0.0)	0(0.0)	9(90.0)	1(10.0)	10(100)
	<b>Total</b>	<b>4(4.7)</b>	<b>3(3.5)</b>	<b>7(8.2)</b>	<b>42(49.4)</b>	<b>29(34.1)</b>	<b>85(100)</b>

Of the 21 males who participated in the study, 8 (38.0%) agreed or strongly agreed that the birth of their first child did not change the relationship. However, 10 (47.6%) of the participants indicated that they either disagreed or strongly disagreed

that there was a change in their relationship after the first child’s birth. Similarly, among the 64 females who participated in the study, 25 (39.1%) indicated a change in the relationship after the first child’s birth. However, 32 (50.0%) indicated that there was no change in the relationship, while 7 (10.9%) were undecided whether there was a change in their relationship after the birth of their child (Table 12).

**Table 12:** Change in the relationship after childbirth

Change in relationship after Childbirth	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)	Total n (%)
Male	3 (14.3)	7(33.3)	3(14.3)	4(19.0)	4(19.0)	21(100)
Female	6 (9.4)	26 (40.6)	7(10.9)	12(18.8)	13(20.3)	64(100)
<b>Total</b>	<b>9(10.6)</b>	<b>33(38.8)</b>	<b>10(11.8)</b>	<b>16(18.8)</b>	<b>17(20.0)</b>	<b>85(100)</b>

## Limitations

The limitations of this study include:

1. Most selected participants were affiliated with a religious group’s marriage ministry. This kind of affiliation can influence how individuals view and function in marriage.
2. The impact of the younger first child on changes in relationship quality from the effects on a couple with an older child was not separated. As the child ages, physical demands on the parents could decrease, so the marriage benefits.
3. The method used in the study was quantitative, which limited detailed responses from the participants. This method of research entailed the use of closed-ended questions. The use of a qualitative method has the potential to allow for a more detailed understanding of how the transition to parenthood affects couples.

## Discussion

Although most of the participants in this study were in the 26–45 age group and more than half were in the 36–45 age group, many were at a mature stage in their lives. This was corroborated by Sanders (2010), who indicated that age indicates development and maturity among individuals and points to a difference in life experiences associated with education, financial security, marital stability, career

establishment, and readiness for the parental role. These dynamics increase the chances for better coping and adjustment after the birth of their first child. Moreover, children born to parents over the age of 25 have significantly better chances of having a more favourable home environment, which results in better long-term outcomes such as increased chances of a better quality of life in adulthood (Mills et al., 2011). Eventually, society benefits when parenting is successful and families are stable.

Most of the participants were found to be in the middle to upper-income brackets of the socioeconomic class and were between the ages of 26 and 45. This positively influenced their ability to adjust to the financial demands of the new parenting role. On the other hand, higher income is one of the functions that protect against increases in marital conflict regarding financial stress. Doss et al. (2009) supported the theory that older parents with a higher income are better prepared for parenthood, as there is more money, time, and commitment. Therefore, new parents with a higher income have access to more support, resources, and other sources that positively affect the period of transition and are at less risk of experiencing a decline in marital quality after childbirth.

The ability to meet the financial responsibilities that come with the birth of a new child reduces stress and can improve the quality of a marriage. In this study, the income of the respondents increased as their age increased. This means that older first-time parents who were more financially able to manage the financial demands of parenting and marriage enjoyed more satisfying marriages than younger parents who struggled financially.

Sanders (2010) argued that couples who have been married for a long time are more likely to adjust to the new parenting role better than couples who have not been married for a long period. The findings of this study indicated that most participants had children older than five years. Among the participants, there was a strong positive correlation between the participant's age group and length of marriage. This indicated that older participants are married for longer periods. This study suggests that couples who have been married longer have more time to develop a shared understanding of relationship responsibilities and goals that help to safeguard them from the demands and additional stress of childcare and general disorganisation after birth.

Importantly, communication is one of the hallmarks of healthy relationships. This study confirmed that most participants were open and honest with each other. Therefore, this enhanced intimacy as the disclosing partner felt valued and cared for. Most of the respondents in this study indicated that partners listened to

each other, communicated effectively, and were more likely to achieve excellent relationship quality and satisfaction during communication. Khalifian (2018) proffered that the interpersonal process model confirms that couple intimacy is formed and maintained in the communication processes in which partners disclose information about themselves and respond to each other's self-disclosure.

In marriage, communication regarding financial matters encourages an atmosphere of trust and respect and enhances the quality of the relationship. While Dew & Stewart (2012) indicate that couples experiencing financial conflicts may have underlying issues with power, commitment, respect, and fairness, this study shows that the majority of the participants indicated that good decisions were made mutually between each other about financial matters compared to approximately a quarter of the participants who indicated that only sometimes were good decisions made. Moreover, most participants always contributed financially to the relationship between the two, with a small percentage indicating that the financial contribution was made most of the time. While low levels of income may exacerbate financial conflicts as couples struggle to meet financial obligations Dew & Stewart (2012). In this study, most participants were in the middle to upper-income bracket, indicating fewer challenges in meeting financial obligations.

A positive correlation was identified among participants in the study who reported that their spouses knew each other's love language, spent quality time together, and felt appreciated. In the end, the quality of the marriage was improved. The frequency and quality of sexual interactions fluctuate after childbirth and are dependent on the age of the child (Ahlborg et al., 2005). The findings of this study suggested a minimal decline in sexual activity after the birth of their first child. Most participants indicated that after the birth of the first child, sex remained a pleasurable experience. These findings may be influenced by the fact that most of the participants' children were over the age of 5 years.

Any form of support is critical to long-term relationships. This study revealed that most participants indicated receiving support from their spouses. Spouses were both reliable and dependable and participated in planning for their child's educational future; this was corroborated by Gipple (2016), who indicated that sharing responsibilities after the birth of a child is an important maintenance strategy, especially for first-time parents. Moreover, most participants who were happy with the new role of being a first-time parent agreed that family support contributed positively to the adjustment to parenting. These findings were supported by Jankelson-Groll (2014), who indicated that the support of family and friends was essential and enhanced the successful transition of first-time parents.

This type of family support allows new parents time alone to rejuvenate and spend time with each other, enhancing the relationship's quality.

