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Acknowledgements

THE EDITORIAL BOARD AND MANAGEMENT COMMITTEE OF THE Journal of Arts Science, and Technology (JAST) extend sincere gratitude and appreciation to Miss Janet James and Miss Heather Thompson for their combined contribution of more than 20 years of dedicated service to the journal.

Miss Janet James

Miss James served the journal for more than 12 years, during which she made significant contributions to its growth and success. Working diligently as an Assistant Editor, she played a key role in ensuring the journal's ongoing development and publication. Her expertise and dedication were instrumental in addressing critical matters such as indexing, EBSCOhost integration, and other initiatives that greatly enhanced the journal's online presence and accessibility. Her tireless efforts to advance JAST's reach and reputation have left an indelible mark on the journal.

Miss Heather Thompson

Miss Thompson served the journal for more than eight years, during which she held key roles, including Assistant Editor, and was later appointed Managing Editor prior to her departure from the university. Her insightful leadership, extensive knowledge, and unwavering dedication have been invaluable to the growth and success of JAST. As she embarks on her next chapter, the JAST team will deeply miss her expertise, guidance, and contributions.

We extend our heartfelt thanks to Miss James and Miss Thompson for their exceptional service and extend best wishes to them in all their future endeavours.

Editorial

The *Journal of Arts Science and Technology (JAST)* is the flagship journal of the University of Technology, Jamaica. Its publication is in keeping with one of the 'Objects' of the University of Technology, Jamaica Act, which is to "Preserve, advance, and disseminate knowledge through teaching, scholarship and research . . . and to make available the results of such . . . to promote wisdom and understanding."

The collection of research papers, commentaries, and a book review in this issue of *JAST*, Volume 16, No. 3, covers a range of topics and domains of scholarship and give credence to the multidisciplinarity of the journal.

Research that has not been published remains incomplete and inaccessible. Therefore, the publication of research work is important for advancing scientific knowledge, fostering collaboration, and ensuring transparency. It enables researchers to share findings and discoveries, validate methodologies, and build on prior work. Peer-reviewed publications establish credibility, encourage innovation, and guide evidence-based policy decisions, making them essential for driving progress and maintaining the integrity of the scientific enterprise.

In the case of scholarly commentaries, they hold significant value in academia because they serve multiple critical functions that contribute to the development and dissemination of knowledge. The functions include helping to clarify complex ideas, illuminate ambiguities, and place works in their broader contexts; fostering critical dialogue within a field, encouraging ongoing discussion and debate that drives intellectual progress; connecting ideas from one discipline to others, providing interdisciplinary insights; framing discussions around challenging topics; and allowing scholars to demonstrate expertise in a subject area, contributing to their academic reputation and career advancement.

Concerning book reviews, acting as a bridge between readers and authors, they are essential for helping readers gain insights into a book's content and quality and engage with diverse perspectives to enhance their reading experience.

Below is a synopsis of the research papers, commentaries, and the book review that comprise this issue of JAST:

The lead research paper, **A Communication-Enabled EV Charging Infrastructure for High-Rise Residences in Jamaica,** presents the design for development of a communication-enabled electric vehicle (EV) charging system tailored for multi-dwelling facilities such as the mushrooming high-rise residences in Kingston, Jamaica. The authors posit that the surge in high-rise residential construction and the government's promotion of electric vehicles (EVs), warrant an efficient EV charging infrastructure in these densely populated areas.

The author of the second research paper, **Single-Frequency Networks: Enhancing Wireless Communication Reliability and Coverage in Jamaica**, investigated the potential of single-frequency networks (SFNs) to address wireless communication challenges in Jamaica, and provides a guide for implementing and testing SFNs in the island's wireless communication landscape.

In research paper three, **Impact of Phishing on Smart City Development: Can Behavioural Economics Provide an Explanation?**, the authors underscore that ICT infrastructure and use of the related services form the spine of smart city development, but there is a direct relationship between the use of ICT services and cybersecurity risk exposure for States seeking to develop smart cities through ICT while contending with the lack of trust in these systems due to cyber-attacks, primarily phishing, at the same time. They explore the literature on phishing and behavioural economics and adapt the Nudging Theory to develop a conceptual framework concerning the types of encouragement or 'nudges', offered by States, that may be effective in increasing the usage of ICT services, especially when lack of trust exists.

The fourth research paper, **Using Deep Learning and Neural Networks to Detect Trojans Within a Network**, delves into the subject of risks to computer networks posed by malicious trojan malware. The authors propose a cost-effective and efficient framework that uses deep learning models to improve the protective capacity of firewalls, enabling them to automatically learn and expose hidden properties within network traffic.

In research paper five, **Screening and Monitoring for Modifiable Risk Factors in Users of Atypical Antipsychotics**, the authors note that, whereas antipsychotics used to treat mental disorders improve patients' quality of life, atypical antipsychotics have attendant risks. This motivated them to assess the practices of healthcare practitioners in screening and monitoring modifiable risk factors in patients prescribed atypical antipsychotics at Jamaica's psychiatric hospital.

Research paper six, **Crisis and Resilience: Jamaican Tertiary-level LGB Students Navigating Identity Formation in Homonegative Educational Contexts**, draws on data gathered from individual interviews with students

and alumni of Jamaican higher education institutions who identify as LGB, and reports on how societal and campus-based homonegative attitudes and behaviour affected their psychosocial development, including the integration of their sexual orientation into their identity.

Within the context of generally weak writing skills among tertiary-level students in Jamaica, the authors of research paper seven, **Common Errors Made by Students Pursuing a Tertiary Level Media and Communication Programme**, used a mixed method approach to ascertain their main types of writing errors and the likely contributing factors. Based on their findings, the authors offer recommendations to address the students' writing deficits.

The author of research paper eight, **Addressing Learning Disabilities in the College English Classroom**, noting that trends indicate an increased number of students with learning disabilities are already enrolled in universities, sought to establish whether further research into the need for more accessible testing for learning disabilities among tertiary level students in Jamaica was warranted.

For research paper nine, **ICT Integration as Reflected in the Written National Standards Curriculum for Mathematics, English Language and Integrated Science**, the authors report on a qualitative document analysis of the associated curriculum documents for three subjects in Jamaica's NSC; the document analysis was undergirded by use of the Substitution, Augmentation, Modification, and Redefinition (SAMR) theory. The findings motivated the authors to offer recommendations to address identified gaps.

The authors of the tenth research paper, **Midwifery Students' Perception of Reintegration in the Clinical Area During COVID-19**, deployed quantitative and qualitative research methodologies to investigate what changes a leading university made to the clinical rotation for its midwifery course of study due to COVID-19 and whether the protocols implemented affected the interaction among the staff, patient, and students in the clinical space; the findings informed recommendations.

In the eleventh research paper, **The Relationship Between Student Employment and Academic Performance: A Case Study**, the authors sought to illuminate the complex relationship between the grades attained by students who work while pursuing their study; they link the utility of their findings to academic advisement.

For research paper twelve, **"Double Whammy?": Unravelling Academic Writing Challenges Students Face in Remote Teaching and Learning**, the authors, within the context of the significant challenges the COVID-19 pandemic posed for educational institutions, investigated and reported on the specific challenges students faced in their academic writing modules during remote teaching and learning, and used their findings to scaffold recommendations.

For the thirteenth research paper, **The Impact of Family Income and Education on University Students' Academic Performance**, noting that for many years it has been asserted that students residing in an educated and financially stable family perform better academically than those from families of low socioeconomic status, the authors used a descriptive cross-sectional survey to investigate and report on whether family earning had a bearing on the Grade Point Average (GPA) earned by students and their ability to procure needed educational supplies.

The fourteenth research paper, **Performance-Based Task Pedagogical Strategy for Assessment and its Effect on Mathematics Performance of Jamaican Grade Nine High School Students**, reports the results of a study aimed at addressing the problem of decreased performance in mathematics amongst students at a rural High School. The researchers also sought to ascertain how teachers and students perceived performance-based tasks (PBT) as an assessment strategy. Based on the results, the authors recommend how teachers' capacity may be enhanced to effectively integrate PBT tasks into their student exercises.

In the fifteenth research paper, **People Leadership: Succession Planning in Health Information Management**, the author sought to get deeper understanding of succession planning practices, identify challenges with succession planning, and identify strategies that could be adopted to enhance succession planning in HIM in Jamaica. From the findings, recommendations are offered to address identified gaps.

The author of the first commentary, **'B-STEM': Integrating STEM Approaches with Business Education**, adds to the discourse on STEM by positing that as a pedagogical model it can be integrated with business education disciplines, and similarly, business education can be integrated with STEM approaches to better prepare the future workforce with strong business and scientific aptitudes and attitudes.

In the second commentary, **Decoding Ancestral Food Matrix to Address Food Insecurity**, the author argues that two historical factors that played a major role in the Caribbean region's legacy of food insecurity were European colonisation and the existence of plantation societies that used forced labour by Africans and Indigenous peoples. And, citing data from the UN's Food and Agriculture Organisation that today Caribbean food insecurity is still driven by structural inequalities and economic constraints, coupled with climate change vulnerability and an over-reliance on imports, the author declares that the real solution also lies in our history, in the survival tactics of our ancestors, from whom we can learn how they navigated scarcity, and their resilience in the face of adversity.

The author of the third commentary, **UTech, Jamaica: The Centre for STEM**

Education and Enabler of a Highly Skilled Workforce, argues that transformation of STEM education at the tertiary level in Jamaica is crucial for creating a more inclusive and prosperous society and, therefore, as Jamaica's national STEM University, UTech, Jamaica, in its own right, and through collaboration with other institutions, must bring tertiary education down to the K-12 pipeline through the Sixth Form Pathways Programme thus providing opportunities for students who may not have otherwise pursued further studies.

In the fourth commentary, **STEM Education: Empowering Creativity and Problem-Solving for a Better Future**, the 14-year-old author argues that STEM education is the future, because it facilitates solutioning the many problems being faced by society and is also how young people, including herself, will be empowered to think creatively and apply that creativity to not just be able to innovate today but build a better tomorrow.

The author of the fifth commentary, **Police Stop and Search: What Does the Law Say?**, cites the Jamaican Constitution, the Charter of Fundamental Rights and Freedoms, case law, and legal authorities to illuminate the often-controversial subject of 'police stop and search'.

The reviewer of the book, **Innovation Policy Formulation for Socioeconomic Transformation of Developing States**, describes its publication as very, very timely because Jamaica has dabbled in bits and pieces around the idea of innovation, but has not embraced it fully – conceptually or pragmatically although doing so it is critical to moving forward, especially given that Vision 2030 requires a National Innovation Policy, as a structural support to give it legs to move it in that direction. The Reviewer endorses the book as an important addition to the literature of innovation, particularly because there is a paucity of information about innovation in the Caribbean, innovation policy, and the importance of it.

Dr. Paul W. Ivey,
Editor-in-Chief

A Communication-Enabled EV Charging Infrastructure for High-Rise Residences in Jamaica

RENEE CAMPBELL, DEVONTEE STEELE, TRINA ROBINSON, AND **CAROLYN FERGUSON ARNOLD**
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Abstract

As Kingston, Jamaica, experiences a surge in high-rise residential construction and the government promotes electric vehicles (EVs), there will be a need for an efficient EV charging infrastructure in these densely populated areas. This paper presents the design and development of a communication-enabled EV charging system tailored for multi-dwelling facilities such as these high-rise residences. The system supports multiple EVs, provides real-time charging status updates, and incorporates Open Automated Demand Response (OpenADR) for energy management. A prototype was developed to demonstrate the system's functionality, including user authentication, charging initiation and monitoring, and data collection. The prototype successfully simulated EV charging, tracked usage patterns, and demonstrated the potential for remote monitoring and billing. This capability can promote increased satisfaction among users. The collected data can inform future planning for EV infrastructure expansion and load management by the Jamaica Public Service Company (JPSCo). Further work is required to integrate the prototype on to a charging station and address any related issues. Actual user data can also be garnered to measure satisfaction. Further work is also required to determine economic and environmental impacts and benefits of implementing the system.

Keywords: Electric Vehicle Charging, High-Rise Residences, OpenADR, Communication Infrastructure, Jamaica

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Introduction

As the government of Jamaica increases the push for electric vehicles and with the increase in high-rise construction in Jamaica, it is anticipated that there will be an increased density of electric vehicles within these residences. "Electric vehicles (EVs) tend to increase peak power for residences in the evening when house owners return home and begin charging. The aggregated EV charging demand can cause a sudden rise in the peak power at the distribution system level . . ." (Gong & Ionel, 2020). High rises have a higher density of residents than family homes and would present an even greater challenge for the owners of electric vehicles and the utility provider. According to Francis (2022) some 50,000 electric vehicles are projected to be in the country by 2030, however it is difficult to project an adoption rate.

This project aims to develop a comprehensive design for electric vehicle (EV) charging infrastructure tailored for these high-rise residences where the EV charging station may be a limiting resource compared to the number of users. The proposed system will support charging for multiple vehicles on a single charging station, ensuring efficient use of the resource. An integrated communication system will notify users of their charging status, preventing prolonged occupation of charging stations and promoting optimal usage. The communication infrastructure will also relay billing information, allowing users to monitor and manage their power consumption effectively. The design incorporates Open Automated Demand Response (OpenADR) technology, which empowers users to adjust their consumption patterns, thereby reducing costs and enhancing energy efficiency. Additionally, property managers will benefit from tools to monitor charger usage and manage the infrastructure effectively. This project will not only facilitate the adoption of electric vehicles but also contribute to sustainable energy practices in high-density residential areas, aligning with Jamaica's energy policy goals, given the potential that "EVs can be readily deployed to enhance the reliability and flexibility of power grids." (Pham et al., 2017).

Research Questions

1. How can a communication-enabled EV charging infrastructure be effectively integrated into multi-dwelling facilities such as high-rise residential buildings?
2. How can the user interface of the EV charging system be designed to enhance user satisfaction and adoption?

Justification

In the first half of 2022, international sales of battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) rose by 62% compared to the same period in 2021 (Irle, 2024). This global trend is likely to affect Jamaica, especially as the Jamaican government has reduced import taxes on electric vehicles to 10% and removed license fees, according to Jamaica Information Service ([JIS], 2022), in order to promote their adoption. However, the lack of EV charging infrastructure, particularly in high-rise residences, presents a significant barrier. The anticipated rise in electric vehicle usage is expected to coincide with increased construction of high-rise residential buildings in urban areas. According to Graham (2024), Real estate developers are requesting EV chargers to be installed in their new apartment complexes.

This project proposes a standard for enabling communication for EV charging. It is important to standardize the design of EV charging infrastructure to manage this increased density. Standardization will ensure adherence to necessary protocols and enable Jamaica's sole electricity provider, the Jamaica Public Service Company (JPSCo), to plan for the load implications of new charging stations. This project will leverage OpenADR to reduce costs and implement a communication infrastructure to help users monitor their energy consumption. The system will support simultaneous charging for multiple vehicles, making it both cost-effective and practical. According to Connect (2022), you can think of OpenADR like a sort of global translator between end users (drivers and vehicle manufacturers), charging stations and the systems that provide power. Normally these systems can't communicate with each other in any usable way for most users. With OpenADR, not only does that change, the translation also serves to make power delivery more efficient and effective. Especially in conjunction with Open Charge Point Protocol (OCPP), it can help save the power grid (Connect, 2022).

Scope of the Project

The project involved designing and constructing a single prototype charger equipped with a remote communication infrastructure accessible to users via an internet connection. This enabled users to monitor and manage their charging sessions remotely, enhancing convenience and ensuring effective utilization of the charging system.

Significance of Project

This project holds significant value for various stakeholders. It will benefit residents of high-rise residences by providing convenient access to EV charging at home. Property developers will see increased property values by including this amenity. For JPSCo, standardizing EV charging infrastructure with OpenADR will provide needed information to help manage electricity demand increases from EVs. Additionally, the project aligns with the Jamaican government's Vision 2030, the country's long-term strategic development plan, by promoting the widespread adoption of electric vehicles.

Literature Review

As the adoption of electric vehicles (EVs) continues to grow, so too does the need for adequate charging infrastructure. In residential settings, particularly those with multiple dwellings or units, sharing EV charging stations becomes a common scenario. This review explores existing research on the challenges, strategies, and solutions related to shared EV charging in residential settings.

Yu et al. (2024) considers the so-called "last one-kilometer" for older residential communities identifying limited space for the deployment of additional charging stations. They propose a registration-based queuing charging mechanism to schedule electric vehicle (EV) charging. However, this scheme is designed to be optimized for fast chargers but demonstrates the principle of the of registering users for sharing the resource.

Nishanthy et al. (2023) demonstrated that with the use of a Transactive Energy Management System (TEMS) in a community-based residential system there was a 51.87 % reduction in Operating and Maintenance cost (O&M) with the presence of TEMS compared to being without and shows that overall system load with TEMS towards the localized grid is most effective. Therefore the capability of any system should be able to provide information to support grid performance.

Almutairi et al. (2024) considers the challenges of electric vehicles (EVs) in parking lots where multiple EVs share the same parking space, such as residential apartments. They highlight challenges due to the involvement of various factors such as limited number of chargers, limited transformer capacity and diverse driving behaviour of EV owners. Their system proposes an optimal demand management framework that addresses limited chargers, transformer capacity, and diverse driving behaviour to promote sustainable EV integration. The performance of the proposed method is compared with a conventional method and the proposed method increases the satisfaction index of the community by

up to 10%. This indicates that the drivers of electric vehicles in shared residential spaces will experience greater satisfaction if there is a system in place to manage the use of the charging stations as drivers also have diverse behaviours that could negatively affect availability.

The provision and standardization of EV charging infrastructure for high-rise residences in Jamaica have not been studied. However, research has been conducted on EV charging in residential and commercial settings, which can inform this project. Rotthier et al. (2013) highlight that home charging infrastructure is essential for the adoption of electric vehicles. This suggests that creating robust home charging solutions is critical for fostering electric mobility and presents the opportunity for doing this research.

Operators such as the Jamaica Public Service Company (JPSCo) could significantly benefit from research offering effective strategies for home EV charging. For example, Vashisth et al. (2023) propose that suitable home charging strategies can alleviate stressed operating conditions in distribution systems. These strategies can also defer investments in Distributed Energy Resources (DERs), thus optimizing the utility's operational efficiency. Sundarrajan et al. (2023) make the case for the utility company when they stated that:

> As the electrification of transportation expands, electric vehicle (EV) charging as residential loads will continue to grow. Residential EV charging has the potential to increase feeder peak loads and decrease voltage quality. As a result of this growing energy demand driven by EV, utilities may employ the use of smart charge management (SCM) controls to modify charging load profiles and mitigate these grid impacts. It is important that utilities understand both the potential benefits-as well as possible implementation challenges-before considering this technology as a solution to managing growing EV loads. (Sundarrajan et al., 2023)

The need for this study is underscored by the unique context of Jamaican multi-storey dwellings managed by strata organizations and the requirements of JPSCo. Gong and Lonel (2020) observed that electric vehicles tend to increase peak power demand in the evenings when residents return home and begin charging. This pattern indicates that without proper planning and infrastructure, the increased EV load could strain the existing power grid during peak times.

Addressing these challenges through a standardized approach to EV charging infrastructure in high-rise residences will be crucial. Such an approach would not only support the adoption of electric vehicles but also ensure that utilities like JPSCo can manage load demands effectively. This study will fill a significant gap in the literature by focusing on the Jamaican context and provide actionable insights for both strata-managed residences and the national utility provider.

Methodology

Overview of Project Design

Electric vehicle charging supply equipment typically displays the current, power, and time taken to charge the vehicle. The display and communications capability for charging stations is discussed by Trinh (2017) where he highlighted the ability to integrate communication functions to relay information over ethernet or a wireless network to a centralized station in order to monitor usage statistical data from the station. The prototype developed in this study replicated these functionalities and extended them by connecting to Wi-Fi, allowing users to view real-time information on their phones. In addition, the prototype featured RFID scanners to grant access to authorized users. All usage data will be displayed and can be utilized by strata managers and project managers to monitor the entire high-rise residence.

The implementation of Open Automated Demand Response (OpenADR) technology was integrated into the design to enhance efficiency and reduce costs. OpenADR has been used for communication on the demand side of the electric power system as outlined by Bienert and Samad (2021):

> Generation and storage are increasingly present behind the meter, in addition to consumption. To effectively coordinate energy assets in consumer facilities and address the increasing intermittency and cost variability of generation, automated demand response (DR) is becoming a necessity. For at-scale adoption globally, technology developments must be coupled with standardization. The OpenADR standards have helped drive the implementation of automated DR in many countries. (Bienert & Samad, 2021)

Key Components and Resources

The following components were utilized to build the prototype: Arduino Mega 2560 Board, RFID wireless module and tags (RC522 RFID Module), ESP32S NodeMCU Wi-Fi & Bluetooth Module, LCD display screen, Breadboard, light emitting diodes (LEDs), 5V DC Relay and an infrared (IR) Sensor. Programming languages used for the development included original C++ and Python codes. A model car and cardboard were used to simulate a residential setup.

Design of Electric Vehicle Charging Infrastructure

The design involved the following key components, each serving a specific purpose:

1. The Arduino Mega 2560, based on the ATmega2560 microcontroller, is programmed using the Arduino IDE software in C++. The board manages the overall operation of the EV charging infrastructure by executing the written code, which is compiled and uploaded to the Arduino.
2. The RC522 RFID Module is used to identify EV owners. The Arduino Mega keeps the RFID reader powered on. The RFID reader's waves detect tags within its range. When a tag is near the reader, the signal received is converted into an electrical signal, powering the microprocessor within the tag. This microchip communicates the stored data (unique ID) back to the reader, which processes it further to complete specific tasks.
3. The ESP32S NodeMCU Wi-Fi and Bluetooth module allows the charging station to transmit information to users' devices. The ESP32 connects to a Wi-Fi access point using station mode (STA), enabling internet access. This mode is the most efficient for this design.
4. The IR obstacle avoidance sensor uses infrared signals to detect the presence of an EV. The detection range can be adjusted between 2 and 20 centimeters. If an obstacle (EV) is detected, the sensor outputs a LOW signal, indicating the presence of a vehicle; otherwise, it outputs HIGH.

Prototype Operation

The Arduino monitored various states such as the presence of an EV and the status of the charging station. These states were displayed on the LCD screen, which also indicated whether access to the charging station was granted or denied.

The operation sequence was as follows:

1. The IR sensor checked for the presence of an EV.
2. The LCD displayed "Charger: Avail" if an EV was present and the station was available.
3. The user identified themself with an RFID card. If authorized, charging started with a soft press button.
4. During charging, the LED indicator was activated, and the LCD displayed "Charging."
5. The system calculated power consumption during the charging process.
6. Charging was stopped by pressing the button again, turning off the LED.
7. The system calculated and displayed the total power consumed, cost, and

duration of the charging session on the LCD and sent this data to the cloud for remote access.