Hardy (2019) confirms that a support system is critical for new parents and that a network of family and friends can offer guidance and encouragement to help the new parent survive and thrive, particularly during the early months of parenthood. Interestingly, most participants were undecided regarding the contribution of parenting workshops to their transition to parenting. In the final analysis, Mickle et al. (2019) indicated that a supportive and flexible work environment helps to enhance the adjustment of first-time parents, as returning to the workplace after childbirth is a significant challenge for them. In contrast, less than half of the males who participated in the study agreed that workplace conditions positively contributed to the adjustment to the new role as parents, while a similar number disagreed. In comparison, a smaller number of the females who participated in the study agreed that work conditions positively contributed to the adjustment to the new role as parents.

## Conclusion

A positive relationship was found between first-time parents achieving intimacy and the quality of their marriage. The study further revealed that achieving intimacy was very important to each couple's well-being. Participants were satisfied and felt happy in the marriage when intimacy was achieved. The age of the participants, duration of their marriage, and income played a significant role in their readiness for this developmental curve of a new addition to the marriage. Furthermore, it was noted that participants who became parents later in life, were married over five years, were middle-income earners and were satisfied with the quality of their marriage.

A system of support was found to positively influence how first-time parents adapt to the changes that occur with parenting. Equally, the findings of this study suggested that spousal support and support from family and friends were crucial in the couples' successful transition to parenting. However, working conditions and parenting workshops had little impact on the couples' ability to adapt to becoming new parents. To put it differently, the findings of this study indicated that the achievement of intimacy and the quality of the existing marriage were not negatively affected after the birth of the first child. A correlation between the couples' adjustment to change and the adverse effects on the quality of the existing marriage following the birth of the first child was identified.

On the other hand, there was a deficit with the execution of support systems such as work conditions, parenting workshops and parent-craft sessions. The participants were still deciding on the value of these workshops and sessions. These findings imply that these workshops and sessions were either limited in frequency or were being implemented with a deficit of not meeting the needs of first-time parents. Of note, parent-craft classes mainly focused on the preparation for labour and delivery and did not educate expectant parents on how to practically approach other areas of parenting. This indicates a need to refocus the teaching and learning strategies employed to meet the needs of expectant and new parents. Regarding work conditions, the findings imply a need to develop workplace policies that positively influence first-time parents' ability to adjust and transition smoothly on return to work.

In conclusion, the findings of this study will contribute new information supporting the review and development of policies within the workplace that influence working conditions and positively influence first-time parents adapting to their new role. Equally, it will provide valuable information on strategies and interventions in facilitating the successful transition to parenting and improving the quality of marriage, particularly for first-time parents.

## Recommendations

The following are the recommendations from the study:

1. Increased training of counsellors and health care providers in practical approaches to parenting and maintaining relationship quality following the birth of the first child is needed. Healthcare providers and counsellors will be better able to structure parentcraft classes and parenting workshops to meet the needs of first-time parents.
2. Policies that promote workplace flexibility and a baby-friendly work environment must be updated and developed by relevant stakeholders. These policies would foster the smooth transition of first-time parents back into the workplace after Childbirth.
3. The findings of this research should be made available to first-time parents. An insight into this information can improve parents' coping strategies and, consequently, marriage quality.
4. Further research should be conducted among first-time parents and the effects on the quality of their existing marriage in Jamaica. Future studies

will enhance the understanding of first-time parents and the effects on the quality of existing marriages in Jamaica.

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# Silent Epidemic

## Uncovering The Health Effects of Sexual Harassment in the Workplace

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**ADELLA CAMPBELL**  
University of Technology, Jamaica

### **Abstract**

*Sexual harassment in the workplace is not a new phenomenon however, it has been established that there is an intricate link between sexual harassment and ill-health among employees. Section 2, Jamaica Sexual Harassment Act 2021 articulates that sexual harassment is the making of any unwelcome sexual advance towards a person by another person which (a) is regarded as offensive or humiliating by the person towards whom the sexual advance is made; or (b) has the effect of (i) interfering with the work performance of the person to whom the sexual advance is made; or (ii) creating an intimidating, offensive or a hostile work environment. Effects of sexual harassment include ill health, such as emotional distress, psychological effects, and physical effects, which have the potential to undermine an employee's job satisfaction, job engagement and, ultimately, productivity. Additional effects of a hostile work environment created by sexual harassment are behaviours such as inability to concentrate and absenteeism. By and large, effective management of health-related effects of sexual harassment must be mitigated through prevention strategies such as accessible channels for reporting and addressing complaints, strategies to empower victims and hold perpetrators accountable for their actions, offering comprehensive support services and zero tolerance for sexual harassment. This may be achieved through a multifaceted approach to address issues such as power dynamics and inequality in the workplace, raising consciousness, establishing training programs, and implementing robust policies and legal framework.*

**Keywords:** Sexual Harassment, Workplace, Health-effects

**Email:** madcampbell@utech.edu.jm

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**MY INTEREST IN THE EARLY 2000S WAS FOCUSED** on uncovering sexual harassment in the workplace, but as fate would have it, I changed focus to pursue doctoral work in the area of health policy in New Zealand. Notwithstanding the change, the scourge of sexual harassment continues to arouse my curiosity.

It is not my experience, but I am acutely aware that sexual harassment in the workplace is real and affects both genders across sectors and industries regardless of their age or social status.

## Sexual harassment defined

Section 2 of Jamaica's Sexual Harassment Act 2021 (The Act) articulates that sexual harassment is the making of any unwelcome sexual advance towards a person by another person, which (a) is regarded as offensive or humiliating by the person towards whom the sexual advance is made; or (b) has the effect of (i) interfering with the work performance of the person to whom the sexual advance is made; or (ii) creating an intimidating, offensive or a hostile work environment.

## The face of sexual harassment

How do you know if you are experiencing sexual harassment? In the first place, it varies in forms and ranges from unwelcome advances, requests for sexual favours, and suggestive remarks to assault and coercion. Section 2 of The Act refers to this behaviour as "sexual advance", which includes any one or more of the following acts, forms of conduct or behaviour, namely (a) physical contact of a sexual nature; (b) a demand or request for sex or for favours of a sexual nature; (c) the making of sexual suggestions, remarks or innuendos; (d) the showing of pornography or the display of images or objects of a sexual nature; and (e) any other physical, gestural, verbal, non-verbal or visual conduct of a sexual nature.

Given these points, one can deduce that sexual harassment in the workplace can create a hostile work environment that may have lasting deleterious effects on those being harassed, not just professionally or personally, but it has the potential to have lifelong health-related consequences on these individuals.

## Health-related effects of sexual harassment

It has been established that there is an intricate link between sexual harassment and ill health. Effects include emotional distress, psychological effects, and physical effects. A compelling point to note, however, is that sexual harassment in the workplace can undermine an employee's job satisfaction, job engagement and, ultimately, productivity. It is also true, that a hostile work environment created by sexual harassment may manifest itself in behaviours such as absenteeism, inability to concentrate, poor decision-making skills and ineffective interpersonal interactions. Under these circumstances, professional success, career advancement, job satisfaction and ultimately economic stability will be stymied, further contributing to ill-health (Harnois & Bastos, 2019; Rospenda et al., 2023).

### Emotional distress

Sexual harassment can have devastating effects on individuals' emotional well-being. Studies have found that these individuals experience feelings of guilt, shame and embarrassment with the ripple effects of social withdrawal and isolation (Willness et al., 2007). These are symptoms of eroded self-esteem and self-worth and decreased morale, generally. Additionally, sexual harassment can disrupt interpersonal relationships and undermine the individual's sense of trust and safety. A point to note is that fragile emotional well-being may extend into relationships with families, co-workers and social networks (Fitzgerald et al., 2017).

### Psychological effects

Equally, sexual harassment poses a risk to psychological well-being. The psychological effects can be deleterious and long lasting. Scholars and clinicians have argued that sexual harassment can trigger symptoms of depression, anxiety, panic attacks, and post-traumatic stress disorder (PTSD) or even exacerbate health conditions that were previously controlled or successfully resolved (McLaughlin et al., 2012).

Individuals may experience unexplained crying, intrusive thoughts, feelings of betrayal, nightmares, shame, fear and powerlessness. These symptoms have the potential to further erode self-esteem and self-worth (Rospenda et al., 2023).

## Physical effects

A point that is often overlooked is that the body reacts to sexual harassment, generally. Physical symptoms can be susceptibility to diseases, suggesting a compromised immune system, increased risk for hypertension, cardiovascular diseases, muscle tension, headaches, fatigue, gastrointestinal disorders, and sleep disturbances (Willness, Steel, & Lee, 2007). Some individuals may experience a pit in their stomach with the thought of work, maladaptive behaviours such as substance abuse, eating disorders, weight gain or loss, hair loss, hives, and lethargy. These are usually precursors of chronic health conditions and reduced life expectancy (Kimerling, Alvarez, Pavao, Kaminski, & Baumrind, 2007).

## Conclusion

As a female, I am careful to highlight that sexual harassment disproportionately affects women and reflects the power imbalances and systemic inequalities within the work environment resulting in a culture of discrimination and exclusion. By the same token, affected women may encounter additional barriers in seeking support and accessing well needed healthcare because of stigma, the shame they feel, and fear of victimisation.

By and large health-related effects of sexual harassment must be mitigated through prevention strategies to include but not limited to accessible channels for reporting and addressing complaints, strategies to empower victims and hold perpetrators accountable for their actions, offering comprehensive support services such as counselling, advocacy, legal assistance and creating a culture of accountability, equity, respect, dignity, and zero tolerance for sexual harassment. This may be achieved through raising consciousness, training programs, robust policies and legal framework.

Generally speaking, sexual harassment in the workplace constitutes a violation of the individual's rights and dignity and has the potential to affect the emotional, psychological/mental and physical well-being of affected individuals. All in all, I believe that addressing sexual harassment and its attendant effects requires a multifaceted approach that addresses diversity, gender disparities, power dynamics and inequalities in the workplace.

## Note

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# Will an Increased Minimum Wage Lead to Healthier Eating by Low-Income Earners?

FITZROY J. HENRY

Professor, Public Health Nutrition

## *Abstract*

*On June 1, 2024, the minimum wage in Jamaica will be raised to J\$15,000 for a 40-hour work week. Whether this wage is enough depends on what can be purchased with it given the prevailing prices of necessities. But do the recent increases in minimum wage match the inflation trends in Jamaica and how much of the gap is closed? In 2018 a nutrient cost analysis in Jamaica showed that 48% of the minimum wage is required to obtain a healthy diet for one individual. This analysis shows the vulnerability of many families particularly those who have little support from the state or relatives at home or abroad. No doubt, increasing the minimum wage to J\$15,000 will allow low-income families to make better and healthier food choices if they use the additional cash for that purpose. A similar analysis to 2018 needs to be done in 2024 to determine how much of the gap remains. When food budgets are small it is possible to spend less and eat more, especially if the extra energy comes from added sugar and added fat. Improving the purchasing power of minimum wage earners to spend more on healthier food could lead to a liveable minimum wage in Jamaica.*

**Keywords:** Minimum Wage, Low-income Earners, Healthy Foods

**Email:** fitzroy\_henry22@yahoo.com

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ON JUNE 1, 2024, THE MINIMUM WAGE IN Jamaica will be raised to J\$15,000 for a 40-hour work week. Whether this wage is enough depends on what can be purchased with it given the prevailing prices of necessities. Nevertheless, this must be

welcome news to low-income families. The principal justification for increases in the minimum wage is an attempt to ensure that the economic condition of the lowest earners of wages in the society can afford the proverbial basket of goods in an economically stable environment. However, the question must be asked: do the recent increases in minimum wage match the inflation trends in Jamaica? This minimum wage increase comes from J\$5,600 in 2014 – a 168% increase. Interestingly, a comparative trend in inflation, measured by the consumer price index (CPI), shows an 86% increase over the same period – 2014 to 2024. The faster increase in minimum wage over inflation should be more good news for the poor. But the real question is: how much of the gap is closed? In other words, what is the extent of vulnerability that remains? And how can we measure that vulnerability?

The United Nations Development Program (UNDP) measures vulnerability by creating a multi-dimensional poverty index which assesses deprivations across 10 indicators in three equally weighted dimensions: health, education and standard of living. Their assessment of Jamaica in 2021 indicated that 5% of the population was classified as vulnerable to multidimensional poverty i.e., 141,000 people. This is not just a statistic. It represents household workers, unskilled labourers, artisans, store clerks, and security workers, among others, who are vital to various sections of the economy – manufacturing, tourism and other service sectors that are critical to the productivity of the country. This UNDP measure is an important advance because it is known that constant GDP increases are often unrelated to the upliftment in the conditions of poor families.

Another way to assess vulnerability is uniquely to utilise a biological benchmark of consuming 2400 Kcals per person. This can measure the cheapest way to obtain a balanced basket of food where only the cost of the food changes over time – a nutrient cost analysis. Further, it highlights the critical need to consume healthy foods by low-income groups to avoid the consequences of obesity and chronic diseases – which are the main health problems and drain the meagre resources of poor families. Solving the hunger and health problems must be attempted at the same time. This nutrient cost analysis, therefore, compares foods, not merely by separating high and low-cost commodities, but by the proportions of those foods, in food groups, that will be required to meet the Population Nutrient Goals of a standard diet of 2400 Kcals.