Results and Analysis

The prototype was built and tested, and it functioned as designed. The following figures demonstrate the results:

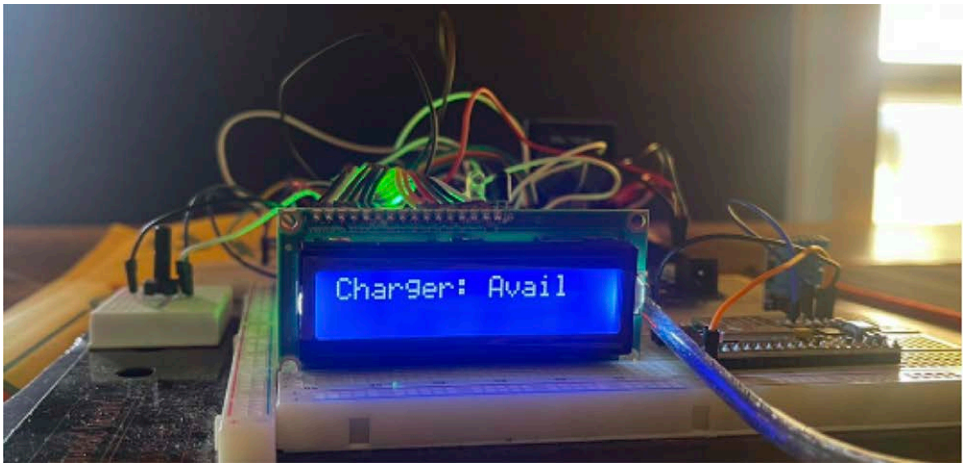

Figure 1. Display showing that a charger is available

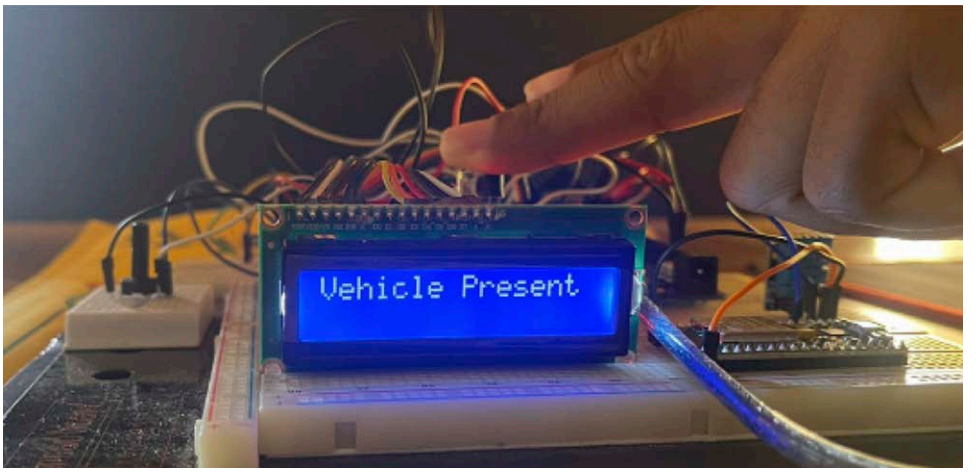

Figure 2. Display indicating the presence of a vehicle

Note: The IR sensor was covered with the researcher's finger, simulating the presence of a vehicle.

Figure 3. Display indicating unauthorized access to the charging station

Note: An unprogrammed RFID card was used to simulate this functionality.

Figure 4. Display indicating authorized access to the charging station

Note: An RFID card with information stored in the database was used to simulate this functionality.

Figure 5. Display indicating charging in progress as the user has been authorized

Note: The Figure shows the researcher simulating the initiation of charging by pressing the switch.

Figure 6. Display of the total charge time

Note: The researcher releases the switch to indicate the end of charging.

Figure 7. Display showing the cost at the end of charging

```
16:49:57.110 -> Charger: Free
16:50:02.173 -> Charger: Waiting
16:50:07.194 -> Access Denied
16:50:09.231 -> Charger: Waiting
16:50:14.239 -> Access Granted
16:50:20.978 -> Charger: Waiting
16:50:26.011 -> Charger: Busy
16:51:51.646 -> Time: 0.02h
16:51:51.646 -> Power: 197.42W
16:51:51.646 -> Cost: $0.07
16:51:51.681 -> 0.02,197.42,0.07
16:51:56.690 -> Charger: Waiting
16:52:01.728 -> Charger: Free
16:52:06.750 -> Charger: Free
16:52:46.355 -> Charger: Free
```

Figure 8. Display on the monitor connected to the serial port displaying the sequence of events at the charging station

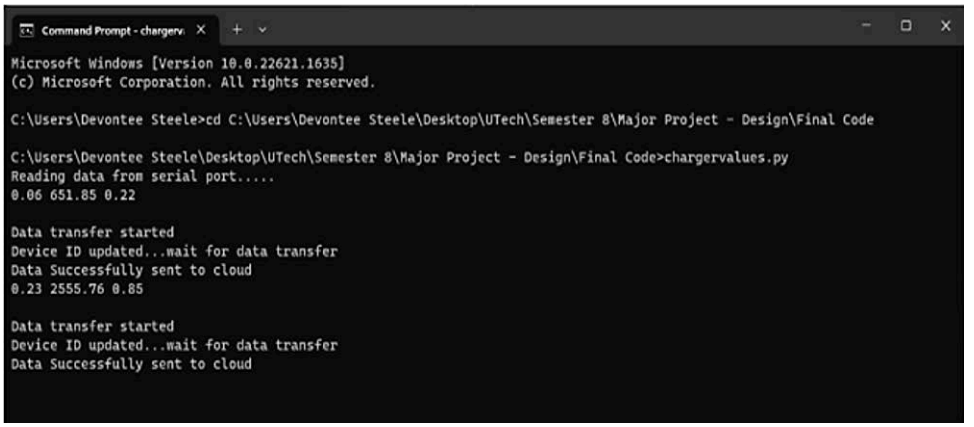

Figure 9. Charge data sent to the web server IoT platform, ubidots.com, at the end of charging

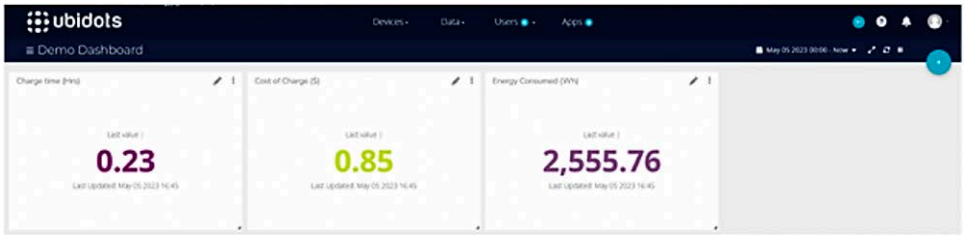

Figure 10. The dashboard showing user charge data. Duration of charge, cost, and amount of energy used

Note: Remote display for users was implemented using the IoT platform ubidots.com

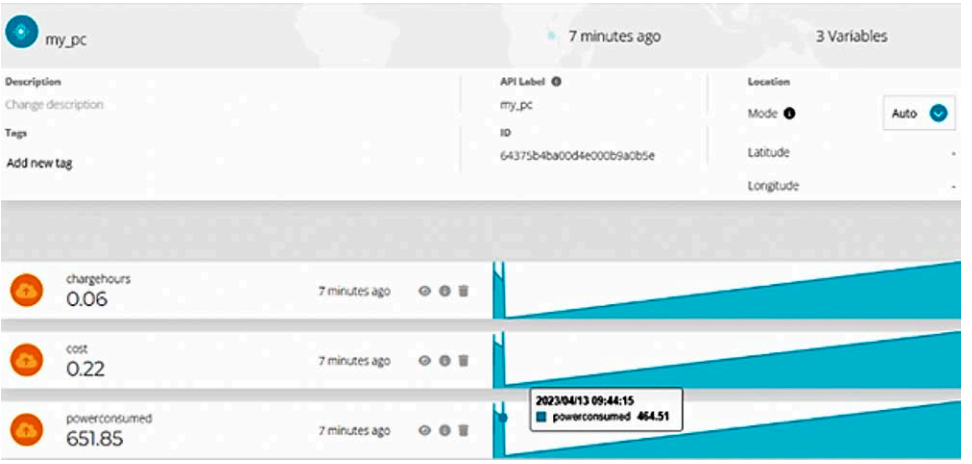

Figure 11. Aggregated data from all chargers displayed graphically

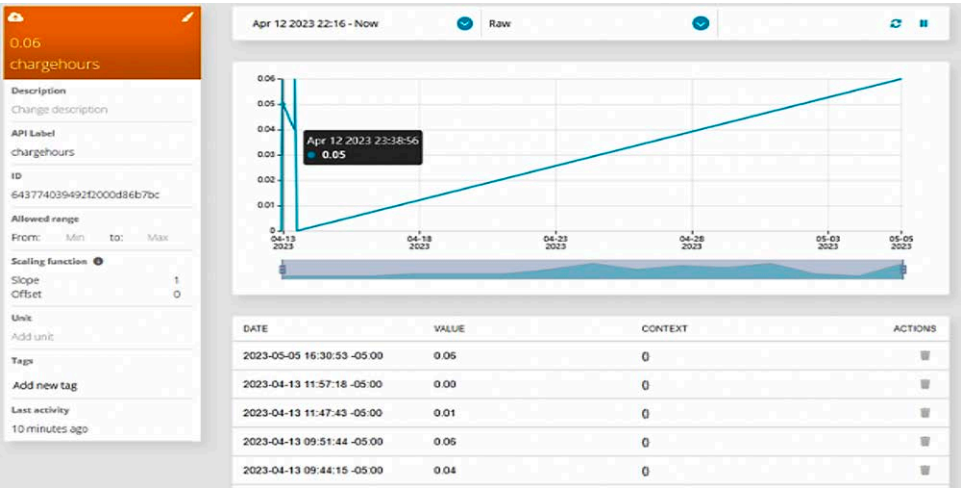

Figure 12. View of the history of a selected parameter

Note: Parameters that can be selected are duration of charge, energy consumed, or the cost of charge over the period of the recording. The ubidots generated dashboard has the ability to view all past data on any one variable and can be used by property managers or the power provider. The following flowchart provides an overview of the process:

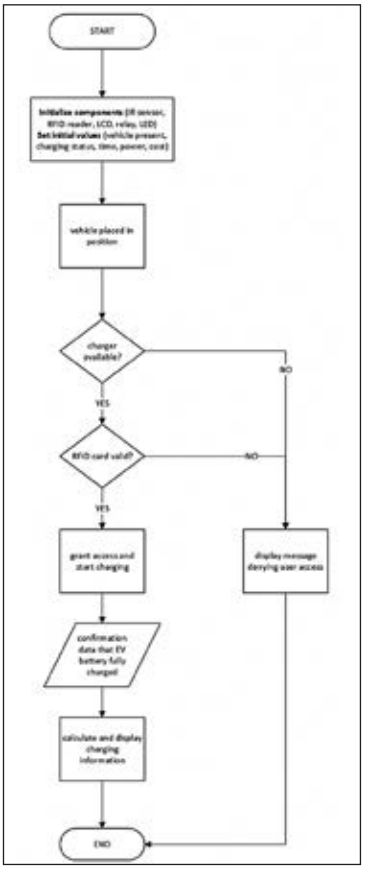

Figure 13. Flowchart of process to access and use charging station

Charger Utilization and Wait Time Analysis

This section examines the potential impact of a one-charger-per-four-EV-customer deployment strategy on charger utilization and wait times. Literature suggests that Level 2 chargers typically require approximately six hours to charge an electric vehicle (EV) from 0% to 80% (Rocket, 2024). By strategically allocating one charger per four EV customers throughout a 24-hour period, the probability of all chargers being simultaneously occupied is minimized. This approach can contribute to reducing wait times and ensuring equitable access to charging infrastructure for all EV owners.

Power Consumption and Cost Estimation

Considering the Level 2 charger specifications, we assume a 220V supply with a 50A output (Rocket, 2024). Given the residential nature of the project, the charging cost would be determined by the local utility's rate schedule. As the system falls under Rate 20, a fixed cost of $0.334 USD per kilowatt-hour (kWh) consumed applies (Jamaica Electricity Prices, December 2023 | GlobalPetrolPrices.com, n.d.).

To accurately estimate the energy consumption and associated costs for electric vehicle (EV) charging in the proposed system, we developed the following equations. These calculations are based on the assumed charge rate, voltage, and local electricity pricing for Jamaica.

- KWh Cost = $0.334/kWh
- Charge Rate (Watts) = 50 Amps * 220 Volts
- Energy Consumed (Wh) = Charge Rate (Watts) * Time of Charge (Hours)

1. Charge Rate (Watts):
   - Charge Rate = 50A * 220V
2. Energy Consumed (Wh):
   - Energy Consumed = Charge Rate * Time of Charge
3. Cost of Charge ($):
   - Cost of Charge = Energy Consumed / 1000 * KWhCost

Combined Equation:

- Cost of Charge = (50A * 220V * Time of Charge) / 1000 * 0.334 $/kWh

By using these equations, we can effectively calculate the energy consumed and the corresponding charging costs for an electric vehicle (EV) based on the duration of the charging session. This information is essential for evaluating the

economic viability of EV ownership and for making informed decisions regarding charging infrastructure planning.

Discussion

The prototype performed as expected, demonstrating a standard of hardware and software that can be effectively utilized by strata managers to monitor and manage charging stations within their complexes. The integration of RFID technology allows property managers to control access to the chargers, potentially enabling them to implement usage fees. The database system facilitates the authorization or denial of user access based on their standing with the strata, ensuring proper management and security.

EV owners can use an authorized RFID to access the charging station in their multi-storey dwelling. The system provides real-time updates on the start, progress, and end of charging, which are displayed at the charger. Additionally, the implementation of IoT technology enables users to remotely monitor charging activity, allowing them to return to their apartment and come back to the station when charging is complete.

The aggregated data can be transferred to a server, where it can be analyzed by the utility provider, JPSCo. This information will inform JPSCo of usage patterns, aiding in the planning and management of load demand.

Further Development

Future development of the prototype could include features that allow users to automatically release a charger for another user or pay a premium to retain access for a longer period. This functionality could also incorporate an override option for strata managers.

To refine the system, further testing is required by connecting the prototype to an existing charger. This will help determine realistic user behavior patterns and accumulate a larger volume of data. Such information will be crucial in establishing a practical ratio of EVs to chargers.

Additionally, a premium fee could be added to the cost of charging to cover maintenance, server hosting, data storage, and the integration of each resident into the RFID database.

Conclusion

A standard for the usage and access of electric vehicle chargers in multi-storey dwellings can indeed be developed. The prototype presented in this research demonstrated the capabilities required for EV owners, strata managers, and Jamaica's sole utility provider, JPSCo.

The system effectively recorded and stored data on charging duration, cost, and energy consumption, providing valuable insights for strata managers and the utility company. User access can be managed through RFIDs, while open communication protocols like OpenADR and free IoT platforms enabled cost-effective and straightforward information retrieval.

Overall, this research established a robust foundation for the development of standardized EV charging infrastructure in high-rise residential buildings, supporting the broader adoption of electric vehicles in Jamaica.

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Single-Frequency Networks:

Enhancing Wireless Communication Reliability and Coverage in Jamaica

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Abstract

Single Frequency Networks (SFNs) have emerged as a powerful solution in wireless broadcasting to enhance spectrum efficiency, increase coverage, and improve signal quality. This research investigated the potential of SFN deployment in Jamaica by analyzing real-world case studies, proposing a detailed methodology for implementation, and evaluating potential impact on the country's broadcasting infrastructure. The study addressed existing broadcasting challenges in Jamaica, such as spectrum scarcity, inconsistent coverage, and high operational costs, by exploring how SFNs can provide a more efficient and reliable broadcasting solution, such as in countries like Greece and the Philippines. These countries have similar geographical terrains to Jamaica. The methodology involved proposing a step-by-step approach for SFN implementation in Jamaica, including network planning, synchronization setup, and performance evaluation. The main findings indicate that SFNs can significantly enhance coverage, optimize spectrum utilization, and reduce network operational costs. These findings are significant as they demonstrate that adopting SFNs can facilitate Jamaica's transition to digital broadcasting, improve access to high-quality digital services, and prepare the country for future technological advancements, including 5G and Internet of Things (IoT) applications.

Keywords: Single Frequency Networks, Wireless Communication, Telecommunications Infrastructure, Coverage Gaps, Spectrum Utilization

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Introduction

Wireless communication networks enable connectivity and information exchange in modern societies (Haider et al., 2022). In Jamaica, as in many other regions, ensuring reliable wireless communication coverage poses significant challenges, particularly in remote areas and densely populated urban centers. Despite technological advancements, coverage gaps, signal degradation, and spectrum congestion persist, hindering the seamless delivery of communication services to all corners of the country.

Single-frequency networks (SFNs) have emerged as a promising solution to address these challenges by synchronizing signals from multiple transmitters operating on the same frequency (Gómez-Barquero et al., 2012). An SFN is a broadcasting network where all transmitting stations emit the same data on the same frequency. This allows for improving spectrum usage, a crucial goal considering that radio resources are scarce and that expanding telecommunications services has rapidly led to the congestion of frequencies (d'Andreagiovanni et al., 2022). In the Jamaican context, it is common practice for the frequency spectrum regulator to assign multiple frequencies to one radio station. This is done so that the radio station transmits its content nationwide. This is because of the country's geographical terrain. However, this practice results in inefficient utilization of the frequency spectrum in Jamaica.

Problem Statement

The Jamaican telecommunications landscape faces several pressing issues that impact the quality and reliability of wireless communication services. Remote and mountainous terrain, coupled with densely populated urban areas, create coverage gaps and signal degradation issues. Additionally, limited infrastructure investment and economic constraints hinder the deployment of traditional wireless communication solutions, exacerbating the digital divide between urban and rural areas. Addressing these challenges requires innovative approaches that leverage existing infrastructure and maximize spectrum utilization.

SFNs offer a cost-effective and scalable solution to extend wireless communication coverage, improve signal quality, and enhance spectrum efficiency (Zhang et al., 2020). Therefore, implementing SFNs in the wireless networks in Jamaica may lead to better utilization of the Jamaican frequency spectrum, among other wireless network improvements.

Hypothesis

It is hypothesized that the deployment of SFNs in Jamaica could lead to a significant improvement in wireless communication reliability and coverage, particularly in underserved rural and urban areas. By synchronizing transmission from multiple transmitters, SFNs can mitigate coverage gaps, reduce signal degradation, and enhance overall network performance. Additionally, SFNs have the potential to optimize spectrum utilization, leading to improved bandwidth efficiency and enhanced user experience.

Objectives

The objectives of this study were as follows:

1. To provide detailed information on how to assess the feasibility of deploying SFNs in Jamaica's diverse geographical and socioeconomic contexts.
2. To provide comprehensive information on how to evaluate the effectiveness of SFNs in extending wireless communication coverage and improving signal quality in rural, urban, and coastal areas in Jamaica.
3. To demonstrate effective ways to analyze the impact of SFN deployment on spectrum utilization, network performance, and user experience.
4. To identify challenges and opportunities associated with SFN implementation in Jamaica and provide recommendations for policymakers, telecommunication operators, and industry stakeholders.

Literature Review

Single Frequency Networks (SFNs) represent a significant advancement in broadcast technology, allowing multiple transmitters to send the same signal simultaneously over the same frequency. This technology has the potential to improve broadcast coverage, reduce interference, and enhance spectrum efficiency. Assessing the feasibility of deploying SFNs in Jamaica requires a comprehensive understanding of the country's diverse geographical and socioeconomic contexts. This literature review examines existing research on SFN deployment, focusing on factors such as geographical challenges, socioeconomic implications, technological requirements, and regulatory considerations.

Geographical Considerations

Deploying SFNs in countries with geographical characteristics similar to Jamaica

requires a thorough understanding of the diverse topographies and environmental conditions.

Jamaica's diverse geography, characterized by mountainous regions, coastal areas, and urban centers, presents unique challenges and opportunities for SFN deployment. Research indicates that geographical features significantly influence the propagation of radio signals, necessitating tailored solutions for different regions (Alobaidy et al., 2022); (del Peral-Rosado et al., 2017).

Elevation changes can cause signal shadowing and multipath interference. Water bodies and coastal geography affect signal propagation differently compared to inland areas. The differences in building density and types between urban centers and rural areas, can all contribute to failures in the SFNs. However, using detailed terrain models and propagation models (e.g., Hata's model and the COST-231 extension) to predict signal behavior in various environments can minimize these challenges (Obot et al., 2023).

Conducting comprehensive site surveys to understand the local topography and identify the best locations for transmitter placement and installing transmitters at elevated locations (e.g., hilltops) to maximize coverage and minimize shadowing effects will improve the efficiency of SFNs (Rappaport, 2024).

Deploying SFN technology in countries with geographical characteristics similar to Jamaica requires careful consideration of topographical diversity, urban density, rural and remote area challenges, coastal and island dynamics, climate conditions, and population demographics. By addressing these geographical considerations through comprehensive planning, pilot projects, stakeholder collaboration, infrastructure investment, and local capacity building, countries can successfully implement SFNs and enhance their broadcasting capabilities (Gakwandi, 2017). These considerations ensure optimal signal propagation and network performance.

Topography and Signal Propagation

Hata's model and the COST-231 extension are commonly used for predicting signal propagation in urban and rural environments. These models consider factors such as terrain, building density, and vegetation, which are critical in Jamaica's varied topography (Obot et al., 2023). The Philippines is an archipelago with numerous islands, mountainous regions, and coastal areas, similar to Jamaica. Researchers in the Philippines have used Hata's model and the COST-231 extension to study signal propagation in urban and rural environments, especially in areas with challenging topography (Hamid et al., 2013). Fiji is an island nation with mountainous terrain and coastal regions, similar to Jamaica. Studies have employed

Hata's model and COST-231 to address the challenges of signal propagation in Fiji's diverse topographical settings (Narayana, et al., 2021).

Studies suggest that mountainous areas may require additional transmitters to ensure coverage and mitigate signal attenuation caused by obstacles (El Khaled et al., 2019); (Borralho et al., 2021).

The use of Hata's model and the COST-231 extension in these countries illustrates their applicability and effectiveness in addressing the challenges posed by diverse geographical topologies. These models help optimize network coverage and signal quality in environments similar to Jamaica, making them valuable tools for planning and deploying Single Frequency Networks (SFNs) in such contexts.

Urban vs. Rural Deployment

Deploying Single Frequency Networks (SFNs) in countries with similar geographical and socioeconomic contexts to Jamaica, such as the Philippines, Indonesia, Thailand, Sri Lanka, Malaysia, and Fiji, presents unique challenges and opportunities for both urban and rural areas.