In 2018 this analysis was done in Jamaica and showed that 48% of the minimum wage is required to obtain a healthy diet for one individual in a family. It should be noted, however, that low-income families do not necessarily select

from the cheapest possible foods – hence the basket cost for their selection may be even higher. It is important to further point out that this food basket cost does not include the cost of cooking (fuel, time, and other ingredients). But just considering the finding for raw foods, if the overall average cost of J\$477 was used, it showed that a family of 3 will require over J\$10,000 to secure healthy meals for one week. The weekly minimum wage in Jamaica at that time was J\$7,000, which means that a single-income earning family would need to spend more than their entire income on food (raw) alone. This is clearly not possible or sustainable and implies that such a family will opt to use less healthy options to fit their purchasing power. So how do low-income families survive? In Jamaica, families are typically larger than three and have more than one income earner. Importantly also, family income is buttressed by remittances in cash or kind mainly from abroad.

The 2018 analysis shows the vulnerability of many families, particularly those who have little support from the state or relatives at home or abroad. No doubt, increasing the minimum wage to J\$15,000 will allow low-income families to make better and healthier food choices if they use the additional cash for that purpose. A similar analysis to 2018 needs to be done in 2024 to determine how much of the gap remains. The Statistical Institute of Jamaica (STATIN) should consider utilising a genuine healthy food basket to assess the challenge of not only poverty and hunger but also, importantly, non-communicable diseases, i.e. Sustainable Development Goals 1, 2 and 3. Such an assessment is critical because adjusting the minimum wage should consider the complementarity with other sectors of the economy. The issues of poverty, productivity, food prices and health have previously been approached as originating from unrelated sectors of the economy. It is crucial not only to recognise the strong links among these sectors but, more importantly, to act upon them structurally and functionally to contribute to the sustainability of human development – which is the overall goal.

The dynamics of food prices and consumer choices are sometimes complex. Price differences in foods have led many to theorise that strategic taxes or other forms of price control could help to motivate consumers to make healthier food purchases. It is generally believed that when the price of a healthy food and an unhealthy food is adjusted so that one type is more expensive than the other, the more expensive food is expected to be purchased less. This may not necessarily translate into substitution with the less expensive item because purchases also depend on the income available for spending, taste preferences, tradition, ease of preparation, cultural practices, among other factors. Nevertheless, incentives



and disincentives for healthy and less healthy food items should be encouraged.

Lack of knowledge is high among the factors that determine food choice, particularly among the poor. When food budgets are small, it is possible to spend less and eat more, especially if the extra energy comes from added sugar and added fat. It has been shown that consumer food choices are driven by taste, cost, and convenience and, to a lesser extent, by health and variety. In 2013 an analysis of 27 studies from 10 countries showed that the healthiest diets cost US\$1.47 more per day than the less healthy options. (Rao, 2013). This observation that healthier diets may indeed cost more has one glaring policy implication — our standard advice to consume “healthier” diets may be hollow to the poor if these diets are unaffordable. Therefore, changing dietary practices with an educational focus on nutrient content alone is unlikely to succeed if the cost of the recommended foods is not considered, particularly for the low-income families. The high energy density and palatability of sweets and fats are associated with higher energy intakes. The lower cost diets tend to be higher in refined grains, added sugars and fats. Energy dense foods are not only palatable, but also satisfy hunger at the lowest cost. This simply means that diets consumed by poorer sections of populations have concentrated energy from fat, sugar, cereals, potatoes, and meat products but very little intake of vegetables, fruit and whole grain. The 2018 Jamaica analysis, mentioned above, points to the need for an education/information program to inform consumers about the combinations of foods which could comprise a tasty, culturally appropriate nutritious diet at low cost. These points emphasize that obesity is principally the consequence of economic decisions that have much to do with social and economic resources, food prices and diet costs.

In conclusion, to improve the purchasing power of minimum wage earners to spend more on healthier food, a combination of targeted educational programs and the government’s strategy of low inflation and macroeconomic stability would see a genuine improved condition among minimum wage earners. This could lead to a liveable minimum wage in Jamaica.

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# Jamaica's Data Protection Act: Implications For Researchers

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ANDRAY R. LAWRENCE  
University of Technology, Jamaica

## *Abstract*

*The enactment of Jamaica's Data Protection Act in 2020 signifies a pivotal development in data management, introducing rigorous standards to safeguard personal data. This legislation is particularly consequential for researchers, presenting a dual challenge and opportunity to balance knowledge advancement with stringent data privacy norms. The Act mandates explicit, informed consent for data usage, emphasising the need for transparency and participant awareness of their rights. Researchers must make sure that data collection is directly relevant to and required for studies by abiding by the principles of data minimisation and purpose limitation. The Act also imposes strict data security guidelines to prevent unwanted data access and combat the growing threat of cyberattacks. Because of this legal framework, researchers must fundamentally change the way they collect and handle personal data. They must also provide a legitimate reason for processing personal data, such as consent, contractual necessity, legal obligation, protection of vital interests, public interest tasks, or legitimate interests. The need for improved data infrastructure and continuous training in data protection best practices is highlighted by compliance challenges, especially in environments with limited resources. Notwithstanding, these obstacles additionally stimulate prospects for novelty, like embracing privacy-by-design approaches that incorporate personal data security from the project's inception. In the end, the Data Protection Act will improve research quality and public confidence in results while promoting legal compliance and ethical integrity. Researchers can greatly enhance participant engagement and data integrity by incorporating strong personal data protection measures and*

*maintaining transparency, thereby complying with local and international data privacy protection standards.*

**Keywords:** Jamaica's Data Protection Act, Research, Data Privacy

**Email:** andray.lawernce@utech.edu.jm

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## Introduction

In the landscape of modern research, the enactment of Jamaica's Data Protection Act in 2020 has marked a significant milestone, introducing a comprehensive legal framework aimed at protecting the privacy and personal data of individuals. This legislative move not only aligns Jamaica with global standards on privacy and data protection but also presents a unique set of challenges and opportunities for the research community. As we delve into the implications of this Act on researchers, it is crucial to understand the balance between advancing knowledge and safeguarding privacy.