Urban areas like capital cities and major towns have high population densities, leading to a higher concentration of users. Urban regions typically have better infrastructure, including electricity, internet connectivity, and road networks. High-rise buildings and dense construction can cause signal reflections and multipath interference.

Due to the high density of users, fewer transmitters are needed to cover a large number of people, making it cost-effective. The availability of infrastructure simplifies the installation and maintenance of transmitters and related equipment.

Urban areas, such as Kingston, benefit from the relatively short distance between transmitters and receivers, making SFN deployment more straightforward (Xu et al., 2019). However, urban environments also face challenges like multipath interference, which must be managed through advanced signal processing techniques (Dobrilović et al., 2022).

Rural areas present different challenges, including sparse population distribution and longer transmission distances. Research highlights the need for higher power transmitters and strategic placement to cover extensive rural areas effectively (Fourati et al., 2022).

Socioeconomic Implications

Deploying SFNs in countries with diverse socioeconomic contexts, such as Jamaica, requires a nuanced approach to address the varying needs and capabilities of

different population segments. Countries like the Philippines, Indonesia, Thailand, Sri Lanka, Malaysia, and Fiji, which share similar geographical and socioeconomic characteristics, provide valuable insights into how socioeconomic diversity can influence SFN deployment. Factors such as income levels, access to technology, and educational background influence the adoption and effectiveness of SFN technology (Gakwandi, 2017).

In the Philippines, high-income disparity necessitates affordable technology solutions. Programs providing subsidies for digital TV receivers have been implemented to encourage adoption. Community-based initiatives, like mobile digital TV units and public viewing stations, help bridge the gap in areas with low individual technology ownership (Barela et al., 2022).

The government of Thailand has launched initiatives to provide affordable digital set-top boxes to ensure wide accessibility across different income groups. Investment in community technology centers has proven effective in increasing access and understanding of SFN technology (Tangkitvanich et al., 2011).

Access to Technology

Access to technology and digital literacy varies widely, with rural and low-income urban areas often having less access. However, developing community access points, such as public libraries and community centers, equipped with SFN-compatible devices and internet access could help with access issues. According to Guz (2019), governments deliberately introduce digital literacy programs to educate the population on using new technologies.

The Philippine government has provided subsidies for digital TV receivers to ensure affordability for low-income households (Barela et al., 2022). The Philippine government also established public viewing stations equipped with SFN-compatible devices in rural areas to bridge the access gap. Nationwide campaigns were launched to educate the population on the benefits and use of digital broadcasting technology.

In Jamaica, efforts must be made to ensure that all segments of the population can benefit from SFNs, particularly in underserved areas. Initiatives to provide affordable or subsidized receivers and enhance digital literacy are essential for maximizing the benefits of SFN deployment (Mokwana, 2016).

Economic Considerations

Implementing SFNs in countries with socioeconomic contexts similar to Jamaica, such as the Philippines, Indonesia, Thailand, Sri Lanka, Malaysia, and Fiji, requires

careful economic planning. These considerations ensure that the deployment is financially viable and sustainable while maximizing the benefits to the population.

The cost of deploying SFNs, including infrastructure, maintenance, and operational expenses, must be evaluated against the potential economic benefits, such as improved broadcast quality and expanded coverage (Weiss, 2017). A cost-benefit analysis is crucial to determine the economic viability of SFNs in different regions of Jamaica, taking into account factors such as population density and economic activity (Bahia et al., 2012).

There are high initial costs for deploying infrastructure, including transmitters, synchronization systems, and network management tools. This requires a substantial upfront capital investment, which may be challenging for developing countries. Strategies should be developed for financing these costs. SFN investors could seek government funding and subsidies to support initial deployment costs. This can include asking the government to provide direct financial support, tax incentives, and grants (Prieger, 2013). The SFN investors could engage in Public-Private Partnerships (PPPs) to leverage private-sector investment and expertise. This can reduce the financial burden on the government and ensure efficient project execution (Aduku, 2018). Another source of funding could be obtained by applying for international aid and concessional loans from organizations such as the World Bank, International Telecommunication Union (ITU), and regional development banks.

Technological Requirements

Implementing SFNs requires advanced technology and infrastructure to ensure seamless operation and optimal performance. This includes transmitters, receivers, synchronization systems, and network management tools (Dobrilović et al., 2022). SFNs rely on precise synchronization of multiple transmitters to avoid interference and ensure coherent signal delivery. Transmitters are crucial in SFNs as they broadcast the same signal over the same frequency from multiple locations, ensuring extensive coverage and signal consistency. Global Positioning System (GPS) based synchronization is commonly used to achieve the required accuracy (Gakwandi, 2017).

Research indicates that the selection of transmitter locations and the use of advanced modulation techniques can enhance signal robustness and coverage (Martínez et al., 2015). The effectiveness of SFNs also depends on the capabilities of receivers. Modern receivers with advanced error correction and signal processing algorithms are essential for handling the complexities of SFN signals (Mosavat,

2023). Ensuring the availability of compatible receivers in the market is crucial for the successful adoption of SFNs by the population (González et al., 2021).

Regulatory and Policy Considerations

The successful deployment of Single Frequency Networks (SFNs) in countries with similar socioeconomic and geographical contexts to Jamaica, such as the Philippines, Indonesia, Thailand, Sri Lanka, Malaysia, and Fiji, requires careful attention to regulatory and policy frameworks. These considerations ensure that SFN deployment is compliant with national and international standards, optimizes spectrum use, and addresses public interest.

Regulatory frameworks and policies play a significant role in the deployment of SFNs. Ensuring compliance with national and international standards, managing spectrum allocation, and addressing public interest concerns are key aspects of the regulatory environment.

Spectrum Allocation

Effective spectrum management is critical for SFN deployment, as it involves the allocation of frequencies for multiple transmitters operating on the same channel (Guz, 2019). Research suggests that regulatory authorities must coordinate with broadcasters to optimize spectrum use and minimize interference (Diener et al., 2012).

Policy Support

Government policies that support digital broadcasting and infrastructure development can facilitate the deployment of SFNs. Incentives such as tax breaks, grants, and public-private partnerships can encourage investment in SFN technology (Scott et al., 2015). Public awareness campaigns and stakeholder engagement are essential to ensure that the benefits of SFNs are understood and supported by the community (Gómez-Barquero et al., 2012).

Summary

Single-frequency networks (SFNs) have emerged as a promising solution to address challenges in wireless communication reliability and coverage. SFNs synchronize transmission from multiple transmitters operating on the same frequency, offering potential benefits such as extended coverage, improved signal quality, and enhanced spectrum efficiency (Gakwandi, 2017).

Single Frequency Networks (SFN), where multiple synchronous transmitters send the same signal over the same frequency channel, at much lower heights and transmit power SFNs have been widely studied and applied in various wireless communication systems worldwide (González et al., 2021). Gakwandi (2017) demonstrated the effectiveness of SFNs in digital television broadcasting, where synchronized transmission from multiple transmitters resulted in extended coverage and improved reception quality. Similarly, Sivaraj and Mohapatra (2017) highlighted the advantages of SFNs in cellular networks, particularly in rural and underserved areas, where SFNs can mitigate coverage gaps and provide better connectivity. Moreover, SFNs have shown promise in public safety communication systems. By deploying SFNs in critical infrastructure and high-density urban areas, emergency responders can benefit from improved coverage, reduced signal interference, and enhanced data throughput, ensuring effective communication during crises (Bettancourt et al., 2017).

While SFNs offer significant benefits, their implementation and effectiveness depend on various factors, including geographical and regulatory considerations. Bettancourt (2018) emphasized the importance of considering geographical features such as terrain and population density when deploying SFNs, as these factors can impact coverage and signal propagation. Additionally, Zhang et al., (2020) noted that regulatory requirements and spectrum allocation policies play a crucial role in SFN deployment, highlighting the need for collaboration between government agencies and telecommunication operators.

Despite the potential benefits of SFNs, there are challenges associated with their deployment and optimization. Rehman et al. (2019) identified synchronization issues, interference management, and scalability concerns as key challenges in SFN implementation. De la Fuente et al. (2016) highlighted the need for advanced synchronization techniques and dynamic spectrum-sharing mechanisms to overcome these challenges and maximize SFN performance.

Furthermore, the economic feasibility and cost-effectiveness of SFN deployment require careful consideration. Financial constraints and return on investment considerations may impact the decision-making process for telecommunication operators and policymakers. According to Maternia et al. (2018), additional research is needed to assess the long-term economic benefits and implications of SFN deployment in various contexts.

In conclusion, SFNs have the potential to enhance wireless communication reliability and coverage significantly. However, their successful implementation requires interdisciplinary collaboration, technological innovation, regulatory support, and careful consideration of economic factors. By addressing these challenges and harnessing the potential of SFN technology, countries can improve

communication services accessibility, foster economic development, and enhance the quality of life for their citizens.

Methodology

To explore how Single Frequency Networks (SFNs) could be implemented in Jamaica and the benefits that could be derived, a qualitative research approach would be most effective. This approach provides a comprehensive understanding of the potential implementation and impact of SFNs. The methodology adopted for this study aimed to delve deeply into the feasibility, efficacy, and challenges associated with implementing SFNs to augment wireless communication reliability and coverage in Jamaica. The steps used for the methodology in this study were:

1. Site Selection Process
2. Field Measurements
3. Simulation
4. Data analysis
5. Stakeholder Engagements
6. Ethical Considerations

Site Selection Process

The site selection process for establishing an effective SFN network was proposed. This process proposed how to meticulously design a representation of diverse geographical and socioeconomic characteristics across Jamaica. The following steps are being proposed as to how best to identify suitable study sites for SFNs:

Geographical Diversity Assessment

To establish suitable SFN sites the researcher is recommending the use of Geographic information systems (GIS) to analyze Jamaica's topography, including elevation data, land use patterns, and terrain features. GIS maps provide visual insights into geographic diversity, highlighting urban, rural, coastal, and mountainous areas across the country. Remote sensing techniques, such as satellite imagery analysis, aided in identifying regions with distinct geographical characteristics. For example, urban areas can be characterized by high population density and extensive infrastructure, while rural and remote areas can exhibit lower population density and diverse terrain types.

Historical weather data and climate information such as rainfall patterns,

temperature variations, and atmospheric conditions should also be considered when assessing environmental conditions that could affect SFN deployment.

Potential Coverage Deficiencies

Community Engagement and Needs Assessment

To obtain information about Community engagement, community engagement sessions should be organized in collaboration with local authorities, community leaders, and civil society organizations. These sessions would provide opportunities for residents to voice their concerns, share experiences, and express their communication needs.

Tools such as surveys, focus group discussions, and interviews should be conducted to gather qualitative and quantitative data on community preferences, usage patterns, and satisfaction levels with existing communication services. All the questions in these tools should be tailored to elicit information on coverage issues, network reliability, and connectivity challenges faced by community members. Researchers conducting these needs assessments should ensure that they obtain reliable data about each community from government-authorized bodies. The population sample must be a statistically accepted sample size. Participatory mapping exercises should be conducted to visualize community perceptions of network coverage and identify specific locations with poor connectivity. Community members should be encouraged to annotate maps with areas where they experienced signal problems or service interruptions, providing valuable insights into coverage gaps.

Stakeholder Consultations

Stakeholder consultations involved discussions with government agencies, regulatory bodies, telecommunication operators, and industry experts to gather insights into policy frameworks, regulatory requirements, and industry best practices. Roundtable meetings, workshops, and focus groups should be organized to facilitate dialogue and collaboration among stakeholders. Discussion topics must include spectrum allocation, licensing requirements, infrastructure investment, and technology standards related to SFN deployment.

The stakeholders mentioned above should be invited to provide input on strategic site selection criteria, such as population density, infrastructure availability, market demand, and regulatory compliance. Their expertise and perspectives will help

to shape the site selection process and inform decision-making regarding SFN deployment strategies.

Preliminary Site Assessment

All prospective SFN sites identified through the processes above should undergo preliminary assessments to evaluate their suitability for SFN deployment. Factors to be considered during the assessment must include geographic location, terrain characteristics, population density, weathering, infrastructure availability, and regulatory constraints.

Site visits must be conducted to visually inspect candidate site locations and assess their accessibility, terrain features, and environmental conditions. Researchers and engineers must document observations, and take photographs to supplement site evaluation reports.

Preliminary site assessments must also include a review of existing infrastructure, such as telecommunications towers, power supply facilities, and backhaul connectivity options. This information will help identify potential deployment challenges and opportunities for infrastructure optimization.

Local knowledge and insights from community members should also be solicited during field visits. This could provide valuable context and perspectives on site suitability and deployment considerations.

Final Site Selection:

To determine the final selected sites for the SFN site a final list of study sites should be compiled, taking into account the diverse geographic, demographic, weather pattern, and environmental characteristics of Jamaica. The selected sites should represent a cross-section of urban, rural, coastal, and remote areas, ensuring comprehensive coverage of deployment scenarios.

Final site selection criteria must include geographic diversity, coverage gap severity, community needs, stakeholder input, logistical feasibility, and regulatory considerations. A multidisciplinary approach should be adopted to weigh these factors and prioritize candidate sites for inclusion in the study.

Ethical considerations, including community consent and regulatory compliance, must be addressed to uphold the integrity and ethical standards of the research endeavor.

Field Measurements

The field measurement phase should be characterized by rigorous data collection using specialized equipment tailored to capture SFN performance metrics. An illustrative example of this methodology in action is the measurement of signal strength and quality in a densely populated urban area versus a sparsely populated rural area. By comparing these measurements, researchers could identify disparities in coverage and assess the effectiveness of SFN deployment in different settings.

Instrumentation Selection

Specialized equipment for field measurements must be carefully selected based on the study objectives, measurement parameters, and environmental conditions. This equipment list should include, but not be limited to spectrum analyzers, signal strength meters, GPS receivers, and Radio Frequency antennas. High-quality instruments with precise measurement capabilities and reliable performance should be chosen to ensure accurate data collection in diverse field conditions. Calibration procedures should be carried out before the site visits, to verify the accuracy and consistency of measurement instruments.

Measurement Plan Development

A detailed measurement plan must be developed to guide data collection activities in the field. The plan should outline specific measurement objectives, target locations, measurement parameters, sampling intervals, and data recording procedures. Measurement protocols and standard operating procedures (SOPs) must be established to ensure consistency and repeatability across measurement sessions. Field teams must be trained on proper measurement techniques and safety protocols to mitigate risks and ensure data quality.

Current Wireless Network Capacities in Jamaica

The major wireless network operators in Jamaica include Digicel, Flow (Cable & Wireless), Licensed Radio Stations, and other smaller providers. These network operators primarily use 2G, 3G, and 4G LTE, and are now contemplating the implementation of 5G technologies. The common frequency bands employed by the used are 700 MHz, 850 MHz, 1800 MHz, and 1900 MHz for LTE. It is a well-known fact that Urban areas in Jamaica have better coverage and higher user capacities, while rural areas often face coverage gaps and lower network performance. High user density in urban areas leads to network congestion

and lower quality of service (QoS) during peak times. This leads to inconsistent coverage, particularly in rural and remote areas. High levels of congestion in urban areas, lead to slower speeds and dropped connections. This leads to high levels of interference, especially in densely populated areas.

Potential Improvements Offered by SFNs

To understand the potential improvements that SFNs can offer to the current Jamaican wireless network capabilities, a simulation and modeling approach could be used to compare the existing wireless network capabilities to that of a simulated SFN. This approach should include data collection by gathering current wireless network performance data from operators (coverage maps, user density, frequency usage, etc.), and collecting geographical data (terrain, population density) to understand coverage challenges.

The next step would be to use network simulation tools like NS-3, MATLAB, or commercial tools like OPNET to model the existing network and the proposed SFN setup. Parameters to be used in the simulation models should include frequency, bandwidth, transmitter power, antenna patterns, user distribution, and interference levels.

Circuit Design and Schematic Capture

Once the simulation tool is chosen, the next step is to design the circuit schematic using the software's schematic capture feature. The circuit schematic should include all the components necessary to implement the feedback amplifier or oscillator topology under study, including active devices (transistors, op-amps), passive components (resistors, capacitors, inductors), and feedback network elements.

Component Parameter Selection

After designing the circuit schematic, the next step is to specify the values of component parameters such as resistor values, capacitor values, and transistor models. These parameters determine the behavior of the circuit and should be chosen based on the desired circuit performance and design specifications.

Simulation

With the circuit schematic and component parameters defined, the simulation setup can be configured and run. Firstly, model the existing Jamaican wireless network. This could be done by creating a baseline model of the current wireless

networks in Jamaica, using data gathered from existing network operators. Use the model to simulate network performance metrics such as coverage, capacity, interference, and QoS.

The next step would be to use the simulator to model a Single Frequency Network. This could be done by designing an SFN model using the same parameters as were used to model the existing Jamaican wireless network but with synchronized transmitters operating on a single frequency. The simulation process often involves iterative design and optimization steps to refine circuit performance and meet design objectives.

Verification and Validation

Finally, the simulation results should be verified and validated against theoretical models, design specifications, and experimental measurements. Verification ensures that the simulation accurately represents the expected behavior of the circuit, while validation confirms that the simulated results match real-world observations and measurements.

Data Analysis

Data analysis should involve a combination of quantitative and qualitative techniques to extract meaningful insights from collected data. Statistical analysis techniques may be used to quantify SFN performance metrics, while qualitative analysis methods can help to identify trends, patterns, and challenges.

Data Collection and Preparation

The first step in the data analysis process is to collect simulation data generated from the simulation runs. This data typically includes waveforms, frequency responses, and other simulation results. Data collected from simulation runs may be stored in various file formats, such as text files, binary files, or proprietary formats supported by the simulation tool. Before analysis, the data may need to be organized, formatted, and imported into data analysis software for further processing.

Data Cleaning and Preprocessing

Once the data is collected, it may undergo cleaning and preprocessing to remove noise, outliers, or artifacts that could affect the accuracy and reliability

of the analysis. Data cleaning techniques may include filtering, smoothing, or interpolation to enhance data quality and consistency.

Exploratory Data Analysis (EDA)

Exploratory data analysis (EDA) involves exploring the characteristics and patterns of the data to gain insights and identify trends or anomalies. EDA techniques include summary statistics, data visualization, and graphical analysis to visually inspect data distributions, correlations, and relationships. EDA helps researchers identify potential areas of interest, formulate hypotheses, and guide subsequent data analysis tasks.

Statistical Analysis

Statistical analysis techniques are used to quantify relationships, trends, and patterns in the data and derive meaningful insights. Statistical methods such as hypothesis testing, correlation analysis, regression analysis, and analysis of variance (ANOVA) may be applied to test hypotheses, assess relationships between variables, and evaluate the significance of findings. Statistical analysis helps researchers draw conclusions from the data, validate hypotheses, and make evidence-based decisions regarding circuit performance and behavior.

Comparative Analysis

Comparative analysis involves comparing simulation results against theoretical models, design specifications, or experimental measurements to validate simulation accuracy and assess circuit performance. Comparative analysis may include qualitative and quantitative comparisons of simulation data with reference data sources to identify discrepancies or deviations. Comparative analysis helps researchers assess the validity and reliability of simulation results, identify potential sources of error or uncertainty, and refine simulation models for improved accuracy and predictive capability.

Visualization and Interpretation

Data analysis results can be visualized and interpreted using data visualization techniques such as plots, charts, histograms, and heat maps. Visualization aids in summarizing complex data sets, highlighting trends and patterns, and communicating findings effectively to stakeholders. Interpretation of data analysis

results involves drawing conclusions, making inferences, and formulating insights based on observed patterns, trends, and relationships in the data. Researchers may use domain knowledge, theoretical models, and analytical reasoning to interpret simulation results and draw meaningful conclusions about circuit behavior and performance.

Stakeholder Engagement

Stakeholder engagement sessions play a pivotal role in gathering insights and feedback from key stakeholders, including government agencies, telecommunication operators, industry experts, and community representatives. These sessions will facilitate collaborative decision-making and inform policy recommendations. The first step in the stakeholder engagement process is to identify relevant stakeholders who have a vested interest in the SFN research and design outcomes.

Stakeholders may include researchers and engineers involved in circuit design and analysis, industry professionals from electronics and telecommunications companies, academic institutions, regulatory bodies, or standards organizations governing electronics and telecommunications (such as the Spectrum Management Authority of Jamaica), and End-users of the wireless communication systems in Jamaica.

Stakeholder Analysis

Once stakeholders are identified, a stakeholder analysis should be conducted to assess their interests, concerns, priorities, and influence on the research project (the SFN). Stakeholder analysis helps prioritize stakeholder engagement activities and tailor communication strategies to address stakeholders' needs and expectations. Stakeholder analysis may involve mapping stakeholders based on their level of interest in the SFN project, and their level of influence on decision-making processes related to the SFN project.

Engagement Planning

A stakeholder engagement plan must be developed to outline how stakeholders will be engaged throughout the project. The engagement plan should define objectives, strategies, and communication channels for interacting with stakeholders and soliciting their input and feedback. Engagement activities may include stakeholder meetings, focus groups, surveys, workshops, interviews, or online discussions.

The timing, frequency, and format of engagement activities should be tailored to the preferences and availability of stakeholders.

Communication and Outreach

Effective communication is essential for engaging stakeholders and fostering meaningful dialogue throughout the SFN project. Communication efforts may include regular written and oral updates, and progress reports must be shared with stakeholders to keep them informed about the project activities, milestones, and outcomes. For example:

1. Hosting of interactive workshops or seminars where stakeholders can provide input, share insights, and participate in discussions on key project topics.
2. Online platforms or forums for ongoing communication and collaboration, allowing stakeholders to ask questions, share resources, and engage in peer-to-peer networking should be encouraged.

Feedback Collection and Integration

Stakeholder feedback is collected through various engagement activities and communication channels, such as surveys, interviews, or focus groups. Feedback may encompass a wide range of perspectives, including technical insights, practical considerations, industry trends, and user preferences.

Feedback collected from stakeholders should be carefully analyzed, synthesized, and integrated into the project process to inform decision-making, refine SFN project objectives, and enhance the relevance and applicability of the project.

Collaboration and Partnerships

Collaboration and partnerships with stakeholders strengthen engagement efforts and facilitate knowledge sharing, capacity building, and mutual learning. This researcher believes that collaboration and partnerships are essential in the designing and implementation of an SFN in Jamaica. Collaborative initiatives may involve joint SFN projects, technology demonstrations, or knowledge exchange activities aimed at addressing common challenges and advancing shared goals.

Monitoring and Evaluation

Throughout the stakeholder engagement process, monitoring and evaluation mechanisms should be implemented to assess the effectiveness of engagement

activities and measure stakeholder satisfaction, participation, and impact. Feedback mechanisms, such as post-engagement surveys or feedback forms, should be used to solicit stakeholder input on the quality and value of engagement activities and identify areas for improvement. Monitoring and evaluation data should be used to iteratively refine stakeholder engagement strategies, optimize communication approaches, and enhance stakeholder satisfaction and engagement levels over time.