## The Core of the Data Protection Act

At its heart, the Data Protection Act 2020 (DPA) establishes clear guidelines on the collection, processing, storage, security, and disclosure of personal data. It emphasises the principles of consent, transparency, and accountability, mandating researchers to adopt even more stringent measures to protect data subjects' privacy rights. The Act categorises personal data into two main types: general and sensitive, with the latter requiring higher protection standards due to its sensitive nature.

## Implications for Researchers

The introduction of the DPA necessitates a paradigm shift in how researchers approach data management. First and foremost, the principle of consent under the DPA means that researchers must obtain explicit, informed consent from participants, outlining the purpose, scope, and use of the data collected. Researchers would normally be guided by ethics principles and by ethics boards. However, the DPA process demands and requires even clearer communication and transparency, ensuring participants are fully aware of their rights and the protections

in place. Which includes the listing of all researchers that will be involved and indicate all future use of collected results.

Data minimization and purpose limitation principles further compel researchers to collect only data that is directly relevant and necessary for their specific study. This approach encourages efficiency and focuses on research design, requiring a judicious assessment of data needs.

Additionally, the DPA mandates robust data security measures to prevent unauthorized access, data breaches, and loss. Researchers must implement and regularly update technical and organisational measures to safeguard personal data. This aspect is particularly challenging in an era where cyber threats are increasingly sophisticated, placing a significant responsibility on researchers and institutions to maintain data integrity

## Legal Basis: A Cornerstone of Ethical Research

The concept of ‘legal bases’ underpins the ethical framework for conducting research, serving as a fundamental prerequisite for any data processing activity. It provides the justification for handling personal data, ensuring that such activities are firmly rooted in legal compliance, ethical integrity, and respect for the privacy and rights of individuals involved in the research.

Under data protection laws such as the General Data Protection Regulation (GDPR), which has influenced many data protection legislations globally, including Jamaica’s Data Protection Act 2020, the legal basis for processing personal data includes:

*Consent* – The individual has given clear consent for their personal data to be used for a specific purpose.

*Contractual Necessity* – The processing is necessary for the performance of a contract with the individual, or to take steps at their request before entering a contract.

*Legal Obligation* – The processing is necessary for compliance with a legal obligation to which the controller is subject.

*Vital Interests* – The processing is necessary to protect someone’s life, making it particularly relevant in emergencies or life-saving situations.

*Public Task* – The processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller.

*Legitimate Interests* – The processing is necessary for the purposes of legitimate interests pursued by the controller or a third party, provided those interests are not overridden by the individual's interests, rights, or freedoms.

For researchers, identifying the appropriate legal basis before commencing data processing is critical to ensuring ethical compliance and safeguarding participant rights.

## Navigating Compliance: Challenges and Strategies

Compliance with the DPA presents several challenges, particularly for resource-constrained research environments. Ensuring data protection requires not only technical solutions but also comprehensive training for research teams on data privacy best practices and legal requirements. However, these challenges also offer opportunities for innovation. For instance, adopting privacy-by-design approaches in research projects can enhance data security from the outset. Collaboration with data protection officers and legal experts can provide researchers with the guidance needed to navigate the complexities of the DPA.

Furthermore, the DPA can drive improvements in research quality. By fostering trust through transparent data handling practices, researchers can enhance participant engagement and the reliability of research outcomes.

## Privacy By Design

An integral component of adhering to Jamaica's Data Protection Act 2020 (DPA) for researchers is to incorporate privacy by design principles by conducting Data Protection Impact Assessments (DPIAs). DPIAs are systematic processes used to evaluate the potential impact of a research project on the privacy of individuals, identifying risks to their personal data at an early stage. This tool is not merely a compliance requirement but a best practice that enhances ethical considerations in research methodologies.

DPIAs encourage researchers to think critically about the necessity and proportionality of data collection and processing activities. By conducting a DPIA, researchers can uncover and assess the privacy implications of their projects, consider alternatives, and implement measures to mitigate identified risks. This process fosters a privacy-by-design approach, ensuring that data protection is an integral part of the project from its inception.

When is a DPIA Required? Under the DPA, a DPIA is required for processing

activities likely to result in a high risk to the privacy rights of individuals. For researchers, this could include projects involving sensitive personal data, large-scale data processing, or innovative technologies that pose privacy challenges. Determining the necessity of a DPIA involves assessing the nature, scope, context, and purposes of the data processing.

### Conducting a DPIA: Key Steps

**Description of Processing Operations:** Clearly outline the data collection, processing, and storage activities, including the types of data and the technologies used.

**Assessment of Necessity and Proportionality:** Evaluate whether each processing activity is essential for the research objectives and ensure that no more data than necessary is being processed.

**Risk Identification** – Identify potential risks to the privacy and rights of individuals arising from the data processing.

**Risk Assessment** – Assess the likelihood and severity of each identified risk, considering both the potential impact on individuals and the project’s broader societal implications.

**Risk Mitigation** – Determine measures to mitigate identified risks, such as data anonymization, enhanced security protocols, or limitations on data sharing.

**Documentation and Review** – Document the DPIA process and outcomes, and plan for regular reviews to update the assessment as the project evolves.

The Benefits of DPIAs, beyond compliance, DPIAs offer substantial benefits to the research community. They promote transparency and accountability, building trust between researchers and participants. DPIAs also encourage innovative data management and security solutions, contributing to the overall integrity and quality of research.

A Call for a Culture Shift, the enactment of Jamaica’s Data Protection Act represents a critical step forward in recognizing the importance of personal data privacy. For the research community, it necessitates a culture shift towards more responsible and secure data handling practices. While the path to full compliance may be fraught with challenges, it is a journey worth embarking on. By embracing the principles of the DPA, researchers can not only comply with legal obligations but also contribute to a culture of trust and respect for individual privacy. In

doing so, the research community can navigate this new frontier with integrity, ensuring that the pursuit of knowledge remains aligned with the values of data protection and privacy.

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# Unpacking Jamaica's Recently Unveiled Education Philosophy

SHERMAINE A. BARRETT  
University of Technology, Jamaica

## Philosophy Statement

*Under God, the Jamaican educational philosophy embraces diverse learning capacities and styles, aiming to nurture each learner's full potential. We provide a comprehensive education, blending academic and vocational pursuits with values-based teachings and life skills. Our focus is on fostering community harmony, appreciating our cultural heritage, promoting inclusivity, environmental stewardship, and respect for all. Through this approach, we aim to cultivate learners' understanding of themselves, respect for humanity and love for country, as embodied in our National Vision, Anthem, and Pledge.*

## Unpacking the Philosophy

The education philosophy outlined in the preceding statement reflects a holistic and inclusive approach to education, rooted in values and aimed at nurturing every individual to reach their full potential. The philosophy appears to prioritise not only academic achievement but also the holistic development of students as individuals and responsible members of society. By integrating values-based teachings, life skills, cultural appreciation, and environmental consciousness into the educational experience, the Jamaican educational system aims to prepare students to navigate the complexities of the modern world with a strong foundation of knowledge, skills, values, and a sense of purpose.

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Email: [shbarrett@utech.edu.jm](mailto:shbarrett@utech.edu.jm)



Let's break down the key elements of this philosophy:

1. **Embracing diverse learning capacities and styles:** Recognizing that each learner is unique, the Jamaican educational philosophy acknowledges and embraces different learning preferences and abilities. This approach indicates a commitment to personalized and inclusive education that caters to the needs of all students. The question is: how this is reflected in the curriculum and the classroom experience when students are learning via route and lessons are predominantly one size fits all as they strive towards culminating exams: PEP at the primary level and CSEC at the secondary level. Students with learning challenges continue to struggle and be left behind in the system. For example, the Patterson Report (2022) noted that a “breakdown of the language arts results indicated that a third of students at the end of primary school could not read, 56% could not write, and 57% could not identify information in a simple sentence” (p25). The report further notes that although the great majority of its [Jamaica's] children have access to primary and secondary schooling, Jamaica has a severe learning crisis, in that a majority of students at the end of primary school remain illiterate and innumerate and most leave secondary school with no marketable skills (p25). This outcome is a violation of this philosophical principle of embracing diverse learning capacities and styles and points to the need for much more to be done to realize this philosophical aspiration.
2. **Comprehensive education:** By blending academic and vocational pursuits with values-based teachings and life skills, the philosophy seeks to provide a well-rounded education that equips students not only with academic knowledge but also with practical skills and moral values necessary for success in life. However, given the government's focus on STEM/STEAM it is interesting that the philosophy statement does not explicitly address the specific aspects of STEM education and its importance in preparing students for the challenges of the modern technological world. It lacks a clear emphasis on the critical role of STEM education in fostering innovation, problem-solving skills, and scientific literacy and the other key skills and knowledge needed to thrive in a rapidly evolving technological landscape.
3. **Fostering community harmony and inclusivity:** The emphasis on promoting community harmony, appreciating cultural heritage, and fostering inclusivity suggests a commitment to creating a supportive and inclusive learning envi-

ronment where students from diverse backgrounds feel respected and valued. It appears to embrace a fundamental principle of quality education which is *education should be accessible to all learners, regardless of their background, gender, ethnicity, or socio-economic status*. Inclusive education practices ensure that every student has the opportunity to learn and succeed. But again, we find dissonance between the written philosophy and the lived reality of the classroom. Far too many of our students continue to feel devalued, disrespected, unfulfilled and excluded and insignificant for various reasons. These reasons may include but are not limited to their socio-economic background or their inability to function academically or behavioural challenges. Of note here is that 17% of primary age children were reported to be out of school due mainly to economic factors (lunch money and transportation fare) and boredom (Patterson Report, 2022). Additionally, rooted in our education system is this dual system evidenced by the existence of two types of schools at the secondary level: the traditional high schools and the non-traditional high schools. This system perpetuates the persistent inequity in access to quality secondary level education due to the difference in availability of resources, physical and human, between the two types of schools.

We acknowledge that in recent years, the country has made concerted efforts to ensure that all Jamaicans, irrespective of their socioeconomic background, have equal access to affordable, quality education and training opportunities (PIOJ, 2022). However, the system continues to be dogged by this challenge such that as noted in the Patterson Report (2022), “most students leave secondary school without a certificate – 70 percent of the 18-year-old cohort in 2018” (p24). This is unacceptable.

4. Environmental stewardship and respect for all: By promoting environmental stewardship and respect for all individuals, the philosophy aims to instil values of environmental responsibility and social respect in students, encouraging them to become responsible global citizens who care for both the planet and its people. A lot takes place in many schools in terms of environmental awareness through the environmental clubs in those schools along with the various environmental competitions in which student participate. This is commendable. Where the challenge lies are in the area of respect for all and the valuing of human life. The frequent incidents of violence being perpetuated in our schools is appalling.

5. Cultivating understanding, respect, and love for country: By emphasizing the cultivation of learners' understanding of themselves, respect for humanity, and love for their country, the philosophy aims to instil a strong sense of identity, empathy towards others, a sense of national pride, civic responsibility, and cultural appreciation in students, as reflected in Jamaica's National Vision, Anthem, and Pledge. Here we see an articulated desire of the education system to respond to the challenge of alienation, greed and crime and violence that threatens our society. Developing a sense of agency is vital to one's personal adjustment in society and one's ability to develop harmonious relationships. Therefore, the school system must respond with a supportive system, and a positive school climate that is accommodating of all students learning. A positive school climate is described as an environment of support, encouragement, warmth, and acceptance; where students are valued and have a sense of safety and belongingness; and where teachers and students can form relationships of trust, respect, caring, and appreciation (Berkowitz, Sherblom, Bier, & Battistich, 2006; Hansen & Childs, 1998). This also positively impacts students' academic achievement as indicated by writers such as (Benninga, Berkowitz, Kuehn, & Smith, 2003; Berkowitz & Bier, 2005). However, the local news, print and otherwise and social media are replete with news of conflicts and fights between students and even students with teachers. How we change this trajectory and achieve this aspect of the education philosophy must be interrogated with urgency.

Overall, the philosophy of Jamaica's education system is laudable and does articulate a vision that in many ways should support the accomplishment of Vision 2030 *Jamaica being the place of choice to live, work, raise families and do business*. However, the lived experience of many students falls well below these stated aspirations and, as such, leaves much to be desired if the philosophy is to be more than just a well-documented statement.

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## Notes on Contributors

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**DELTON A. GORDON** obtained his Doctor of Philosophy in Criminology and Criminal Justice at the Atlantic International University. He is the Head of the Forensic Division and Lecturer at the University of Technology, Jamaica. His research interests include Forensic Science, Criminology, and Criminal Justice.

**ANDREA B. FENDER-LONGMAN** obtained her Master of Philosophy in Zoology at the University of the West Indies, Mona, Jamaica. She is a Senior Lecturer in the Biology Division at the University of Technology, Jamaica. Her research interests are varied to include Education, Ecology, Environmental and Forensic Science.