Ethical Considerations

Ethical considerations must be paramount throughout the project process to safeguard the rights and privacy of participants. Institutional review board approval must be obtained, and project management protocols must adhere to ethical guidelines and best practices. The following are some of the ethical steps that must be followed in designing and implementing an SFN in Jamaica:

Ethical Review and Approval

Before initiating the SFN project, network operators, and SFN project engineers should submit the SFN project to an ethical review and seek approval from relevant institutional review boards (IRBs) or ethics committees. Ethical review ensures that the SFN project complies with ethical principles and guidelines, safeguards participant rights and welfare, and minimizes potential risks and harms associated with the project.

Informed Consent

Informed consent is essential for ensuring that participants understand the purpose, procedures, risks, and benefits of the project, and voluntarily agree to participate. Organizations and engineers intending to implement an SFN project must obtain informed consent from all participants before involving them in the study. Informed consent documents should clearly explain the study's objectives, procedures, potential risks and benefits, confidentiality measures, participant rights, and contact

Participant Privacy and Confidentiality

The SFN team must prioritize participant privacy and confidentiality throughout the project process to protect participants' sensitive information and ensure data security. Confidentiality measures may include anonymizing or pseudonymizing

participant data, storing data securely, limiting access to data to authorized personnel only, and using encryption or password protection for sensitive information.

The SFN project team should adhere to relevant data protection regulations and guidelines, such as the recently implemented Jamaica Data Protection Act, to safeguard participant privacy and comply with legal requirements.

Minimization of Risks and Harms

The SFN team should take proactive measures to minimize potential risks and harms to participants associated with the project. This should involve assessing potential risks, implementing risk mitigation strategies, and monitoring participants' well-being throughout the study. The SFN project team should take steps to mitigate these risks and ensure that participants' safety and well-being are protected for the duration of the project.

Respect for Participant Autonomy and Dignity

The SFN team must respect participants' autonomy and dignity by ensuring that participants have the freedom to make informed decisions about their participation in the study and that their rights and preferences are respected throughout the research process. Researchers should provide participants with the opportunity to withdraw from the study at any time without penalty or repercussion.

Ethical Considerations in Data Analysis and Reporting

Ethical considerations extend to data analysis and reporting, therefore the SFN team must ensure the integrity, accuracy, and impartiality of their findings. The project team should avoid selective reporting or misrepresentation of data and should adhere to best practices for data analysis and interpretation.

Continuous Ethical Oversight and Reflection

Ethical considerations should be integrated into every stage of the project, from study design and data collection to analysis, interpretation, and dissemination of results. The SFN project team should engage in continuous ethical oversight and reflection, seeking guidance from institutional ethics committees, mentors, or colleagues as needed to address ethical dilemmas. The team should also adhere to professional codes of conduct and ethical guidelines relevant to their field

of study, such as those established by professional associations or disciplinary societies, to uphold the highest standards of ethical conduct in research.

Results and Discussion

The adoption of Single-Frequency Network (SFN) technology in Jamaica aims to address issues related to coverage gaps, signal quality, and spectral efficiency in the country's wireless communication infrastructure. This research did not execute the implementation of an SFN but instead provides details as to how an SFN could be implemented, and the benefits and challenges that would result from doing such SFN implementation in Jamaica.

The adoption of SFNs in countries with geographical and socioeconomic profiles similar to Jamaica, such as Greece and the Philippines, provides valuable insights into the potential benefits and challenges. These countries share characteristics such as diverse terrains, mixed urban and rural populations, and varying levels of economic development. This section presents the results and discusses the implications of deploying SFNs in these countries, offering a comprehensive understanding of their impact on wireless communication reliability and coverage. The takeaway from studying these countries with SFNs implemented is that Jamaica could benefit similarly.

According to Kalogirou et al., (2018), the implementation of SFNs in Greece resulted in:

- Improved signal coverage across Greece, especially in remote and mountainous areas. Coverage maps indicated a 25% increase in areas receiving strong and consistent signals.
- Uniform signal distribution reduced coverage gaps, benefiting regions such as the Blue Mountains and the Cyclades islands.
- Enhanced signal-to-noise ratio (SNR) with a 30% improvement across the network.
- Significant reduction in multipath interference, improving signal clarity in urban areas with dense buildings.
- Frequency reuse improved spectral efficiency by 40%.
- Optimized bandwidth utilization supported additional services and high-definition content.
- Maintenance costs decreased by approximately 20%.
- Energy consumption reduced by 15%, contributing to lower operational expenses.
- Improved access to information and communication services in remote areas.

- Economic benefits through increased advertising revenues and operational savings.

According to Barela et al., (2022), the implementation of SFNs in the Philippines resulted in:

- Consistent wireless coverage, significantly reducing gaps in signal reception. Coverage increased by 30%, particularly benefiting remote islands and rural regions.
- Strategic placement of transmitters ensured reliable coverage despite geographic challenges.
- Improved SNR and reduced signal dropouts, enhancing the viewing experience for users across urban and rural areas.
- Multipath interference was minimized, leading to clearer audio and video quality.
- Efficient frequency utilization allowed for the introduction of new digital services and channels.
- Bandwidth management supported higher data throughput, enhancing service offerings.
- Reduced frequency management complexity and streamlined network operations lowering operational costs by 20%.
- Energy-efficient transmitters contributed to further cost savings and environmental benefits.
- Enhanced public service broadcasting and access to educational and emergency services.
- Economic growth driven by improved communication infrastructure and increased advertising revenues.

The results from Greece and the Philippines highlight several key implications for the adoption of SFN technology in Jamaica:

- SFN deployment can significantly improve coverage in Jamaica's remote and mountainous regions, ensuring uniform signal strength and reducing coverage gaps.
- Improved accessibility supports social and economic development by providing reliable communication services to underserved communities.
- Enhanced SNR and reduced multipath interference ensure higher-quality audio and video transmission.
- Better signal quality supports the introduction of advanced services such as high-definition television and digital radio.

- Efficient frequency utilization allows for the expansion of service offerings without requiring additional spectrum.
- Optimized bandwidth management supports higher data throughput and more simultaneous users.
- Reduced maintenance and energy costs contribute to lower operational expenses, providing economic benefits to broadcasters and network operators.
- Savings can be reinvested in further network enhancements and new service development.

SFN deployment can significantly improve coverage in Jamaica's remote and mountainous regions, ensuring uniform signal strength and reducing coverage gaps. Improved accessibility supports social and economic development by providing reliable communication services to underserved communities through the deployment of SFNs.

SFNs enhance SNR and reduce multipath interference ensuring higher quality audio and video transmission. This leads to better signal quality, which supports the introduction of advanced services such as high-definition television and digital radio.

SFNs lead to efficient frequency utilization allowing for the expansion of service offerings without requiring additional spectrum. SFNs also optimize bandwidth management, which results in higher data throughput and more simultaneous users.

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JOURNAL OF ARTS SCIENCE AND TECHNOLOGY

Impact of Phishing on Smart City Development:

Can Behavioural Economics Provide an Explanation?

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Abstract

The development of Information and Communications Technology (ICT) infrastructure and the use of its related services form the backbone of smart city development. However, there is a direct relationship between the use of ICT services and cybersecurity risk exposure. This poses a dilemma for states trying to advance the development of smart cities through ICT and simultaneously having to contend with the lack of trust in these systems due to cyber-attacks, primarily phishing which seeks to lure people into passing on sensitive information to illegitimate parties. States, therefore, must consider how to not only increase the supply of these services, but also how to influence demand in the face of these risks. By exploring the literature on phishing and behavioural economics, Nudging Theory is adapted to develop a conceptual framework to explore what types of encouragement or 'nudges,' offered by the state, may be more effective in increasing the usage of ICT, especially when lack of trust exists. System 1 nudges are those which make a behaviour easier to conform to by urging an almost automatic response, whereas System 2 nudges are those which focus on re-educating individuals towards reasoned decision-making of the desired behaviour. By examining the Jamaican case, it appears that the lack of trust, caused by the high vulnerability to phishing risks and the lack of awareness among the population with regards to detecting these risks, may make System 2 nudges more efficacious than System 1 nudges.

Keywords: Phishing, Smart City, ICT, Cybersecurity Awareness, National Development, Nudging Theory

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Introduction

Smart city development can be considered as an extension of urbanisation, characterised by the development of and a high level of dependence on Information and Communications Technology (ICT). Among the major components is the fostering of interconnectedness through the Internet of Things (IoT), Big Data, Fifth Generation Mobile Network (5G), Artificial Intelligence (AI), and clouds (Huang et al., 2021). Though some persons may believe that these technologies are luxuries for the elite in society, it can be argued that the push towards smart city development, around the world, is congruent with an inclusive development agenda with Sustainable Development Goal (SDG) 11, which speaks to making cities/communities inclusive, safe, resilient, and sustainable. Leem et al. (2019) makes this connection by suggesting that smart city development should enhance access to sustainable livelihoods for all, and not just be focused on the provision of modern technology for a small, exclusive, group. The challenge herein centres around how to make the ICT backbone of smart city development accessible to, and used by most of the population, to bring about the desired benefits. ICT in the smart city is used to enhance quality, performance and interactivity of urban services, to reduce costs and resource consumption, and to improve contact between citizens and city stakeholders. ICT is therefore the lifeline of a smart city and without it the smart city idea cannot be operationalized (Bibri, 2018).

Some governments have made steps towards expanding ICT, such as expanding the overall capabilities of countries through phone and internet coverage, and the provision of free Wireless Fidelity (Wi-Fi) in public spaces. And while many individuals embrace the basic use of technology, there is a greater level of hesitancy observed with regards to the usage of services involving AI, cloud facilities, 5G and the collection of Big Data. Flaherty et al. (2022) points out that the use of advanced technological services may be subject to conspiracy theories and refers to the belief that emerged during the Covid-19 Pandemic, that the transmission of the virus was linked to the development of 5G mobile technology as a prime example. They highlight, more broadly, that many historical atrocities have been linked to distrust in governments and conclude that without proper understanding of the methodologies involved with data used in ICT, then conspiracy theories can be easily created and spread. One dilemma regarding the Covid-19 Pandemic situation is that there was the idea, which some people believed, that the pandemic could be caused by 5G technology (Allchin, 2020). At the same time, the response to the pandemic which involved lockdown measures with remote work and school arrangements then necessitated increased use of online technologies such as 5G.

There is also a connection with lack of trust and lack of awareness or education. Specifically, as it relates to Latin America and the Caribbean, CEPAL (2021) noted that while some digital skills are taught in schools, the ones which are more technical and require more knowledge are often not taught. It was noted that students in Organization for Economic Cooperation and Development (OECD) countries receive more training at school in this regard when compared to Latin America. Since Covid-19 has accelerated the use of online technologies while simultaneously raising questions about trust in those technologies, a very pressing and ubiquitous cybersecurity problem comes to the fore. That is the issue of phishing. Adejobi et al. (2021) explained that phishing attacks are designed to deceive a user to provide sensitive information, often financial data, to a solicitor they consider to be legitimate. They also noted that many types of attacks have been developed as new technologies emerge, such as attacks conducted via email or mobile phones. Here, another important connection should be made with the aforementioned Covid-19 pandemic, as the writers note that the responses to the crisis such as switch to remote work and greater reliance on ICT created even more avenues for phishing attacks.

This conceptual article examines the case of Jamaica where there is a high level of lack of awareness regarding phishing risks (Drummonds et al., 2022). We explore the susceptibility towards these risks among Jamaicans and with the use of Behavioural Economics, particularly Nudging Theory, we conceptualise the impact of trust in ICT technology on decision-making of the users. Finally, we suggest what approaches may be useful to increase the usage of ICT where lack of trust in the technologies is high. The objective of this conceptual work is to establish a relationship between trust and human behaviour with regards to using ICT to drive smart city development. This may help to guide policymakers regarding the types of nudges or incentives which may encourage ICT usage.

Literature Review

Phishing Risks in Smart City Development

For a smart city to be successful it must be inclusive, safe, resilient, and sustainable, and there are several components that must be in place to achieve these goals. Figure 1 illustrates the different components that work in tandem to make a smart city successful. The smart city infrastructure must be able to make intelligent decisions based on continuous interactions of the citizens and their surroundings, using Artificial Intelligence (AI) and machine learning. To achieve that, a Customer

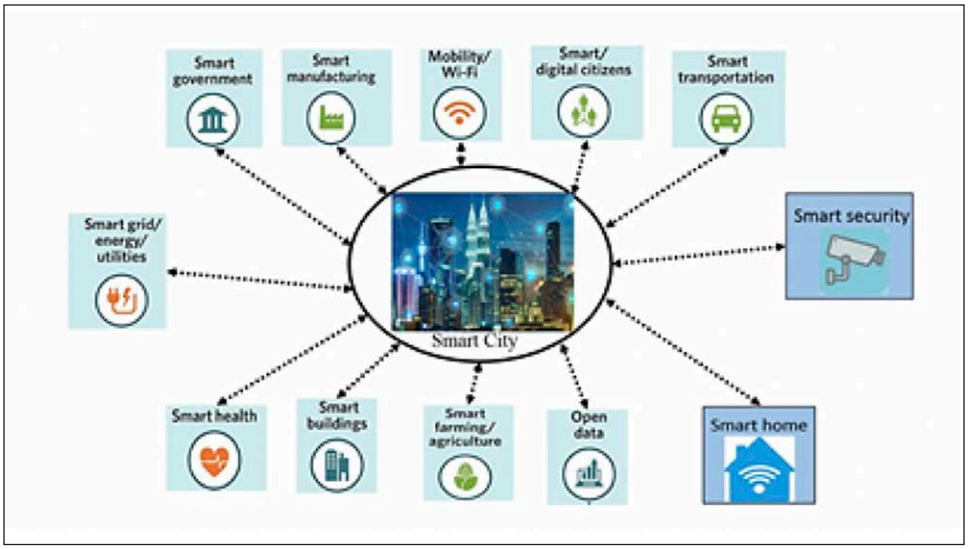

Figure 1. Components of the Smart City. (Yang et al., 2018)

Relationship Management (CRM) solution is imperative. According to Baran and Zerres (2010), CRM can be defined as a process that maximises customer value through on-going marketing activity founded on intimate customer knowledge established through collection, management and leverage of customer information and contact history.

Citizens are important enablers of smart city development and their acceptance of the technologies which come with smart city development is crucial (Manfreda et al., 2020). However, we have seen noteworthy cases where trust is not being maintained between the citizens and the smart city applications. This is primarily due to recent breaches in those smart city applications, particularly in Jamaica. One case is where the JAMCOVID website developed by the Amber Group exposed thousands of Jamaican citizens' personal information to the public (Jamaica *Gleaner*, 2021). Another case according to the Jamaica Gleaner (2023) is with the JamaicaEye, which is an intelligent surveillance system used by the government to monitor public spaces to ensure public order is maintained. Their website was hacked, and the server's data exposed. With all these breaches, one can understand why many would not likely gravitate toward trusting smart city technologies. However, it gets much more interesting when we realise that the citizens themselves have just about the same responsibilities as the public and private sectors in protecting themselves, especially as it relates to phishing attacks.

All factors that contribute toward the development and longevity of a successful smart city can be affected by phishing attacks. This is where human vulnerabilities are exploited to expose sensitive information (Drummonds et al., 2022). In Figure

2 we illustrate the various types of phishing attacks that exist, and in Table 1 we highlight the risks associated with each smart city component if phishing attacks were to be successful. The risks that can affect smart city development greatly are denial of service, loss of trust and damage to infrastructure. Denial of service is a case where citizens are denied access to various services or platforms. This can become frustrating and have negative outcomes. For example, not being able to make payments for household bills on time can have severe consequences. Loss of trust is seen as the second most important risk to pay attention to. Frequent breaches or inappropriate exposure of personal information can result in citizens not feeling comfortable having their personal information collected and stored. Then, there is damage to infrastructure, where the success of the economy, public health and safety, and national security are at risk.

With phishing attacks, we stand the risk of sacrificing our smart cities being safe, resilient, and sustainable. One thing to note however, is that if the aforementioned goals are to be achieved in any country, there must be a strong relationship between the public and private sectors. This is to ensure that there is a data-driven environment outside the local government. But above all else, the citizens' trust must be the focus, as well as ensuring they are digital literate, and can protect themselves from phishing attacks.

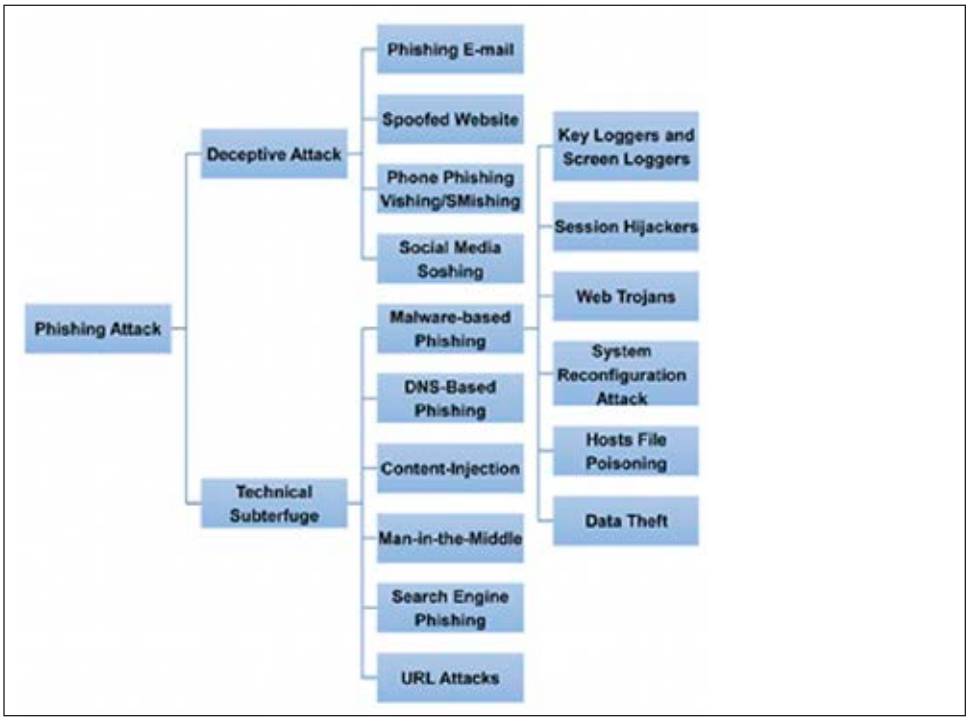

Figure 2. Phishing attack types and techniques drawing upon existing phishing attacks. (Alkhalil et al., 2021)

Table 1. Smart City Components and their Phishing Risks. (Demertzi et al., 2023[1], Yazdinejad et al., 2021[2], Soykan et al., 2021[3], Harvey and Kumar, 2020[4], Tuptuk and Hailes, 2018[5], Gulyás and Kiss, 2023[6], Moore and Clayton, 2011[7])

Component	Phishing Risk								
	Unauthorised access to personal data	Denial of service	Loss of sensitive data	Loss of trust	Loss of lives	Identity Theft	Energy loss	Damage to infra-structure	Financial loss
Smart Health[1]	✓	✓	✓	✓	✓	✓		✓	✓
Smart Grid[3]		✓		✓			✓	✓	✓
Smart Transportation[4]		✓		✓	✓			✓	
Smart Agriculture[2]		✓		✓				✓	
Smart Manufacturing[5]	✓	✓		✓	✓			✓	✓
Smart Citizens[1]		✓		✓				✓	
Smart Government[1]	✓	✓	✓	✓	✓	✓		✓	
Mobility/Wi-Fi[1]		✓		✓					
Smart Buildings[1]		✓		✓				✓	
Open Data[7]		✓		✓					✓
Financial Institutions[6]	✓	✓	✓	✓	✓	✓		✓	✓

A discussion of what characteristics of individuals make them more susceptible to phishing risks is presented by Alkhalil et al. (2021). They concluded that human nature is perhaps the single broadest factor contributing to risk. They suggest that the reason for this is that the attackers play on psychological as well as technical factors. More specifically, it was noted that persons who are experiencing high levels of stress may make decisions without thinking. Demographically, it was suggested that young persons between the ages of 18–24 are also at high risk as they are more likely to trust online communication. Interestingly, it was noted that women may be more at risk since men may, on average, have more technical know-how and experience in some locales than women. The study also noted that this may vary depending on the medium used by the attacker as men may actually be more susceptible to mobile attacks.

Considering these factors in the context of Jamaica makes for an interesting case. Considering the high crime rate in Jamaica and continuous struggles with economic development, particularly, high levels of poverty, then it is reasonable to

expect that stress is a factor affecting many Jamaicans. With regards to workers, Bryan-Rose and Bourne (2018) examined the nursing profession and noted that burnout has been on the rise due to a shortage of workers and a requirement to work longer hours. While this example refers to the nursing profession, this is a wider concern for Jamaican workers across sectors. Regarding gender, Khokhar (2017) identified Jamaica as one of only thirteen countries in the world where internet usage among women is greater than among men. Regarding age, Morris (2013) noted that Jamaican youth are active internet users in much of the same ways as those from other countries where young people have been exposed to risks online.

Considering the aforementioned factors, a preliminary deduction is that the Jamaican population likely has a high level of susceptibility to phishing risks. When combined with the findings of Drummonds et al. (2022) regarding a lack of awareness among the Jamaican population in relation to the detection of phishing risks, there is much cause for concern. That experiment tested the recognition of phishing risks by Jamaicans and found that in 38% of instances, the research participants believed that phishing websites were legitimate. Interestingly, the research also found where persons wrongly identified legitimate websites as phishing websites 36% of the time. The authors also highlighted cases where warnings about phishing attacks have been communicated via newspaper articles. This high susceptibility to these risks and numerous cases of cyberattacks which have been publicised, cause a lack of trust in the technologies, since these are the conduits where exposure to these risks manifest.

Methodology

The conceptual methodology utilizes theory adaptation to bring about an understanding of the relationship concerning a number of variables which are necessary for the smart city idea to be operationalized so as to reap societal benefits. The literature review has shown that ICT usage is important for smart city development, but that usage of ICT is still a challenge in Jamaica which is compounded by trust in the technologies.

According to Jaakkola (2020), conceptual research can be useful once the choice of theories is justified and their role in the analysis is clear. Behavioural Economics and more precisely, Nudging Theory, presents an appropriate lens through which to guide understanding the issue of ICT usage in Jamaica as a driver of smart city development based on the facts established above.

Behavioural Economics is concerned with how psychological insights can help

to understand economic decision-making (Wilson, 2020). This is concerned with how the social context may affect how individuals or groups may make decisions. Understanding ICT usage requires understanding the decision-making of users and potential users. The analysis is nestled in a specific theory of Behavioural Economics which is Nudging Theory. Nudging Theory allows for analysing decision-making when trust is an important factor and can help to explain the types of nudges or incentives which policy makers may employ to gain an outcome (Thaler and Sunstein, 2008). In this case, the outcome is to increase ICT usage so as to drive smart city development. The analysis establishes how the important variables of ICT usage, trust, and nudges interact. This represents an adaptation of Nudging Theory.