**DUJON D. L. DUNN** obtained his Master of Philosophy in Mathematics at the University of the West Indies, Mona, Jamaica. He is a Lecturer in the School of Mathematics and Statistics at the University of Technology, Jamaica. His research interests include Applied Data Science, Machine Learning, and Artificial Neural Network Methods for solving non-linear differential equations, etc.

**NATALA BURNETT** is a lecturer in the Faculty of Science and Sports at the University of Technology Jamaica; she is a graduate of the University of the West Indies, Mona (BSc Biochemistry; PhD Molecular Biology) and a Fulbright Scholar. Her research interests include Molecular Biology, Biotechnology, Plant Tissue Culture, Genotyping, Microbiology, Agricultural Development and Caribbean Policy.

**BRITNEY DALLINGTON** obtained her Bachelor of Engineering in Chemical Engineering Degree at the University of Technology, Jamaica, in 2023. Her research interests include the creation of value-added products from ackee waste as well as sustainable fuel generation.

**JEROHN BROWN** is a final year student in the Bachelor of Engineering, in Chemical Engineering programme, at the University of Technology, Jamaica. His research interests include sustainable energy, plastics, and environmental science.

**PATRICK ANDERSON** is a graduate of the Bachelor of Engineering in Chemical Engineering programme (2023) from the University of Technology, Jamaica. His

research interests involve finding solutions in the modern world concerning sustainable energy.

**SHEMONE WRIGHT** obtained her Bachelor of Engineering in Chemical Engineering at the University of Technology, Jamaica, in 2023. Her research interests are sustainable engineering-based, with a special focus on wastewater treatment engineering and creating green and sustainable energy from agricultural waste in Jamaica.

**LISA D. A. BRAMWELL** is an associate professor in the Chemical Agricultural and Biological Engineering Department in the School of Engineering at the University of Technology, Jamaica. She is a graduate of Clarkson University, Potsdam, NY, with a PhD in Civil and Environmental Engineering. Her doctoral thesis evaluated the use of CONTAM (NIST, USA) to model the transport of pollutants within the residential micro-environment.

**DAVID A. VERDECIA TORRES** obtained his Master's in Energy Management at the University of Cienfuegos, Cuba. He is a Senior Lecturer at the University of Technology, Jamaica. His research interest includes Mathematical Modelling, Energy Management and Biomass Combustion.

**UFOT B. INAMETE** is a professor of political science at Florida A&M University. His current research areas are national security policy; foreign policy decision-making systems and theories; diplomacy; comparative studies of multinational corporations; the design, development, and creation of premier high technology economy corridors in international border regions; comparative studies of the economies of international border regions; international/comparative political economy; and, comparative studies of federal systems (as mechanisms for the management of irredentism, separatism, and other forms of intra-state and inter-state conflicts, due to regional, religious, ethnic/nationality, and/or language differences).

**JUNIOR A. BENNETT**, Graduate Research Assistant and PhD student, Purdue University, USA. He is a former Lecturer and Industrial Work Experience (IWE) Coordinator of the University of Technology, Jamaica. He has a M.Sc. in Manufacturing Engineering Systems from Western Illinois University, USA. His research interests are productivity improvement, Extended Realities Technology in STEM, cooperative education, and higher education institution leadership.

**ARLENE MCKENZIE-CAWLEY**, MSc. in Power Electronics and Drives, University of Birmingham, England. Lecturer and Industrial Work Experience Coordinator, UTech, Jamaica. Research interests: Ocean waves power, generation technology, piezoelectric, project-based teaching and productivity improvement.

**SHANA-GAE T. REID** obtained her Master of Education in Educational Administration at the University of the West Indies, Mona. She is a Lecturer, Course Coordinator for College English, and Research Supervisor at the Caribbean Maritime University. Her research interests include Educational Leadership, Quality Assurance, English Language Evolution, and Child Literacy and Safety.

**MYLÈNE R. FERRIERA** is a French Lecturer at the Caribbean Maritime University, Kingston, Jamaica. She holds a master's degree in Languages from the University of Rouen, France. Her research interests include Education and Maritime related issues.

**GEORGE A. FERRIERA** is a Physicist and lectures at the University of Technology, Kingston, Jamaica. He holds an MSc Degree in Applied Physics from Brunel University, West London and is currently a PhD candidate in Applied Physics specialising in non-ionizing radiation at the University of the West Indies, Kingston, Jamaica. His research interests include Education and Medical Physics.

**SONIA A. RICHARDS-MALCOLM** obtained a Doctor of Health Science from Nova Southeastern University. She is a Professor of Clinical Laboratory Sciences and Vice Dean of the College of Health Sciences at the University of Technology, Jamaica. Her research interests include health policy, public policy, ethics, stem cells, clinical sciences, education, and human resources management.

**TIECA HARRIS-KIDD** obtained a Master of Philosophy in Pharmaceutics from the University of Technology, Jamaica. She is a Senior Lecturer at the University of Technology, Jamaica and a registered Pharmacist with the Pharmacy Council of Jamaica. Her research interests include pharmacy and pharmaceutical science education and pharmacy practice specialising in compounding of medicines and paediatric medicines.

**ANDREA M. WILKINS-DALY** obtained a Doctor of Pharmacy (PharmD) from The Ohio State University, USA. She is a Senior Lecturer at the University of Technology, Jamaica, a trained educator, and a registered Pharmacist with the Pharmacy Council of Jamaica. Her research interests include diabetes education, women's health, and education.

**CAROL HUTCHINSON** obtained her Master of Education in Special Education at The Mico University College and her Bachelor of Arts in Community Development at the Mel Nathan College (A Constituent College of the International University of the Caribbean). She is the Supervisor of the University of Technology, Jamaica

Mustard Seed Communities Centre, which serves the population of children with severe disabilities. Her research interests include exploring the different aspects of the Jamaica Disabilities Act of 2014.

**ANDREA PUSEY-MURRAY** is an Associate Professor and Coordinator of Graduate Studies, Research and Entrepreneurship in the College of Health Sciences, University of Technology, Jamaica. She has published peer-reviewed articles in journals such as the International Journal of Nursing Science, Biomedical Science and Engineering, and Mental Health in Family Medicine.

**SHAUN WRIGHT** obtained a Doctoral Degree in Business Administration from the University of Phoenix. He is the founder and managing director of the College of Entrepreneurship & Innovation Limited. He is a part-time lecturer and facilitates research supervision at all levels. His research interests are entrepreneurship and small business development, financial management and accounting, project and program evaluation, organisational behaviour, construction engineering, and education.