Application of Nudging Theory

It can be argued that the usage of ICT required to drive smart city development has both a supply and demand side. The supply can be achieved through the availability of the technologies and the development of the infrastructure to support this. However, usage requires that demand also exists. That is, even if ICT infrastructure and services are available, if they are not used by the population, then the benefits expected will not be derived. In other words, the socially optimal equilibrium may not be reached, constituting a market failure. To address the issue, it is important to understand how individuals make decisions about using these services, especially when risk is involved. Behavioural Economics has become an important field concerned with exploring ways to develop effective policies given the psychological and social nuances of developing countries (Wilson, 2020). Whereas mainstream economic thinking may believe certain behavioural factors are not significant, Behavioural Economics contends with the behavioural factors which affect human decision-making.

In the context of encouraging the use of ICT, the state must consider the factors which drive the decision-making of the users of these technologies. Understanding how a state may encourage a desirable form of behaviour, when risks or lack of trust is involved, can be explored using Nudging Theory. Thaler and Sunstein (2008) posit the idea of nudging to refer to approaches that the state can use to encourage a desirable behaviour, without restricting other options. In this case, it is widely accepted that ICT usage is desirable, and it is evident that the Jamaican government has been trying to urge persons to expand their usage of those technologies. According to the Government of Jamaica (2015) in the National Cyber Security Strategy:

> This Strategy recognizes that Information and Communications Technology is a necessary tool for national development, but with it comes inherent risks which must be mitigated against. Cybercrimes have the potential to erode confidence and trust in the economy, thereby impairing national development (pg. 5).

Kahneman (2011) explains that there are two basic types of decision-making processes to consider, which may be described as System 1 and System 2. System 1 nudges are those which require no deliberate thinking on the part of the individual as the nudge simply makes the desired behaviour easier to do and leads to an almost automatic response. System 2 nudges, however, are those which require deliberate engagement in decision-making. For example, providing access to a mobile banking wallet by extending a monetary incentive to sign up, can be considered a System 1 nudge, as it is targeted at getting a quick response due to the incentive. A System 2 approach on the other hand, would involve providing financial literacy training on the benefits of online banking so as to influence the reasoned decision-making of the individual.

System 1 nudges may be considered to be manipulative and raise ethical questions about the role of the state in influencing decision-making. However, they can work if there is the existence of trust in the officials and the system that persons are participating in. It is already established that phishing risks create increased lack of trust in the use of ICT, and this is therefore a factor worth considering with regards to what types of nudges may be most effective. Where there is a lack of trust in the technologies or the actor offering the nudge to use the technology, System 1 nudges may not work. System 2 nudges may be necessary in those cases which are often more costly since they involve educating individuals towards making the decisions in a deliberate and calculated way (Sunstein, 2016). System 2 nudges could accomplish greater awareness of the risks and greater ability to detect risks among users. If the user is able to detect the risks, then the potential costs of using the technologies is lower relative to the benefits, which therefore changes the decision-making metric of the user leading to the desired behaviour of greater usage of ICT technology.

Figure 3 provides a simplified representation of the interconnected relationship regarding susceptibility to phishing risks, trust, and the use of ICT. Panel A shows an inverse relationship between susceptibility to phishing risks and trust. A high level of susceptibility to phishing risks is associated with a low level of trust. A low level of susceptibility to phishing risks, therefore, is associated with a high level of trust. Panel B shows that a high level of trust is associated with a high level of usage of ICT. Therefore, focus must be placed on reducing the susceptibility to phishing risks.

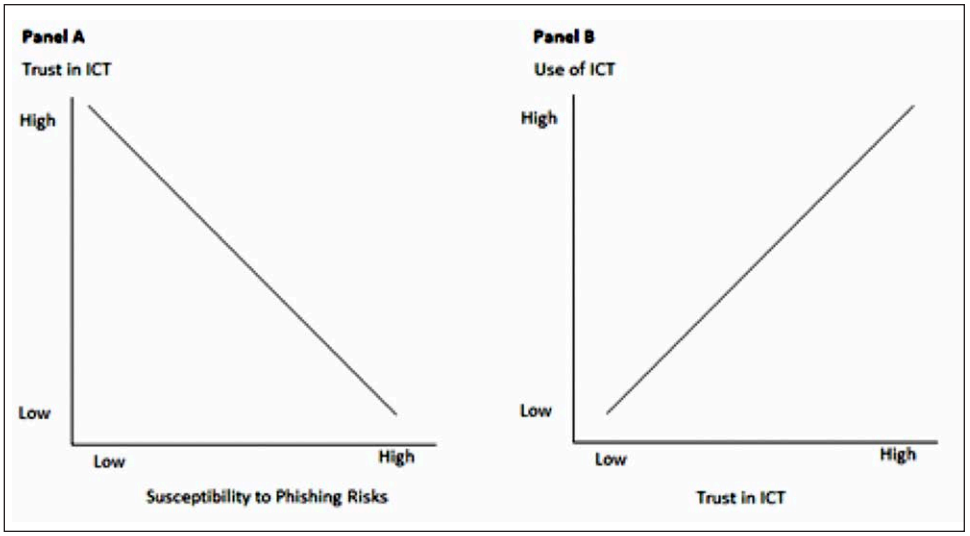

Figure 3. Graphical relationship: Susceptibility to phishing risks, trust, use of ICT. Authors' adaptation of Nudging Theory (Thaler and Sunstein, 2008).

According to the Government of Jamaica (2015), public education and awareness is an important aspect of the National Cyber Security Strategy. In this regard the following objectives are listed:

- Jamaicans are knowledgeable and aware of cyber risks, as well as the actions to be taken regarding cyber security,
- Measures are implemented to protect vulnerable groups in cyberspace,
- Jamaica has a culture of cyber security (pg. 39).

The listed, associated activities include executing a national assessment, public awareness campaigns, promoting safe access among vulnerable groups, having a cybersecurity day, establishment of private and public partnerships, and policies for cybersecurity in the public sector. These objectives and menu of activities are generally geared towards educating individuals and the nation, as a whole, to be equipped with the knowledge of how to detect and handle cybersecurity risk. It is fair to say that the state's intention is not simply geared towards System 1 nudges, in terms of making access easier or less expensive. These measures of educating people towards better decision-making are congruent with System 2 nudges, which are often costly, but necessary given the lack of trust within the population.

Despite the National Cyber Security Strategy, outlining these activities, being launched in January 2015, an assessment of the strategy has not been made public. There is a Jamaica Cyber Response Incident Team (JaCRIT) that has

been established. As recently as October 2022, "JaCRIT urges local businesses to report cyber security vulnerabilities" (2022), highlighted a call from JaCRIT for businesses to report cybersecurity vulnerabilities and breaches to the team. It was also expressed that several things still need to be put in place for the process to be congruent with industry standards and international practices. According to the Caribbean Military Academy (2022), after conducting a needs assessment on behalf of the Government of Jamaica, it was noted that the island will be establishing a Cyber Academy, and that legislative efforts such as the new National Identification System (NIDS) and the operationalising of the Data Protection Act are forthcoming. It was also noted that sectoral Cyber Response Incidence Teams are to be developed to share information with JaCRIT. It was concluded that the level of cybersecurity skills base in Jamaica still is to be assessed. It is already established that susceptibility to phishing is high in Jamaica and that there is a lack of awareness regarding phishing detection among the population. It is therefore highly concerning that despite having a National Cyber Security Strategy from 2015, safeguarding the population against cyberattacks can be considered to be in its infancy. It is safe to argue that the usage of ICT infrastructure among the population, especially the more advanced services requiring big data, AI, cloud usage, and 5G, to get to the level where smart city development is a real possibility, will not be automatic. The System 2 nudges, which require financial and other resources, will need to be deployed to increase trust as prerequisite to increasing usage.

Conclusion and Recommendations

The analysis herein establishes a number of interrelated facts regarding the effects of phishing on smart city development in the Jamaican locale:

1. The development and usage of ICT infrastructure and services is crucial for smart city development to be possible (Government of Jamaica, 2015; Leem et al., 2019)
2. There are significant deficiencies regarding awareness and detection of phishing risks among Jamaicans and the population is vulnerable to cyberattacks (Drummonds et al., 2022; Morris, 2013)
3. Phishing risks that are not easily detected erode trust in ICT (theory adaptation of Thaler and Sunstein (2008))
4. Low trust in ICT is associated with low usage of ICT (theory adaptation of Thaler and Sunstein (2008); outlined in figure 3)

If the state wants to increase usage of ICT when there is lack of trust, the nudges required are those which educate persons towards being able to make better decisions. These are System 2 nudges which involve equipping persons with the ability to reduce their susceptibility to phishing risks, through being able to easily detect and avoid falling prey to them, so that they view the benefits of using ICT infrastructure as being greater than the risks or costs. It is not enough to simply supply the services, or to make them easier or less expensive to use. While the population may use basic internet services at a high rate, the types of advanced services, such as those involving AI, big data, 5G, and cloud usage which can fuel smart city development, are the ones where risks are especially high and where the lack of trust manifests greatly.

The National Cyber Security Strategy may indeed propose an appropriate set of activities to build awareness of these risks and mitigate the lack of trust, however, the pace of implementation is very concerning. This process needs to be accelerated if smart city development is to be pursued. The development of smart cities in Jamaica is as much a social endeavour as it is a scientific one, as it relies on human decision-making as well as the advancement of the ICT infrastructure. Unfortunately, for now, smart city development in Jamaica remains a distant goal. It is, however, not unattainable. Policymakers must be cognisant of the trust issues among citizens regarding ICT usage so as to effectively nudge individuals to use the ICT services which form the backbone of smart city development.

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Using Deep Learning and Neural Networks to Detect Trojans Within a Network

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Abstract

The steady rise of computer breaches is a major concern for individuals and businesses worldwide. Thousands of malicious trojan malware are created daily. However, cybersecurity experts are struggling to keep up with malicious users prowling the digital space. Artificial intelligence techniques such as deep learning and neural networks are cost-effective and efficient methods that can support network protection. The trojan malware is a type of malicious software that disguises itself as a legitimate program or file while performing unauthorized behavior, often with devastating impacts, on the computers or networks of victims. Identifying network attacks is a critical component of Trojan detection software. Cybersecurity legislations, standards and safeguards in developing countries (DCs) are still in the early stages. Weaker safeguards in DCs and their inability to effectively protect their digital resources make them more vulnerable and more adversely impacted. This experimental study sought to develop a framework aimed at strengthening network firewalls. The proposed framework utilizes deep learning models to improve the protective capacity of firewalls, enabling them to automatically learn and expose hidden properties within network traffic. A situational analysis method was used to gather and pre-process a large dataset of labeled network traffic, which included both normal and malicious cases. The dataset was trained using artificial neural network (ANN), a deep learning method. The results showed that deep learning models/algorithms demonstrated improved performance in network attack detection compared with various baseline models/algorithms such as logic regression and decision trees.

Keywords: Deep Learning, Neural Network, Trojans, Network Attacks, Machine Learning, Cyber Security, Information Security

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Introduction

The interconnected nature of the digital era makes safeguarding sensitive information paramount. Hackers are creating innovative ways to access information systems (Sadiku et al., 2020). As cyber threats evolve rapidly, countering cybercriminals requires automated threat detection and responses (Belani, 2022). Global cyberattack costs reached $6 trillion in 2021, projected to escalate by 15% annually to $10.5 trillion by 2025 (Morgan, 2020). Integrating deep learning algorithms into networked systems' cybersecurity systems is one way to mitigate the escalating cybersecurity challenges faced by users of networked systems (Welukar & Bajoria, 2021). However, online machine-learning systems are susceptible to "data poisoning" attacks, where manipulated data can compromise their effectiveness (Verde et al., 2021).

Deep learning can revolutionize information processing and decision-making (Sarker, 2021). It overcomes the limitations in traditional machine learning models by automatically extracting complex features from large datasets, deep learning models can detect intricate patterns that traditional approaches often miss (Potnurwar et al., 2024; V et al., 2023). Consequently, deep learning can find intricate patterns in network traffic that simpler models often cannot. Unlike other models that rely on manual feature engineering, deep learning can unearth intricate, multi-layered patterns, in high-dimensional and non-linear data.

The framework of this paper provides this adaptive capability and strengthens its efficiency in cybersecurity, as models such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNN) perform well in static malware and sequential Trojans attacks respectively, making them more resistant to evolving threats. Several countries have developed national firewalls, such as China, Iran, Saudi Arabia, Russia, and Turkey, to enhance cybersecurity by filtering and monitoring internet traffic (Ahmed et al., 2022). Turkey is one example of a developing country that used artificial intelligence to develop a low-cost national firewall.

In this study, the researchers propose integrating deep learning models into network security infrastructure, aiming to improve cybersecurity resilience in developing countries like Jamaica. The research employs experimental and

situational analysis methods, leveraging deep learning techniques to build and expand low-cost firewall solutions.

Background

In this section, artificial intelligence deep learning techniques and cybersecurity are reviewed.

Machine learning (ML) techniques give the computer the ability to learn from data without explicit programming (Sabharwal & Miah, 2022). Machine learning algorithms are designed to discover data themes and patterns within large datasets to inform future decisions (Priya et al. 2022). There are several machine learning techniques: these are reinforcement, unsupervised, and supervised learning. Supervised learning employs labeled data for regression or classification (Mathew 2021). Unsupervised learning clusters and reduces data dimensions, identifying hidden patterns (Bhatele, Shrivastava & Kumari, 2020). Reinforcement learning learns actions based on rewards or penalties (Morovat & Panda, 2020).

Machine Learning in Cybersecurity

Machine learning has become foundational for network intrusion detection systems (IDS), significantly enhancing adaptability, efficiency, and accuracy (B.C. & P, 2018; Zhang et al., 2022). By learning from historical data, machine learning algorithms allow IDS to detect patterns in vast amounts of network traffic and adapt to new attacks (Sharma, 2023), which is crucial in a rapidly evolving cyber threat landscape. Basic models like logistic regression and decision trees are effective for classification but struggle with complex malware patterns. Advanced models, including Support Vector Machines (SVM) and ensemble methods like Random Forests and Gradient Boosting, handle high-dimensional data well and improve classification accuracy, especially with diverse network traffic (Zhang et al., 2022). Although Naive Bayes has lower accuracy, it is faster and useful for detecting novel attack types.

Deep Learning (DL)

Deep Learning is a machine learning branch utilizing multi-layered models, inspired by human neurons. Processing more data enhances machine performance, making deep learning pivotal for handling vast data. The algorithm improves pattern detection with growing data. It autonomously performs feature extraction from raw data due to learning from processed data (Banan et al. 2020). Deep

learning (DL), exhibits a high detection rate (DR) for morphing threats, aiding information security by extracting and learning features from known and unknown attacks without manual feature engineering (Panker & Nissim 2021). Unlike machine learning methods that often require custom features, deep learning identifies data characteristics, and allows transfer between domains (Morovat & Panda, 2020). Incorporating deep learning into network security enhances threat identification.

Deep Learning and Trojan Detection

Deep learning improves Trojan identification, extracting patterns from extensive network data for precise detection (Ahmed et al., 2022). Integrating deep learning into security architecture bolsters Trojan detection and improves the ability to mitigate breaches (Janiesch et al. 2021). Unlike signature-based methods, deep learning adapts to Trojan threats by discerning subtle activity indicators (Ali et al. 2022).

Deep learning techniques, including artificial neural networks, are being explored for cybersecurity, particularly in detecting and preventing cyber-attacks (Ahmed et al., 2022). Maniriho et al. (2022) propose deep learning for Trojan malware detection in network traffic due to its capability to extract significant patterns from vast data. Deep learning's popularity in building firewalls is due to its data handling capacity, automation of feature extraction, and high accuracy in malicious traffic detection, minimizing false positives and negatives (Al-Amiedy et al. 2022; Janiesch et al. 2021)

Approaches like Artificial Neural Networks (ANN), Convolutional Neural Networks (CNN), and Recurrent Neural Networks (RNN) have proven effective in cybersecurity by showing promise in tasks such as malware categorization and intrusion detection (Safa et al., 2019; Sarker et al., 2021). CNN models are accurate at finding patterns in data and malware behavior analysis. On the other hand, RNN models, such as LSTM, are good at handling data sequences and useful in understanding malware behavior (Haidur, 2023; Safa et al., 2019). ANNs operating via feed-forward propagation are excellent at recognizing trends, in network traffic to identify activities of Trojans. Also, combined models like CNN LSTM have managed to score a 98.73% accuracy in action recognition on the Microsoft BIG Cup 2015 dataset by utilizing the strengths of both: feature extraction from CNN and temporal processing from LSTMs.

Comparative Approaches to Trojan Detection

Incorporating deep learning into network security can greatly enhance proactive malware detection by increasing detection rates and reducing false positives. Research by Mahdavifar and Ghorbani (2019) showed that deep learning models support intrusion detection through automated feature extraction and adaptability to new attack patterns. Dixit and Silakari (2021) further highlighted deep learning's capability in handling large datasets and complex security issues. Given the evolving nature of cyber threats, this study compares traditional and advanced models, including SVM, ensemble methods, CNNs, and RNNs, to identify the most effective models for Trojan detection, especially in developing countries where low-cost defenses are critical.

Neural Networks (NN)

The term "Neural Network" refers to the construction of machine systems that emulate the human brain's functionality. Different types of Neural Networks include Convolution Neural Networks (CNN), Recurrent Neural Networks (RNN), and Artificial Neural Networks (ANN). RNNs handle sequential data, facing challenges like the vanishing and exploding gradient problem (Pai, 2020). CNNs excel in image analysis and sequential input tasks (Lindsay, 2021). ANN, is a computational model resembling biological neurons and operating in a feed-forward manner (Pai, 2020).

ANNs consist of interconnected processing units, that process data and produce outcomes, these are applicable in classification and regression tasks (Rahmadsadli, 2022). The input layer feeds data to the hidden layer, which processes and sends results to the output layer, with each layer learning specific weights. ANN is versatile, applicable to tabular, image, and text data, and capable of learning any nonlinear function (Pai, 2020). While deep learning-based firewalls have proven adept at identifying novel cyber threats, they are not infallible and may struggle against highly sophisticated attacks designed to evade detection (Ravikumar et al., 2022).

National Firewall

Turkey, categorized as a developing nation, has responded to escalating cyber threats by deploying an AI-supported national firewall, referred to as "Seddulbahir". This was initiated in 2016, and the project utilized AI algorithms. The system successfully countered 21 attack types across 66 networks, boasting a 97.99%

accuracy rate in rule establishment after detection (Sari, 2019). Turkey has reported a decline from 118,470 attacks in 2020 to 84,113 in 2021 due to the fortification of Turkey's "cyber shield" through locally developed software, underscoring its effectiveness in thwarting attacks (Sabah, 2022). Given Turkey's success, which was in response to a surge in cyberattacks, adopting a similar approach could mitigate the rising cyber threat reported in Jamaica. Establishing an efficient and affordable national cyber firewall, mirroring Turkey's strategy emerges as a practical means to address the escalating issue (Sari, 2018).

Data Poisoning

Data poisoning refers to a type of adversarial attack where an attacker deliberately manipulates the training dataset of a machine learning (ML) system to degrade its performance (Oprea, 2021; Sameen & Hwang, 2022). These attacks can cause the ML system to make incorrect predictions or classifications, which is particularly concerning in applications where integrity and reliability are critical, such as healthcare, finance, and cybersecurity (Alsuwat, 2023; Apruzzese et al., 2019; Oprea, 2021). Interestingly, while data poisoning attacks are a known threat, the specifics of their impact can vary widely. For instance, they can be tailored to target specific subpopulations (Oprea, 2021), or they can be designed to be imperceptible, as in clean-label poisoning attacks (Han et al., 2023).

The impact of these attacks is not uniform across different ML models; some algorithms may exhibit varying degrees of robustness against them (Yerlikaya & Bahtiyar, 2022). Additionally, the presence of noise in the data can exacerbate the vulnerability of ML systems to poisoning attacks (Verde et al., 2021). In summary, data poisoning attacks represent a significant vulnerability for ML systems, potentially undermining the integrity and reliability of their outputs. These attacks can be sophisticated and difficult to detect, requiring robust defense mechanisms to ensure the security of ML applications. The development of such defenses is an ongoing area of research, as evidenced by the various approaches and frameworks proposed to detect and mitigate the effects of data poisoning (Alsuwat, 2023; Jonnalagadda et al., 2024; Sameen & Hwang, 2022).

Methodology

An experimental approach and a situational analysis was utilized in this study. To assess the efficacy of various models in identifying Trojan malware in network traffic, traditional machine-learning models were compared with advanced deep-learning architectures. The models chosen were logistic regression, decision

trees, support vector machines (SVM), ensemble approaches (Random Forest and Gradient Boosting), convolutional neural networks (CNN), and recurrent neural networks (RNN). Each model had unique features that addressed different areas of malware detection, particularly the handling of sequential data and complex patterns.

Machine Learning Models

1. Logistic Regression (LR): A linear model designed largely for binary categorization. Logistic regression is useful as a starting point because it is simple to use and comprehend, but it has the disadvantage of complicated non-straight-line correlations.
2. Decision Tree (DT): This model generates decisions based on data attributes using a tree-like structure, making it simple to understand and adaptive to non-linear patterns. However, it may struggle to overfit the noisy training data.
3. Support Vector Machine (SVM): This AI architecture was selected because of its reliability in high-dimensional data categorization and capacity to determine appropriate decision limits. It also has the ability to distinguish between normal and malicious network traffic. They key hyperparameters are:
    - C (regularization parameter): Set to 1 to balance margin maximization with classification accuracy.
    - Gamma: Set to 0.01 to reduce overfitting, based on cross-validation results.
4. Ensemble Methods:
    - Random Forest (RF): Composed of multiple decision trees to improve classification accuracy.
5. Hyperparameters:
    - n_estimators: Set to 100 trees.
    - max_depth: Set to 10 to prevent overfitting.
    - Gradient Boosting (GB): Builds trees sequentially, with each tree improving on the errors of the previous one. Hyperparameters:
    - n_estimators: Set to 200 for optimal performance on imbalanced data.
    - learning_rate: Set to 0.1 for a balanced learning speed and accuracy.

Deep Learning Architectures

1. Convolutional Neural Network (CNN): Can capture spatial hierarchies in network data streams by analyzing traffic patterns as if they were image-based. This study used a CNN architecture with parameters that include:
   - Convolutional layers: Involve using three layers with 64 filters and a 3x3 kernel to capture complex patterns in network traffic.
   - Pooling layers: 2x2 max-pooling layers after each convolutional layer.
   - Fully connected layer: A dense layer with 128 neurons and ReLU activation, followed by a softmax output layer.
   - Optimization: Adam optimizer with a learning rate of 0.001; dropout of 0.3 to prevent overfitting.
2. Recurrent Neural Network (RNN): Long Short-Term Memory (LSTM) networks capture temporal dependencies in network traffic. This model includes:
   - LSTM layers: To learn sequential patterns LSTM utilizes two layers with 64 units each
   - Dense layer: A dense layer with 128 neurons and ReLU activation, followed by a softmax layer for classification.
   - Optimization: Adam optimizer with a learning rate of 0.001; early stopping to mitigate overfitting.

Evaluation Metrics

The study employed a range of evaluation metrics that went beyond just accuracy. These included precision, recall, F1-score, and AUC-ROC. This approach had two aims:

1. To obtain a comprehensive report on the performance of each model
2. To Assess the intrinsic value and effectiveness of the models in accurately identifying malicious network traffic while reducing false positives.

Location of Experiment

The experiment was done in a "virtual lab," which means that computer software or other technology was used to simulate a lab setting. The study was conducted with "virtual subjects" or "models."

Instrument Design

In the context of improving information security, structured observations of

an artificial neural network (ANN) involve analyzing its architecture, neuron weights, input-output mechanisms, and interactions. These observations were conducted within a virtual environment on a computer. The ANN is trained using supervised or unsupervised learning methods on labeled or unlabeled datasets of security breaches, respectively. It detects patterns and anomalies in the data, enhancing security. Various statistical techniques like logistic regression, decision trees, Bayesian analysis, and natural language processing (NLP) for unstructured data analysis were employed.

Results

In this section, the findings are discussed in response to the research question: To what extent can the application of artificial intelligence methods, deep learning, and neural networks be integrated into network security infrastructure to detect Trojan malware?

In this research project, the researchers aimed to explore the effectiveness of different classification algorithms, including Decision Tree, Logistic Regression, and their developed Artificial Neural Network, in detecting and classifying network attacks. They conducted multiple experiments and training iterations to evaluate the performance of each algorithm.

The performance of each model was assessed based on the selected metrics.

Table 1: summarizes the results across all models, revealing the effectiveness of each approach.

Model	Accuracy	Precision	Recall	F1-Score	AUC-ROC
Logistic Regression	0.92	0.88	0.89	0.88	0.90
Decision Tree	0.89	0.85	0.87	0.86	0.88
Support Vector Machine	0.93	0.91	0.92	0.91	0.92
Random Forest	0.94	0.92	0.93	0.92	0.94
Gradient Boosting	0.95	0.93	0.94	0.94	0.95
Convolutional Neural Network (CNN)	0.96	0.94	0.95	0.95	0.96
Recurrent Neural Network (RNN)	0.97	0.95	0.96	0.96	0.97

Traditional approaches such as decision trees and logistic regression tend to be easier to use and more interpretable but lack the level of sophistication needed for advanced malware detection. Nevertheless, SVM and ensemble techniques show considerable advancements as they tackle non-linear and high-dimensional spaces more effectively, particularly Gradient Boosting which is quite resilient to class imbalance.

The deep learning models, CNN and RNN, outperformed all other models, highlighting their strengths in capturing complex patterns essential for distinguishing between normal and malicious network traffic. CNN's ability to interpret spatial hierarchies proved valuable for static malware analysis, while RNN's capacity to model temporal dependencies made it highly effective in detecting sequential behaviors associated with Trojan malware.

These findings underscore the potential of deep learning architectures in intrusion detection, particularly for complex and evolving threats. The study also shows the importance of balancing traditional and advanced models to develop a comprehensive detection system.

To obtain a more reliable assessment, the researchers adopted a comprehensive approach by training each model multiple times and calculating the average performance metrics. Through this methodology, the researchers were able to obtain a more comprehensive and accurate evaluation of each algorithm's effectiveness in network attack (Trojan) detection.

In addition, to address biases, the researchers thoroughly reviewed the dataset for any uneven representations. They utilized evaluation criteria beyond just accuracy, including precision, recall, and the F1-score, to assess the model's capability in correctly recognizing malicious traffic even in the presence of data imbalances. These metrics provide a fairer assessment of the model's performance as they consider both incorrect positive and incorrect negative results.

Moreover, the researchers understand that distortions in gathering data – like the kinds of attacks recorded or the time frames of data collection – can affect how the model functions with actual traffic that hasn't been seen before. Future research could integrate data sets from various sources or time frames to ensure a wider range of potential attack types and variations in network activity are covered.

Based on the findings, there were variations in the classification results among the different algorithms. In three of the 10 instances, the Logistic Regression technique outperformed the developed Artificial Neural Network algorithm, yielding better classification outcomes. However, it is important to note that these individual cases may not fully represent the overall performance of the algorithms.

The analysis revealed that the deep learning models were the best-performing

models and the decision tree was the worst-performing models. The deep learning models demonstrated higher accuracy, precision, and recall rates, indicating their possible effectiveness in identifying and classifying Trojans within network traffic.

Deep learning models have also been incorporated into network security architecture, showing promise for proactive and real-time Trojan detection. Organizations can continually monitor network traffic and immediately spot possible Trojan attacks by utilizing the power of deep learning algorithms, enabling prompt reaction and mitigation actions.

These results also demonstrate the need to integrate deep learning models into network security systems to enhance the effectiveness and accuracy of Trojan detection. Organizations may improve their defenses against Trojan assaults and fortify their entire cybersecurity posture by utilizing deep learning capabilities.

Discussion

The findings collaborate with studies done by Mahdavifar & Ghorbani 2019) and (Dixit & Silakari 2021). Researchers Mahdavifar and Ghorbani (2019) suggested that deep learning techniques can be applied in networks to support intrusion detection. The study done by Dixit and Silakari, indicated that deep learning can be employed to analyze large data sets and solve difficult problems. In developing countries, cost-effective cybersecurity relies on Trojans being detected in real-time and is enabled by the combination of CNN's spatial analysis and the RNN's temporal pattern recognition.

In this study, the researchers demonstrated that artificial neural networks and deep learning can be applied in the information security domain to identify the Trojan virus. The proposed technique outperformed the logic regression and decision tree algorithm in terms of accuracy, recall, and precision.

Contribution and Application of Findings

This study contributes to both theory and practice. Theoretically, this study adds to the limited literature on the use of artificial intelligence in the cybersecurity domain especially in developing countries. Practically, the insights gained from our study can be applied in the field of network security to develop advanced intrusion detection systems capable of accurately identifying and classifying Trojans. This can aid in the timely detection and prevention of cyber-attacks, bolstering the security posture of organizations and individuals. Furthermore, the findings can support the development of machine learning algorithms or AI-based systems for efficient Trojan detection, enabling automated and proactive

defense mechanisms against evolving threats. These practical applications have the potential to significantly enhance the resilience and effectiveness of cybersecurity measures in both corporate and personal contexts.

Limitations and Future Studies

In this experimental study, the researchers focused on the detection of the Trojan virus. The daily production rate of malicious software studies can expand the analysis to identify additional malicious software. A limitation of this study is that the researchers did not investigate the paradoxical issue of overfitting related to deep learning networks that can undermine the effectiveness of the desired solution (Xiao et al. 2021). Overfitting can adversely affect the performance of deep learning networks and reduce the accuracy of the results on test data (Rice et al. 2020; Salmon & Liu 2019). Other researchers have proposed several optimization methods and algorithms such as stochastic gradient descent, regularization and data segmentation and algorithms early stopping and consensus-based classification (e.g., Rice et al. 2020; Salmon & Liu 2019) because there are no magic bullets and no one size fits all solutions.

Future studies could investigate the use of a stochastic hybrid framework that integrates the strengths of semi-supervised artificially intelligent models and the early stopping technique which is said to be a fairly good algorithm with a classification model. The stochastic hybrid framework would incorporate the uncertainty associated with adversarial testing and training with the strength of the early stopping technique with a semi-supervised learning technology. According to research done by Rice et al. (2020) only data augmentation used with semi-supervised learning techniques have outperformed the early stopping technique. Additionally, no single technique or model as so far managed to address the problems associated with overfitting (Rice et al. 2020). The integration of these techniques could reduce the overfitting issues associated with deep learning networks result in a more robust adversarial technique to support cyber-defense against malicious attacks such as trojan. Additionally, developing countries like Jamaica can build their cyber resilience by investing in cost-effective artificial intelligent tools.

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Screening and Monitoring for Modifiable Risk Factors in Users of Atypical Antipsychotics

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Abstract

Antipsychotics are medications used in treating mental disorders to improve patients' quality of life. Atypical antipsychotics may cause metabolic abnormalities, including weight gain and hyperglycaemia, which are risk factors for cardiovascular disease. Requirements for atypical antipsychotics are increasing, implying wider prescribing or higher dosage requirements for stabilisation, and the resultant effects of increased metabolic and cardiovascular risks in patients, especially where measures are not taken to reduce them. This study assessed the practices of healthcare practitioners in screening and monitoring modifiable risk factors in users of atypical antipsychotics at the psychiatric hospital in Jamaica, aimed at reducing the development or worsening of obesity or diabetes in these patients. This was a cross-sectional study involving 30 healthcare practitioners and 28 patients, and a retrospective longitudinal review of the patients' medical records over a 5-year period. Self-administered questionnaires, interviews, and an assessment form were used to gather data on baseline tests and parameters monitored. Statistical Package for the Social Sciences version 20.0 was for data analysis. Screening and monitoring rates were calculated and stratified by atypical antipsychotic, age and gender. Screening and monitoring of personal medical history and weight were minimal (< 50%), but moderate (50% - <70%) to high (80% - <90 %) for fasting or random blood glucose. Greater efforts should be made at the study hospital to assess modifiable metabolic risk factors in patients taking atypical antipsychotics because screening and monitoring will enable preventative and remedial interventions.

Keywords: Atypical Antipsychotics; Metabolic Abnormalities; Hyperglycaemia; Obesity; Type 2 Diabetes mellitus

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Introduction

Mental health, an essential aspect of health, can affect one's daily life, relationships and physical health (Nordqvist, 2014). The World Health Organization [WHO] (2022) states that "Mental health is a state of mental well-being that enables people to cope with the stresses of life, realise their abilities, learn well, work well, and contribute to their community" (para. 1). It may then be said that many persons experience some degree of mental ill-health, but not all mental illnesses or disorders require treatment.

In Jamaica, the burden of psychiatric illnesses requiring treatment continues to grow. In 2015, almost 108,000 Jamaicans were treated for mental illnesses in public health facilities island-wide, of which nearly 2,000 were admitted to hospitals for extensive treatment. This is a sharp increase over 2013 and 2014 when an average of 90,000 persons were treated yearly (Jones, 2016). Data from the United Nations Interagency Task Force on the Prevention and Control of Non-communicable Diseases [UNIATF] et al. (2019) further revealed that the number of visits increased by about 20% in 2016, with nearly 132,000 visits in that year. These numbers may represent about half of the actual need for treatment, as the treatment gap for mental disorders in the Caribbean ranges from 37.4% (non-affective psychoses) to 64.0% (bipolar disorder) (UNIATF et al., 2019).

Antipsychotics are among the classes of medications used to treat mental disorders, in particular, schizophrenia, schizoaffective disorder and bipolar disorders, and are effective in the treatment of hallucinations, delusions, and thought disorders, regardless of aetiology (Reus, 2012). For these patients, "antipsychotics open a new world," promoting clear thinking, improved functioning at work, and better social interaction skills (Fast, 2010, para. 3). Fast (2010) further stated that antipsychotics are especially effective for the mentally ill with thought disorders that affect societal functioning.

Antipsychotics are broadly classified as typical, conventional or first-generation antipsychotics (FGAs) and atypical or second- or third-generation antipsychotics (SGAs or TGAs).

Examples of available FGAs are haloperidol, trifluoperazine and chlorpromazine, whereas available SGAs include risperidone, quetiapine, olanzapine, clozapine, aripiprazole, paliperidone and ziprasidone. The FGAs effectively treat positive symptoms, most notably hallucinations, delusions, aggression and hostility. The main disadvantages have been the lack of response of negative symptoms, such as apathy, social isolation, withdrawal and lack of motivation, and the high rate of extrapyramidal symptoms (EPS), including dystonic reactions, akathisia, drug-induced Parkinsonism, and tardive dyskinesia (Llorente & Urata, 2006).

Church et al. (2010) emphasised that SGAs have become the drugs of choice in the treatment of schizophrenia since their emergence in the 1990s. The SGAs have largely replaced FGAs, as they demonstrate similar efficacy with minimal or no EPS at therapeutic doses in treating positive symptoms, but modest on negative symptoms, except clozapine. Clozapine is superior to FGAs in treating refractory schizophrenia and is associated with a reduced risk of suicide attempts (Llorente & Urata, 2006).

Evidence from clinical trials indicated that side effects associated with SGA use include hyperglycaemia, ketoacidosis, and diabetes, with clozapine and olanzapine having the greatest risk of clinically significant weight gain and diabetes (WHO, 2009).

Classic anthropometric indices used to measure obesity include Body Mass Index (BMI), waist circumference, and waist-to-height ratio, whereas diabetes may be diagnosed based on glycosylated haemoglobin (HbA1c) or plasma glucose criteria, such as the fasting blood glucose (FBG) value or random blood glucose (RBG) value accompanied by classic hyperglycaemic symptoms, such as polyuria, polydipsia, or unexplained weight loss, or hyperglycaemic crisis (Sadeghi et al., 2024; American Diabetes Association Professional Practice Committee, 2024).

Obesity and diabetes mellitus are among the contributors to a large percentage of morbidity and mortality in Jamaica associated with non-communicable diseases ("NCDs", 2017; "Jamaica Moves", 2017). The appropriate management of patients receiving SGAs, including screening and monitoring, is critical to prevent or reduce metabolic disorders of obesity and diabetes. This study evaluated the management practices of healthcare practitioners in assessing modifiable risk factors for obesity and type 2 diabetes mellitus (T2DM) in users of SGAs at the major psychiatric hospital in Jamaica, aimed at preventing or reducing the development of these metabolic disorders in patients treated with SGAs. It involved a cross-sectional study, which included healthcare practitioners and patients, and a retrospective longitudinal review of patients' medical records. Screening and monitoring rates were calculated and stratified, providing a detailed analysis of the data.

This study sought to answer the following questions:

1. What factors were considered when screening patients before initiating SGAs to assess modifiable risk factors for obesity and T2DM?
2. What parameters were monitored by healthcare practitioners to assess patients treated with SGAs for modifiable risk factors for obesity and T2DM, and how frequently?
3. The findings of this study could improve current healthcare practices.

Literature Review

Treatment of mental health disorders is aimed at reducing the most serious symptoms, such as hallucinations, delusions, and disorganised thought and behaviour (WHO, 2009). The WHO (2009) report emphasised guided prescribing of pharmacological therapy and consideration of the potential risks and benefits to individual patients. The WHO (2009) further underscored the healthcare providers' requirement to discuss potential risks and benefits of antipsychotics with patients, family members and caregivers. They also recommended that a detailed clinical assessment be performed before any treatment is prescribed (WHO, 2009).

Antipsychotics are the pharmacological backbone in treating mental disorders and, like many other pharmaceutical agents, are prone to cause side effects (WHO, 2009). Studies have assessed the effects of SGAs on inducing metabolic-related disorders, especially relating to schizophrenia.

Obesity is a pandemic which significantly contributes to a range of metabolic disorders responsible for several morbidities and mortalities (Wirshing, 2004). Wirshing (2004) also stated that obesity in schizophrenia is "further enhanced by factors related to the illness, such as poor dietary conditions and more sedentary lifestyles" (para. 1). Additionally, SGA-induced weight gain "may result in the usual obesity-associated morbidity and mortality, if left untreated" (Wirshing, 2004, para. 1).

Studies have shown that weight gain patterns vary with treatment duration and also among antipsychotics. Long-term studies indicated that weight gain induced over the first year of treatment by quetiapine and risperidone, the most widely used SGAs at the study hospital, were associated with weight gain of 2 to 3 kg (4.4–6.6 lb.) (Nasrallah, 2007).

Studies with clozapine in treatment-resistant or treatment-refractory patients revealed an average weight gain of 12.4 kg (27.3 lb.) over ten months, compared to olanzapine with a weight gain of 6.8 to 11.8 kg (15.1–26.2 lb.) during the first year of treatment. Many patients gained more than 20% of their initial body weight (Nasrallah, 2007).

Lambert (2011) identified clozapine, olanzapine and quetiapine as having the highest potential for weight gain. Those drugs have a high metabolic potential, while risperidone has a mild-moderate metabolic potential.

A review of the relative risks for weight gain and diabetes consistently showed an increased risk for weight gain for selected SGAs. An increased risk for diabetes was shown among patients treated with clozapine or olanzapine, but in patients

taking risperidone or quetiapine, only some studies showed an increased risk for diabetes (American Diabetes Association [ADA], the American Psychiatric Association [APA], the American Association of Clinical Endocrinologists [AACE] and the North American Association for the Study of Obesity [NAASO], 2004).

Along with lifestyle and genetic factors, metabolic adverse effects of weight gain and hyperglycaemia are risk factors for cardiovascular disease which contribute to the decreased lifespan of patients with schizophrenia (Church et al., 2010; Patel et al., 2014). Psychiatric illnesses, in particular schizophrenia, are risk factors which predispose patients to metabolic-related disorders. Such patients treated with SGAs are, therefore, at even greater risk for developing these disorders, which in some cases result in early death.

A consensus development conference was convened in November 2003 by the ADA/APA/AACE/NAASO to better understand this relationship between SGAs and the development of these major cardiovascular risk factors. The conference panel developed a consensus position recommending the following:

1. Consideration of metabolic risks when starting SGAs
2. Patient, family, and caregiver education
3. Baseline screening
4. Regular monitoring
5. Referral to specialised services, when appropriate. (ADA et al., 2004, p. 600).

The panel further recommended guidelines for screening and monitoring patients taking SGAs - personal/family history and waist circumference at baseline and annually, blood pressure and FBG at baseline, 12 weeks and annually, fasting lipid profile at baseline, 12 weeks and every 5 years, and weight [BMI] at baseline and monthly for the next 3 months, then quarterly. They also advised that more frequent assessments may be warranted based on the patients' clinical status (ADA et al., 2004).

The WHO also recommends that management of patients on antipsychotics include weight and blood pressure measurements before initiating antipsychotics and that other suggested monitoring include blood glucose (WHO, 2009).

No study was found on the metabolic adverse effects of SGAs in the Jamaican population. However, a study was undertaken to determine the prevalence of metabolic syndrome in a Jamaican adult psychiatric inpatient population, including patients taking SGAs. The researchers reported that of the 38 patients recruited, 29% were overweight, and 13% were obese (Gossell-Williams et al., 2012). Gossell-Williams et al. (2012) stated that metabolic syndrome was common (28.9%) in the cohort of Jamaican psychiatric inpatients studied, which could lead to the development of T2DM.

According to Nasrallah (2007), epidemiological studies have demonstrated an increased risk of diabetes in schizophrenia patients treated with many SGAs.

Leslie and Rosenheck (2004) studied the incidence of new-onset T2DM for at least one year in patients taking antipsychotics. The researchers reported that 7.3% of the participants developed diabetes, with the highest risk for clozapine and olanzapine. These findings were consistent with the phase I findings of the CATIE (Clinical Antipsychotic Trials of Intervention Effectiveness) trial (2003; as cited in Church et al., 2010), in which olanzapine was associated with a significant increase in mean HbA1c, whereas quetiapine and risperidone had a much lower increase. Church et al. (2010) postulated that based on epidemiologic studies and clinical trials, clozapine and olanzapine appeared to have the greatest risk for diabetes, similar to weight gain.

Cohn and Sernyak (2006) outlined two overall goals of metabolic monitoring:

1. Identifying treatable pathology in a high-risk population and additional risk factors and disease markers to facilitate preventative strategies and early diagnosis.
2. Tracking and linking metabolic disturbance related to antipsychotic treatment.

It is highly recommended that patients treated with SGAs receive appropriate baseline screening and ongoing monitoring of height, weight, waist circumference, blood pressure, fasting blood glucose and lipid profile, and proper records of these values be maintained (ADA et al., 2004; Church et al., 2010).

In the Maudsley Prescribing Guidelines in Psychiatry (2021), Taylor et al. recommended that patients should at least be weighed and their weight clearly recorded, when starting treatment with an antipsychotic or changing drug. They further stated that ideally, BMI and waist circumference should also be recorded. The authors opined that there was an overwhelming need for improved diabetes monitoring and support for any test for diabetes, including urine glucose and RBG. They also stated that physical factors, such as weight gain, and known risk factors, such as a family history of diabetes, should determine the frequency of monitoring. The absolute minimum is annual testing for diabetes for all patients (Taylor et al., 2021).

Zeier et al. (2013) recommended baseline and periodic monitoring due to the known metabolic side effects that occur in patients taking SGAs. They advised that BMI and waist circumference be recorded at baseline and throughout treatment, ideally monthly for the first three months of therapy or after any medication adjustments, then at six months and annually thereafter. For the monitoring of HbA1c and FBG, the authors recommended that these be measured at baseline

and throughout treatment, at three months, then annually thereafter, unless the patient developed T2DM.

Marder et al. (2004) recommended that the patient's BMI be recorded before medication initiation or change and at every visit for the first six months, regardless of the antipsychotic being considered or prescribed. They further stated that the patient be weighed (and the BMI recorded) at least quarterly when their weight is stabilised, and more often if overweight. BMI monitoring should be supplemented with the measurement and recording of the patient's waist circumference (Marder et al., 2004).

Üçok and Gaebel (2008) have cautioned healthcare practitioners that monitoring weight alone may be insufficient to screen for diabetes mellitus risk, as diabetes occurrence is not always associated with weight gain.

Methodology

Study Design

This study employed two study designs: a cross-sectional survey of healthcare practitioners and patients and a retrospective longitudinal review of patients' medical records over a 5-year period. The practices of the healthcare practitioners at the study hospital were compared to the ADA/APA/AACE/NAASO (2004) recommendations for screening and monitoring metabolic risk factors in patients treated with SGAs.

Eligibility Criteria and Recruitment

The study population consisted of healthcare practitioners and patients at the study hospital.

Healthcare practitioners. The population of healthcare practitioners consisted of physicians, nurses, and pharmacists involved in the clinical management of patients. Healthcare practitioners were eligible for the study if they had at least five years' experience in psychiatry; physicians actively involved in clinical psychiatric management of patients and Charge nurses working on the wards, emergency room or Day Clinic. The Medical Internist and HIV specialist, not actively engaged in clinical psychiatric management of patients, nursing personnel other than Charge Nurses and the Chief Pharmacist, being the principal researcher, were excluded.

All healthcare practitioners deemed eligible for this study, five physicians and twenty-five nurses, were recruited.