**SHORNA MCGHIE** obtained a Master of Science in Counselling and Consulting Psychology from the International University of the Caribbean. She is a Lecturer and Programme Leader for the Post Registered Midwife completion degree in the Caribbean School of Nursing for the College of Health Sciences, University of Technology, Jamaica. Her research interests are maternal and child health, public health nursing, marriage and family life, parenting, clinical sciences, and education.

**ADELLA CAMPBELL** obtained her Doctor of Philosophy in Nursing at the Victoria University of Wellington, New Zealand. She is an Associate Professor and Dean in the College of Health Sciences, University of Technology, Jamaica. Her research interests include Health issues, Health Policy, Nursing, Midwifery, HIV/AIDS, and COVID 19 and Food Security.

**FITZROY HENRY** obtained his PhD from the University of London. After being a research scientist on five continents, he was a professor of public health nutrition at the University of Technology, Jamaica, for 10 years. His research interests include public policy, food security, chronic diseases, nutrition, and environmental health.

**ANDRAY LAWRENCE** obtained his Master of Science in Information System Management with a major in Enterprise Security at the University of Technology, Jamaica. He currently serves as the university's Data Protection Officer. His research interests



include Data Privacy and Security, Artificial Intelligence, emerging technologies and privacy and online exam security.

**SHERMAINE BARRETT** obtained her PhD in Work and Human Resource Education from the University of Minnesota, USA, and a Master's in Adult Education from Mount Saint Vincent University in Halifax, Canada. She is a Professor of Adult Education and Workforce Development and Deputy President (Acting) at the University of Technology, Jamaica. Her research interests include adult teaching and learning, online teaching and learning, workforce education, STEM and TVET education and teacher professional development.

# Journal of Arts Science and Technology

## Submission Guidelines

### About the Journal of Arts Science and Technology

The *Journal of Arts Science and Technology (JAST)* is the flagship, international, multidisciplinary, peer-reviewed journal of the University of Technology, Jamaica. Its publication is in keeping with one of the objects of the University of Technology Act, to “preserve, advance, and disseminate knowledge through teaching, scholarship and research . . . and to make available the results of such . . . to promote wisdom and understanding.”

### Aims and Scope

*JAST* aims to promote and enhance research and technology in diverse fields of knowledge, including engineering, computing, business management, finance, marketing, health, sports, pharmacy, arts, hospitality, architecture, urban planning, education, liberal studies, and law.

### Responsible Office

The School of Graduate Studies, Research & Entrepreneurship [SGSRE] is responsible for the academic publications of the University of Technology, Jamaica. The school is directly in charge of the publication of *JAST*.

### Frequency of Publication

*JAST* is published twice per year.

## Author Representation

The Editorial Board of the *Journal of Arts Science and Technology (JAST)* considers the submission of a manuscript to be representation by authors that it is not copyrighted by another party, not currently under consideration for publication elsewhere, and was not previously published.

The *JAST* considers the following types of articles for publication:

- **Research Article** (A written account of original research results; should not exceed 6,000 words, excluding references and appendices).
- **Concept Paper** (Should outline a proposed idea, project, or research study by providing a clear and concise overview of the concept, including its rationale, objectives, methodology, and potential outcomes; 1000–3000 words).
- **Commentary** Should be written in a coherent manner and provide insight, analysis, or criticism of a topic to encourage readers to think critically about the issue; 1000–1500 words).
- **Book Review** (A critical analysis and evaluation of a book's content, style, and relevance, comprising a summary of the book's main ideas and themes, an assessment of its strengths and weaknesses, and a recommendation for or against reading the book; 500–800 words).
- **Industry Perspective** (A point of view from the standpoint of a practitioner within a particular industry, involving analysing and interpreting the various economic, social, and technological factors that affect the industry, as well as the opportunities and challenges that arise within it. 800–1000 words).
- **Scholarly Personal Reflection** (A combination of personal experiences and academic analysis to explore a particular topic; it is a reflective essay that goes beyond a simple personal narrative by incorporating critical thinking and academic research; 1000–1500 words).

## Preparation of Manuscripts

*Language:* English

*Writing style:* The following writing styles are acceptable: APA, MLA, Chicago, or others based on authors' disciplines.

*Font, line-spacing, alignment:* Calibri, double-spaced lines in MS Word, 12-point font, margins 2.5 cm, and left align.

## Organization of Manuscripts

### Research Article

- Title page (The front page should include the title only).
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- Introduction (State background – nature, significance, and scope of the problem investigated, the research questions, and the methods used)
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- Materials & Methods (Provide the details of the materials and methods used; may include research design, sample selection, data collection procedures, data analysis, reliability & validity, & ethical issues considered)
- Results (Summarize and present the results in a clear and concise manner; tables, graphs, or other illustrations may be used as appropriate; report descriptive or inferential statistics as appropriate)
- Discussion (Explain the results in relation to the research questions/objectives; show how the results and interpretations of them agree (or disagree) with the published literature; present alternative interpretations (if any); theoretical or practical implications).
- Conclusion (State conclusions clearly based on the results; summarize the evidence for each conclusion)
- References (Use APA {latest edition} or an appropriate discipline-specific style)
- Acknowledgements (Optional)
- Appendix (Optional)

### Concept Paper

Title page (The front page of the Concept Paper should include the title only).

Body: Should follow a logical order

References (Use APA {latest edition} or an appropriate discipline-specific style)

Acknowledgements (Optional)

## Commentary

Title page (The front page of the Commentary should include the title only).

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References: (Use APA {latest edition} or an appropriate discipline-specific style)

Acknowledgements (Optional)

## Book Review

Title page (The front page of the Book Review should include: the title of the book being reviewed, name, affiliation, postal address, and email of the Book Reviewer).

Body: Should follow a logical order

## Industry Perspective

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Title page: (The front page of the Scholarly Personal Reflection should include the title only).

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References (Use APA {latest edition} or an appropriate discipline-specific style)

Acknowledgements (Optional)

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Please submit a separate page with all the names and affiliations of each author. The title, abstract, and keywords should be the only material on the first page (title page) of the manuscript. There should be no acknowledgements, footnotes, or other information that could be used to identify the authors.

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Each author should include a brief bio on a separate page that lists their highest degree, affiliation with the institution, current position(s), and areas of interest in research.

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Manuscripts that do not adhere to the submission guidelines may be returned to the corresponding author. Feel free to contact our editorial team at [jasteditor@utech.edu.jm](mailto:jasteditor@utech.edu.jm) if you have any questions or need help.

## Publication Fees

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# The School of Graduate Studies, Research & Entrepreneurship



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