Patients. The patient population comprised in- and outpatients, 18 years and older, diagnosed with a mental disorder and treated with an SGA available at the study hospital – risperidone, quetiapine, olanzapine or clozapine. Patients were included in the study if they received treatment with an SGA between January and December 2010 and thereafter maintained on the therapy for the 5-year review period. Patients with a personal medical history of diabetes before initiating SGA therapy were excluded. Patients assessed as being mentally unstable by their physician or found to be incoherent during the interview were considered non-respondents.

Of the thirty-three patients who met the eligibility criteria using the Pharmacy database, three were eliminated from the study because they could not be contacted. However, two of the thirty patients recruited were unable to participate – one patient was mentally unstable when contacted, and the other patient's therapy was discontinued in 2013, two years prior to the end of the review period.

Data Collection

A questionnaire-based survey of healthcare practitioners and patients was conducted to ascertain the screening and monitoring practices used to assess modifiable risk factors in users of SGAs. Medical records for the patients surveyed were reviewed to determine the healthcare practitioners' practices regarding assessing modifiable metabolic risk factors in SGA users.

International recommendations for the screening and management of patients treated with antipsychotics were also reviewed. A form adapted from the ADA/APA/AACE/NAASO (2004, p. 598) was used to assess screening and monitoring practices. Retrospective data was retrieved from participants' medical records for the period 2010 to 2015 to complete the screening and monitoring assessment form.

The following screening and monitoring periods were pre-defined for this study:

Baseline – Within 7 days, before or after the first day of taking an SGA

Monthly – Within 7 days, before or after each 30-day period

Quarterly – Within 14 days, before or after each 90-day period

Annually – Within 30 days, before or after each 12-month period

Data Analysis

A statistician analysed data using the Statistical Package for the Social Sciences (SPSS) version 20.0. The following interpretation was used in defining the frequency of responses: Often = 50% or more of the time; Rarely = Less than 50% of the time.

Screening and monitoring rates were calculated and stratified according to the SGA, age and gender for each parameter. The frequency distribution of the practices of the healthcare practitioners was determined and compared with international recommendations for managing these patients. In the absence of a standard rating scale for screening and monitoring, the researchers adapted the following five-point scale defined by Mitchell et al. (2012) to assess screening and monitoring practices for each testing period:

Minimal – Less than 50% of the study sample screened or monitored

Moderate – 50% or more but less than 70% of the study sample screened or monitored

Suboptimal – 70% or more but less than 80% of the study sample screened or monitored

High – 80% or more but less than 90 % of the study sample screened or monitored

Optimal – 90% or more of the study sample screened or monitored.

Reliability and Validity

Structured questionnaires were pre-tested for reliability and validity at another health facility.

Ethical Considerations

Approval was received from the study hospital's Management, and the University of Technology, Jamaica and the Ministry of Health, Jamaica Ethics Committees. Informed consent was obtained from all participants.

Results

Healthcare Practitioners' Survey

The majority of healthcare practitioners (n = 23, 76.7%) had 6 – 10 years of practice in psychiatry. Twenty-eight (93.3%) respondents indicated awareness of at least one metabolic/cardiovascular adverse effect of SGAs. The most frequently named was diabetes mellitus/hyperglycaemia (n = 21, 70.0%), followed by weight gain/obesity (n = 19, 63.3%).

All except one of the healthcare practitioners reportedly screened patients' personal or family medical history. The majority (n = 16, 53.3%) reported doing

so often, while only 4 (13.3%) said always (Figure 1). The majority of respondents (n = 28, 93.3%) reported performing baseline tests, including measurements, for patients being initiated on an SGA (Figure 2). Monitoring of patients taking SGAs was reportedly often done by the majority (n = 16, 53.3%) of healthcare practitioners (Figure 3).

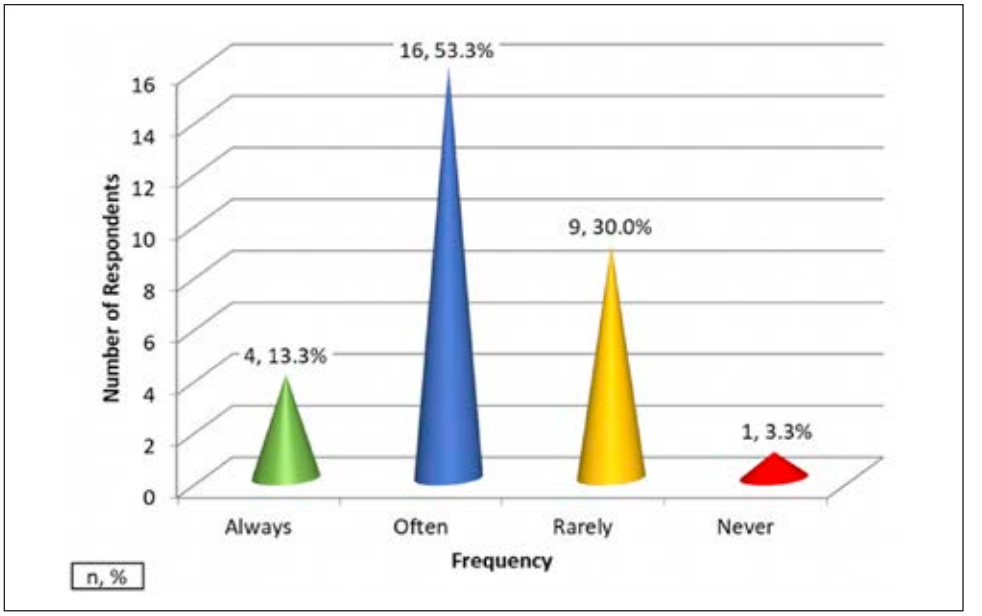


Figure 1. Healthcare practitioners' self-reports of screening patients' personal or family medical history.

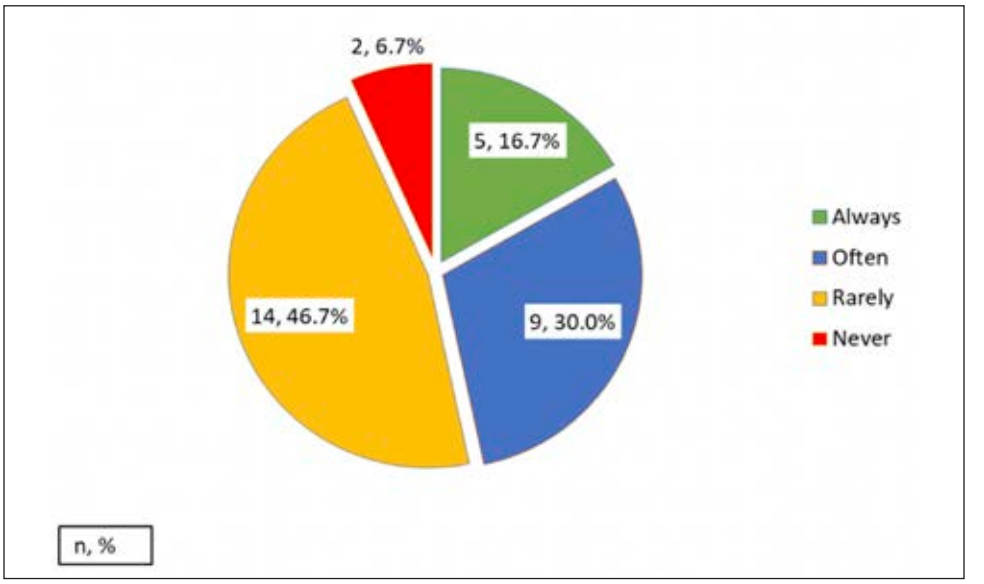


Figure 2. Healthcare practitioners' self-reports on the frequency of performing patients' baseline tests/ measurements.

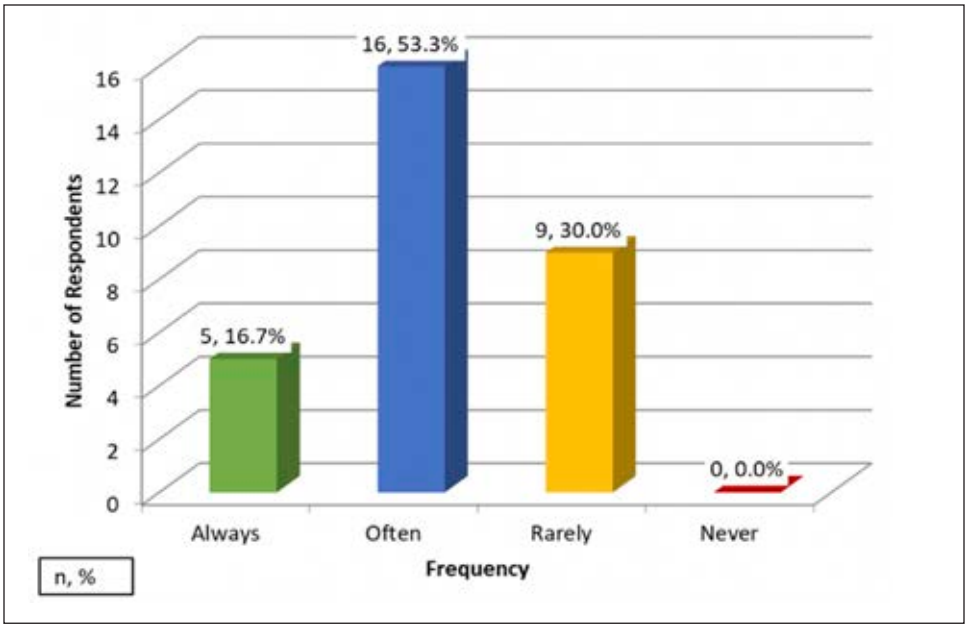


Figure 3. Healthcare practitioners' self-reports on the frequency of monitoring patients.

Patients' Survey

Twenty-one (75.0%) participants were males and seven (25.0%) were females. Most of the participants were between 38 and 57 years old (n = 19, 67.9%), and just under one-half of them (n = 13, 46.4%) were diagnosed with a mental disorder for more than 20 years.

Patients' Medical Records Review

The SGA most widely taken by the participants was risperidone (n = 21, 75.0%); six (21.4%) took quetiapine, and only one (3.6%) was taking clozapine. None was treated with olanzapine over the 5-year review period.

The percentage of patients screened or monitored for obesity or T2DM risk factors, as recommended by the ADA/APA/AACE/NAASO (2004), was generally low. There was no record of the participants' height, waist circumference, BMI, or HbA1c in their medical records at baseline or over the 5-year review period. However, at least one indicator each for obesity and T2DM was monitored for some patients.

Of those indicators for obesity and T2DM risk for which participants were screened, less than one-half were screened for each indicator. Five of the twenty-eight participants (17.9%) were weighed, eight (28.6%) FBG and nine (32.1%) RBG

were tested, and eight (28.6%) personal medical histories were taken at baseline (Figures 4–7). These all revealed minimal screening practices by the healthcare practitioners. Table 1 shows stratified screening and monitoring rates for weight within the testing periods recommended by ADA/APA/AACE/NAASO (2004).

Monitoring of indicators for obesity and T2DM risks was similar to that of screening, as less than one-half of the participants had monitoring of the specified indicators for obesity and T2DM risk at the ADA/APA/AACE/NAASO (2004) recommended periods, representing minimal monitoring practices (Figures 4–7). The most frequently monitored indicators were RBG at 1 year and 4 years and FBG at 4 years, done for thirteen participants (46.4%) at each identified period.

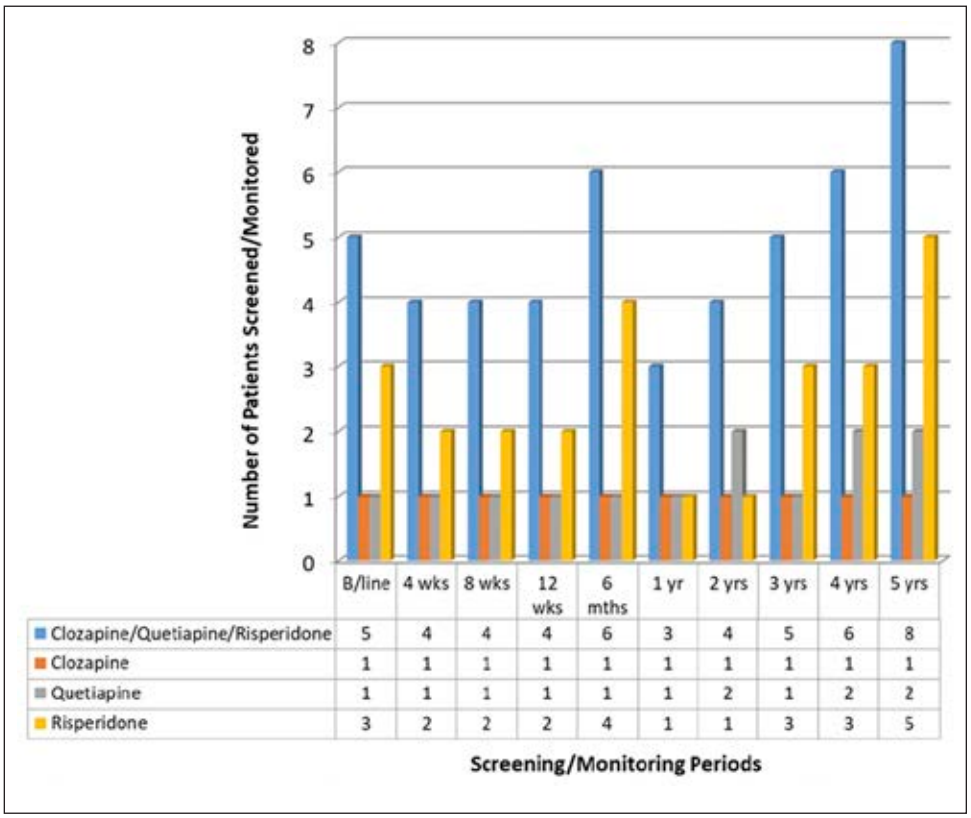


Figure 4. Number of patients with weight screened/monitored within target periods.

Note. B/line = baseline; wks = weeks; mths = months; yr = year; yrs = years.

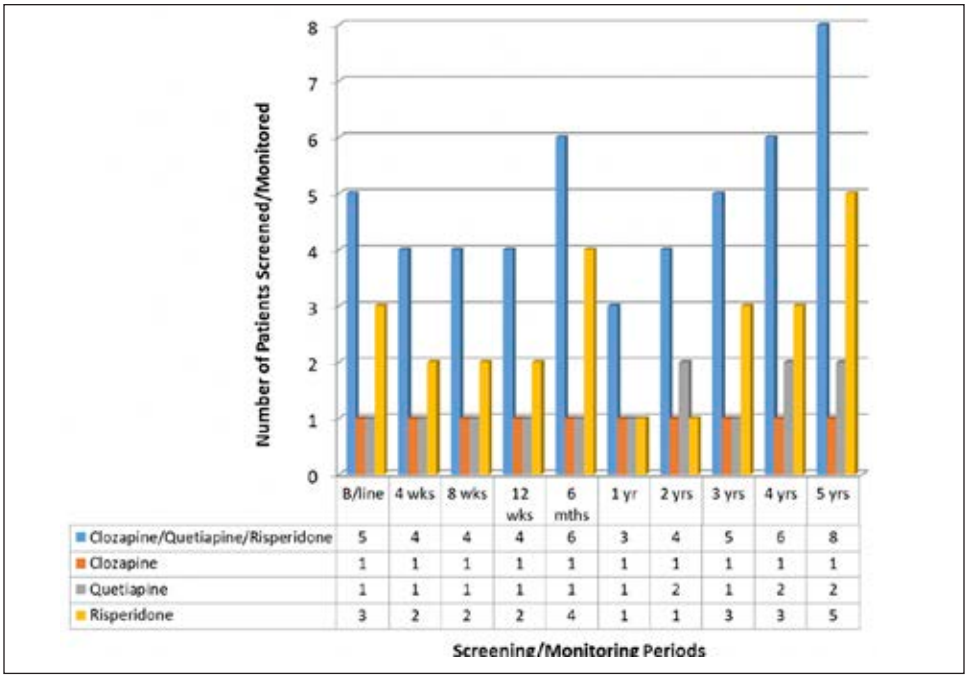


Figure 5. Number of patients with fasting blood glucose screened/monitored within target periods.

Note. B/line = baseline; wks = weeks; yr = year; yrs = years.

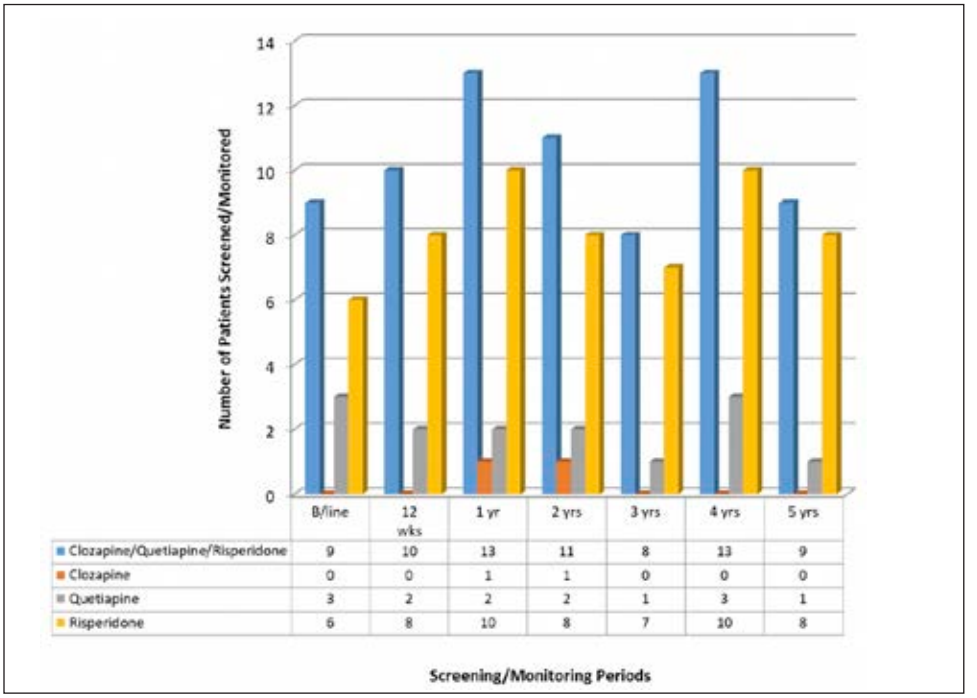


Figure 6. Number of patients with random blood glucose screened/monitored within target periods.

Note. B/line = baseline; wks = weeks; mths = months; yr = year; yrs = years.

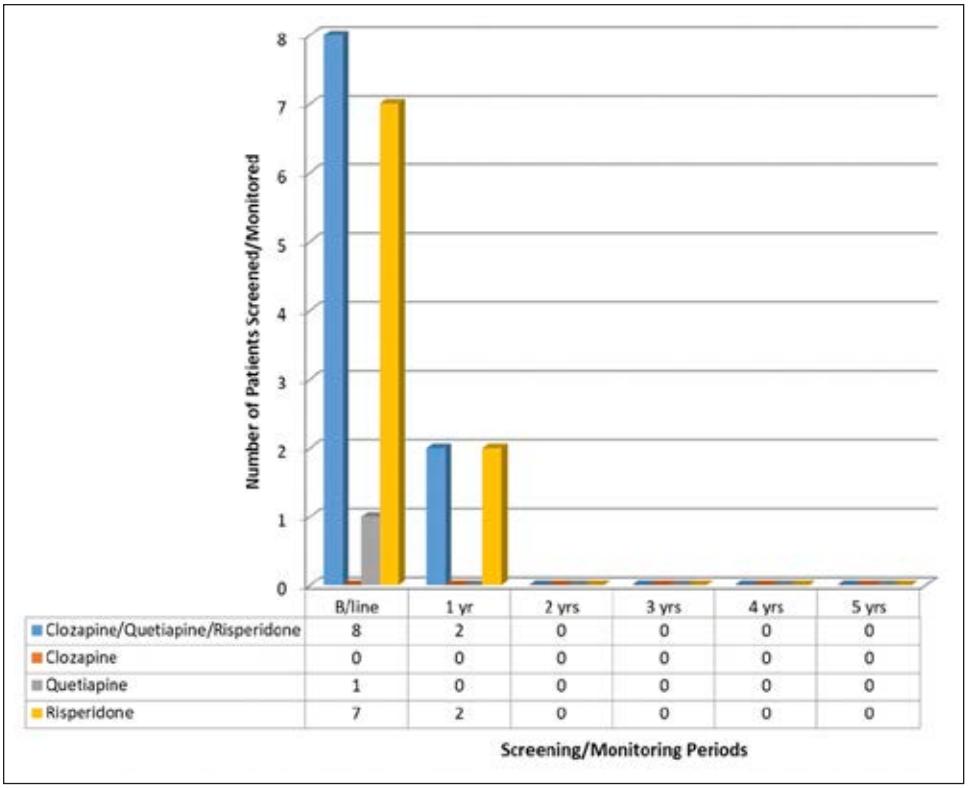


Figure 7. Number of patients with personal medical histories screened/monitored within target periods.

Note. B/line = baseline; yr = year; yrs = years.

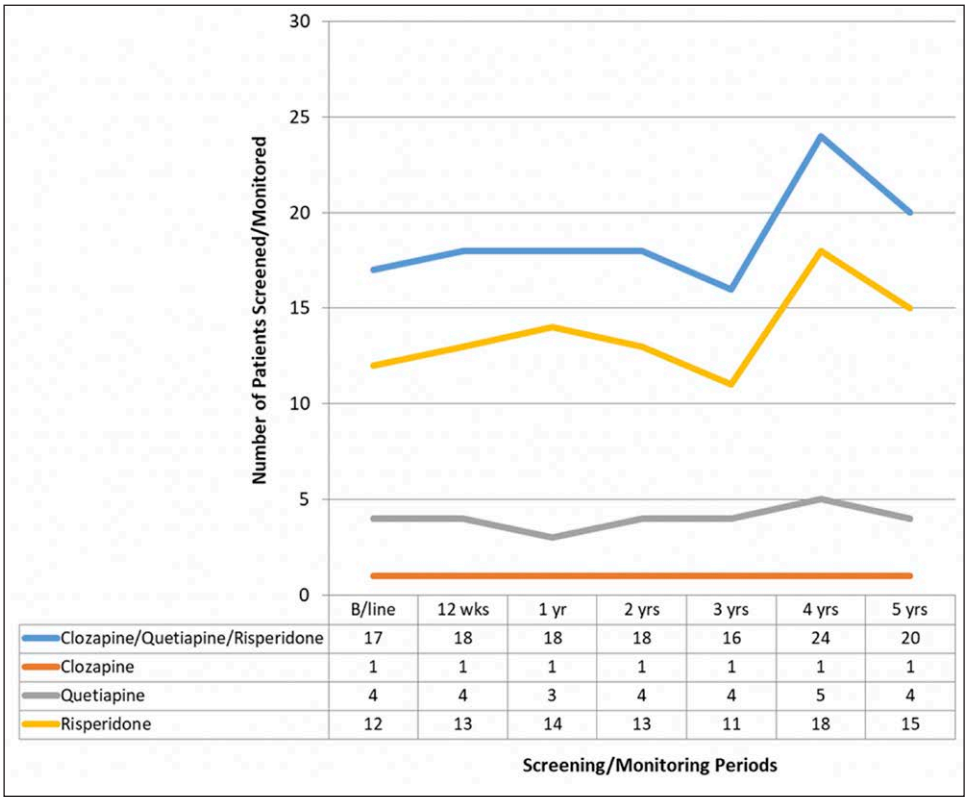
Table 1: Stratified Screening and Monitoring Rates for Weight Within Target Periods

		B/line	4 wks	8 wks	12 wks	6 mths	1 yr	2 yrs	3 yrs	4 yrs	5 yrs
Characteristics	**N (%)**	**n (*%)**	**n (*%)**	**n (*%)**	**n (*%)**	**n (*%)**	**n (*%)**	**n (*%)**	**n (*%)**	**n (*%)**	**n (*%)**
Total	28 (100)	5 (18)	4 (14)	4 (14)	4 (14)	6 (21)	3 (11)	4 (14)	5 (18)	6 (21)	8 (29)
Atypical Antipsychotic											
Clozapine	1 (4)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1(100)	1 (100)	1 (100)	1 (100)	1 (100)
Quetiapine	6 (21)	1 (17)	1 (17)	1 (17)	1 (17)	1 (17)	1 (17)	2 (33)	1 (17)	2 (33)	2 (33)
Risperidone	21 (75)	3 (14)	2 (10)	2 (10)	2 (10)	4 (19)	1 (5)	1 (5)	3 (14)	3 (14)	5 (24)
Age											
18 – 27 years	0 (0)										
28 – 37 years	4 (14)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (25)
38 – 47 years	9 (32)	3 (33)	1 (11)	2 (22)	1 (11)	2 (22)	2 (22)	1 (11)	2 (22)	3 (33)	3 (33)
48 – 57 years	10 (36)	1 (10)	3 (30)	2 (20)	3 (30)	4 (40)	1 (10)	2 (20)	3 (30)	2 (20)	3 (30)
> 57 years	5 (18)	1 (20)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (20)	0 (0)	1 (20)	1 (20)
Gender											
Male	21 (75)	3 (14)	4 (19)	3 (14)	4 (19)	6 (29)	3 (14)	4 (19)	4 (19)	6 (29)	7 (33)
Female	7 (25)	2 (29)	0 (0)	1 (14)	0 (0)	0 (0)	0 (0)	0 (0)	1 (14)	0 (0)	1 (14)

Note. (*%) = Proportion - % of N in each row; B/line = baseline; wks = weeks; mths = months; yr = year; yrs = years

The data revealed that only one indicator for T2DM risk, FBG or RBG, was used to screen patients. Considering this, an assessment was done to determine whether patients were screened with either indicator, which presented a new scenario. As shown in Figure 8, the screening practices for determining T2DM risk improved to moderate, as seventeen of the twenty-eight (60.7%) participants had their FBG or RBG tested at baseline.

Regarding monitoring, three participants had both FBG and RBG tested during the same period over the 5-year review period: one participant at 1 year and 4 years, another at 2 years and 3 years, and the third at 4 years. Excluding testing one of these indicators for the testing periods identified, monitoring practices for T2DM risk were considered moderate at 12 weeks, 1 year and 2 years when eighteen participants (64.3%) were tested (Figure 8). At 3 years, there was a slight decrease when sixteen participants (57.1%) had either their FBG or RBG tested. The fourth year of the 5-year review period showed the highest frequency of monitoring for T2DM risk when twenty-four (85.7%) participants were tested, but this dropped



	B/line	12 wks	1 yr	2 yrs	3 yrs	4 yrs	5 yrs
Clozapine/Quetiapine/Risperidone	17	18	18	18	16	24	20
Clozapine	1	1	1	1	1	1	1
Quetiapine	4	4	3	4	4	5	4
Risperidone	12	13	14	13	11	18	15

Figure 8. Number of patients with either fasting or random blood glucose screened/monitored within target periods.

Note. B/line = baseline; wks = weeks; yr = year; yrs = years.

Table 2. Stratified Screening and Monitoring Rates for T2DM (Fasting or Random Blood Glucose) Within Target Periods

		B/line	12 wks	1 yr	2 yrs	3 yrs	4 yrs	5 yrs
Characteristics	N (%)	n (*%)	n (*%)	n (*%)	n (*%)	n (*%)	n (*%)	n (*%)
Total	28 (100)	17 (61)	18 (64)	18 (64)	18 (64)	16 (57)	24 (86)	20 (71)
Atypical Antipsychotic								
Clozapine	1 (4)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)
Quetiapine	6 (21)	4 (67)	4 (67)	3 (50)	4 (67)	4 (67)	5 (83)	4 (67)
Risperidone	21 (75)	12 (57)	13 (62)	14 (67)	13 (62)	11 (52)	18 (86)	15 (71)
Age								
18 – 27 years	0 (0)							
28 – 37 years	4 (14)	3 (75)	2 (50)	1 (25)	2 (50)	1 (25)	3 (75)	1 (25)
38 – 47 years	9 (32)	5 (56)	5 (56)	5 (56)	7 (78)	6 (67)	8 (89)	8 (89)
48 – 57 years	10 (36)	6 (60)	9 (90)	8 (80)	7 (70)	6 (60)	9 (90)	8 (80)
> 57 years	5 (18)	3 (60)	2 (40)	4 (80)	2 (40)	3 (60)	4 (80)	3 (60)
Gender								
Male	21 (75)	14 (67)	15 (71)	16 (76)	16 (76)	11 (52)	19 (90)	15 (71)
Female	7 (25)	3 (43)	3 (43)	2 (29)	2 (29)	5 (71)	5 (71)	5 (71)

Note. (*%): Proportion - % of N in each row; B/line = baseline; wks = weeks; mths = months; yr = year; yrs = year

from high to suboptimal in the fifth year. Table 2 shows stratified screening and monitoring rates for T2DM within target testing periods, for which FBG or RBG testing was performed.

In light of the evidence of none to minimal screening and monitoring of the majority of the indicators for obesity and T2DM in patients taking SGAs, the researchers further evaluated the data. This revealed that nine (32.1%) participants had screening and complete monitoring, conforming to the ADA/APA/AACE/NAASO (2004) recommendations for FBG or RBG (Figure 9). Only two (7.1%) participants had screening and complete monitoring of weight.

Discussion

Healthcare Practitioners' and Patients' Survey

Screening and Monitoring Practices. The ADA/APA/AACE/NAASO consensus statement, a pivotal document developed in 2004, serves as a beacon for healthcare practitioners, guiding them in screening, monitoring, and managing this patient population. These guidelines were adapted to assess the practices of the healthcare practitioners in this study.

Screening Practices. The majority of healthcare practitioners reported taking patients' personal or family histories, either always or often, before prescribing or administering a new medication. This might have been because they were

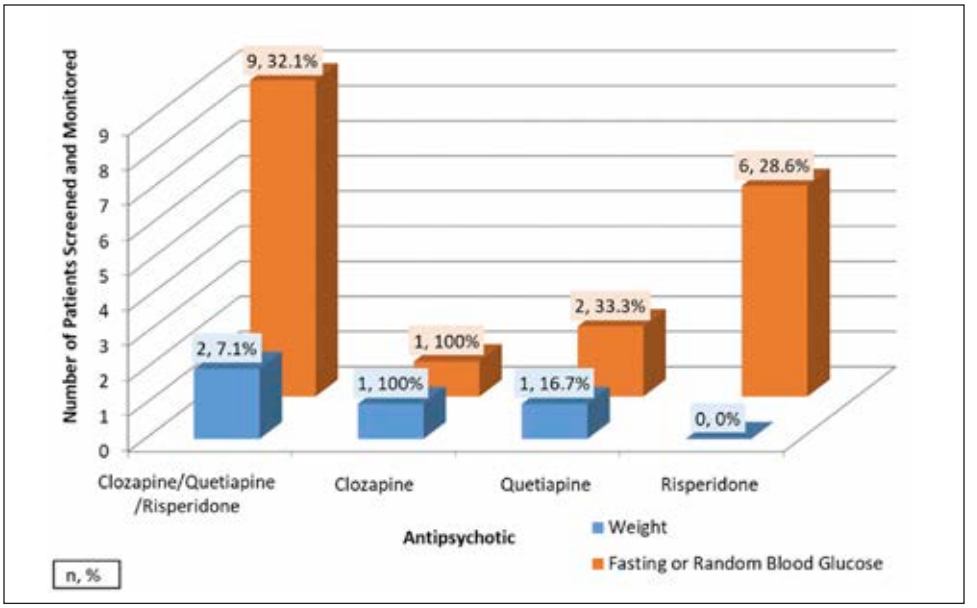


Figure 9. Number of patients screened and monitored within all target periods for weight and fasting or random blood glucose.

knowledgeable of metabolic and cardiovascular adverse effects associated with SGAs. A patient's personal and family histories help determine his medical comorbidities and risk for developing metabolic disorders.

The ADA/APA/AACE/NAASO (2004) taskforce recommends assessing a patient's personal and family histories for obesity and diabetes, among other medical conditions, before, or as soon as clinically feasible after, the initiation of an antipsychotic (baseline). For metabolic disorder risk reduction and determining a patient's current status, the ADA/APA/AACE/NAASO (2004) taskforce also recommends assessing at baseline a patient's weight and height, which would be used to calculate the BMI, waist circumference at the level of the umbilicus, and FBG.

While it is encouraging that only 6% of the healthcare practitioners reported never conducting baseline tests or measurements for patients being initiated on an SGA, the fact that only 13% reported always performing these tests is concerning. The low rate of screening practices reported by healthcare practitioners may be attributed to time constraints and limited human and physical resources. Not consistently screening patients may result in a missed medical diagnosis, which may be more challenging to treat or result in morbidity or mortality later in life. This underscores the critical importance of ensuring thorough and consistent screenings for all patients.

Monitoring Practices. Having recognised the possibility of developing medical disorders over time, as well as a patient's choice to visit different doctors over a period, the ADA/APA/AACE/NAASO (2004) consensus statement also recommended reassessing a patient's personal and family histories annually after initiating an antipsychotic. Unlike the greater proportion of healthcare practitioners who reported assessing patients' personal or family histories at baseline, very few reported reassessing them over time. However, those who did reassessments did so more frequently than recommended. More frequent assessments would enable healthcare practitioners to more readily determine changes in a patient's risk.

Monitoring of BMI and waist circumference is recommended at 4 weeks, 8 weeks, 12 weeks, and quarterly after initiating an antipsychotic, whereas FBG is recommended to be retested at 12 weeks and annually. Similarly to baseline testing, only 17% of healthcare practitioners reported always monitoring patients, but all reported monitoring at some point during a patient's therapy. By routinely monitoring, there would be increased opportunities to detect early derangements in parameters, thereby significantly impacting patient care.

The researchers identified one instance in which one patient from the study sample was referred to the dietitian because that patient "appeared to have excessive weight gain," for which there was no empirical data. It is commendable that an intervention was made to address the patient's perceived weight gain, even without empirical data.

The findings revealed that the patients in the study sample had the highest rate of monitoring for T2DM in the fourth year. This could have been due to the increased procurement of blood test tubes and glucose monitoring (GMR) test strips by the institution, facilitating testing. On the other hand, there was a fall-off in monitoring frequency in year five. A contributing factor to this decrease could be due to clinical inertia on the part of the healthcare practitioners, as the principal researcher, being familiar with the study site, reported the removal of expired blood tubes and GMR test strips from clinical points of care from time to time.

In instances where monitoring was infrequently done, it is possible that the healthcare practitioners were unaware of the recommended monitoring schedules, as well as, time limitations.

Another finding revealed by the study was that only three participants had both FBG and RBG tested during the same period, amounting to five instances. The observations showed that in four of those five instances, the RBG was initially done, but the results were elevated, following which the FBG was requested, but

with normal blood study results. This supports the recommendation of not using RBG alone as a screening or monitoring tool.

Patients' Medical Records Review

Screening and Monitoring Practices. Some researchers sought to determine whether monitoring rates and psychiatrists' attitudes increased after the ADA/APA/AACE/NAASO consensus statement was published. Dhamane et al. (2013) reported monitoring rates in which the number of times a parameter was measured was equal to the frequency recommended in the ADA/APA/AACE/NAASO consensus statement. They reported rates of 27.4% in the monitoring of BMI and 27.1% for glucose. These rates were much different from weight monitoring rates of 75.9% and glucose monitoring rates of 56.1%, as Mitchell et al. (2012) reported in their study. In this study, glucose screening rates were 69%, and monitoring ranged from 57% to 86% at different target periods. During the fourth year of the review period, a marked increase was noted in monitoring rates compared to the previous year. This could have been due to increased glucose testing resources and increased knowledge of the metabolic effects of these drugs. Although FBG is more sensitive than RBG in screening for T2DM, it may be more challenging to obtain in the acutely ill patient who is disorganised. Taylor et al. (2021) have recommended measuring RBG or HbA1c in those cases.

Regarding monitoring of weight, the study's findings showed that screening and monitoring rates were consistently low.

No studies were found that assessed the screening and monitoring of personal and family medical history in patients taking SGAs. A review of patients' medical records revealed that very few participants were assessed at baseline for personal medical history, and this further declined at 1-year follow-up. There was no documentation of family medical history, but oftentimes, the patients' family psychiatric history was documented.

Risperidone was the SGA most widely taken by participants. Clozapine and olanzapine have been identified as being most strongly associated with weight gain and T2DM, whereas quetiapine and risperidone have been implicated to a lesser extent (Nasrallah, 2007; Lambert, 2011; Leslie & Rosenheck, 2004; Church et al., 2010). None of the participants was treated with olanzapine, and only one was taking clozapine.

The findings of this study revealed that the proportion of patients taking quetiapine who were screened and monitored within all target periods for weight and either FBG or RBG was more than that of patients taking risperidone. The same holds true for the monitoring of weight except at 6 months and the screening

of either FBG or RBG at baseline. The results, however, were inconsistent in that monitoring of either FBG or RBG was greater for patients taking quetiapine or risperidone at different periods of the review. This negates the initial assumption that more screening and monitoring were performed in patients taking SGAs with a greater propensity for weight gain or T2DM risk.

One study in which electronic health records were evaluated found that the level of monitoring was similar for the SGAs studied (Dhamane et al., 2013). Similarly, the findings of this study did not show many differences in the proportions of patients screened and monitored for obesity and T2DM with respect to the SGA they were taking.

The only patient taking clozapine was not included in the comparisons but was screened and monitored for weight and either FBG or RBG at the recommended target periods. On the other hand, his personal or family medical history was not assessed throughout the review period.

Age is a risk factor for both obesity and T2DM. The National Institutes of Health states that the risk of unhealthy weight gain increases with age, with weight starting in young adulthood and continuing until 60 to 65 years old, after which there tends to be weight loss (The National Heart, Lung and Blood Institute [NHLBI], 2017, "Risk factors"). The Centers for Disease Control and Prevention (CDC) has listed being 45 years or older as a risk factor for prediabetes and T2DM (CDC, 2017, "Who's at risk?"). Age did not seem to be a factor in screening and monitoring patients for obesity or T2DM, as the rates also fluctuated over the 5-year review period. Monitoring of weight peaked for the 48–57 years age group at 6 months after initiating therapy with an SGA. Monitoring of either FBG or RBG peaked in the 48–57 years age group at 3 months and 4 years and in the 38–47 years age group at 4 and 5 years.

Patients were more often screened and monitored for T2DM than for weight gain. Monitoring rates fluctuated over the review period for both weight gain and T2DM, with monitoring for weight gain (weight) peaking in the fifth year and monitoring for T2DM (either FBG or RBG) peaking in the fourth year after initiating an SGA.

Limitations

A few limitations to the study are worth noting.

- The Pharmacy database at the study hospital may only represent some patients who initiated SGA therapy, as some patients seen outside of the pharmacy's opening hours may not have returned to fill their prescriptions. Additionally, the lack of a computerised medical record system removed another option to

determine all the patients for whom SGAs were prescribed, which may have limited the population size.
- Contact telephone information for three patients was either outdated or unavailable, so the researchers could not invite them to participate.
- The study did not have a control group to ascertain whether the practices of the healthcare practitioners were the same for patients who were not taking SGAs. However, this study was not designed to be a comparative study, hence the recommendation for future research to strengthen the analysis of the findings.
- Important screening data necessary to assess obesity and diabetes risks were absent from patients' medical records.
- A delimitation of the study was that only three SGAs prescribed at the study hospital were studied – risperidone, quetiapine and clozapine, as none of the participants were treated with olanzapine during the study period. All other SGAs were excluded as they were not on the list of approved drugs for use at the study hospital.

Conclusion

The researchers conclude that healthcare practitioners did not consider the specific SGA, age or gender in screening for modifiable risk factors for obesity and T2DM when initiating SGAs. This was determined to be so because the screening rates were found to be inconsistent when the data was evaluated. Screening and monitoring of parameters for obesity and T2DM are essential for making preventative and remedial interventions.

The practices of healthcare practitioners at the study hospital in screening and monitoring patients taking SGAs to assess modifiable risk factors for obesity are minimal or moderate for T2DM when compared to the ADA/APA/AACE/NAASO (2004) consensus statement recommendations. The complete screening and monitoring rates of weight and blood glucose for patients taking SGAs, as recommended by the ADA/APA/AACE/NAASO (2004) consensus statement, were 7% and 32%, respectively. Height, BMI, waist circumference, and family history were not assessed for the study sample.

Recommendations

The researchers recommend that adequate resources be made available to enable screening and monitoring of patients taking antipsychotics, as antipsychotic-induced metabolic abnormalities increase the risk for cardiovascular diseases

and associated morbidity and mortality if left untreated. Early implementation of interventions will be vital in minimising deleterious effects. Equipment required for screening and monitoring (such as scales and tape measures) must be located at each nursing station and in each psychiatrist's room. Blood investigation forms and blood-taking equipment (such as vacutainers and needles) must also be readily available at the point of care.

All members of the healthcare team must collaborate to maximise patient care outcomes. For example, nurses, pharmacists, and dietitians could assist with measuring and charting patients' BMI and waist circumference, allowing the physicians more time to assess other patients.

It is further recommended that protocols be developed and integrated to govern the prescribing of atypical antipsychotics, and the monitoring and management of patients being treated with these drugs.

Additionally, the authors recommend that future research should include a prospective study in which patients initiating SGAs obtain baseline clinical assessment and tests and that recommended monitoring schedules are adhered to, in determining the incidence of new onset obesity and diabetes mellitus. The findings should then be compared with the ADA/APA/AACE/NAASO consensus statement which guides the screening, monitoring, and management of this patient population.

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Crisis and Resilience:

Jamaican Tertiary-level LGB Students Navigating Identity Formation in Homonegative Educational Contexts

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Abstract

Jamaican tertiary-level students who self-identify as lesbian, gay and bisexual (LGB) are often subjected to homonegative discourse, constituting stereotyping, marginalisation and verbal abuse, which reinforces the adverse childhood experiences (ACEs) they lived earlier in the education system. Ultimately as they grow into adulthood, the extensive experience of trauma impinges the narratives they produce of themselves and their interactions in society. Drawing on data gathered from individual interviews with 28 students and alumni of Jamaican higher education institutions who identify as LGB, this article reports on how societal and campus-based homonegative attitudes and behaviour affected their psychosocial development, including the integration of their sexual orientation into their identity. It reveals that post high school, informants entered a phase where they attempted to negotiate with a homonegative societal value system regarding their sexual orientation. From the summarised narratives contained in the interviews, three possible types of resolution emerged, viz. conformity with homonegative social norms, the (relative) open embrace of an LGB identity or remaining in a state of psychological inertia. Using the theoretical framework of discourse and identity, the article crafts a developmental profile of the informants that explicates their journey through a homonegative education system.

Keywords: Educational Leadership, Trauma, Homo-traumatic Experiences, Homonegativity, LGB Students, Jamaican LGB University Students, Discourse Identity

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Introduction

Public discourse in Jamaica, like in many Commonwealth Caribbean territories, focuses significant attention on the issue of homosexuality, traditionally in stigmatising and discriminatory ways (Gaskins, 2013, Martin-Mack, 2012). Researchers across multiple disciplines and domains, from cultural studies (Gutzmore, 2004; Hope, 2006, 2009 and 2010) to religion (Perkins, 2016 and 2020), gender (Kempadoo, 2003 and 2009) and HIV (Beck et al., 2017; Schleifer, 2004), have chronicled the challenges that same sex attraction represents for the country, which has developed an international reputation for antipathy towards homosexuality. West (2018a) cited the difficulties that globally celebrated Jamaicans who happen to be gay, such as award-winning writer Marlon James, have had navigating space in the land of their birth. Indeed, discursive violence sometimes morphs into physical assault, such as that against Stacey-Ann Chin, a Jamaican poet and lesbian activist, who was 'correctively' raped (Patel, 2023), an act premised on the view that the 'pathology' of lesbianism needed 'correcting' because, in heterosexist terms, it denied men the exercise of power over women's bodies that by right were theirs (Kempadoo, 2009; Patel, 2023). Besides, same sex attracted individuals, particularly males, are interpellated through pejorative naming, emblematised in the Jamaican expression 'batiman', with its essential association to anal sex (Farquharson, 2005). Antigay rhetoric has also been weaponised into what Meiu (2023) calls 'political homophobia,' which, while not requiring concrete gay and lesbian bodies, "often entails digging up such bodies along the way, assembling them, and investing them with various fantasies of national doom and redemption" (p. 163).

The intersection of gender, sex and discursive power is where questions of sexuality emerge most prominently. The University of the West Indies, through its gender studies programmes, was among the first to explore broad questions relating to heterosexist ideology and its link to what it meant to be 'masculine' in the Caribbean (Allyn, 2012; Atluri, 2001; Kempadoo, 2003 and 2009). Subsequently, scholarship focusing on sexuality, particularly that relating to constructions of and attitudes towards homosexuality, particularly in Jamaica (Cowell, 2011; Harris & Jarrett, 2018; Lovell, 2016; West, 2016 and 2018b) as well as studies detailing the impact of homonegativity on members of the LGB community, proliferated (Campbell, 2018; Gromer, Campbell, Gomory & Maynard, 2013).

Using data from the first author's 2022 doctoral research for which the second author was a co-supervisor, this article joins those discussions, expanding into the area of higher education, specifically in relation to the experiences of LGB

higher education students. Reporting on the lived realities of 28 LGB students and alumni of five Jamaican tertiary-level institutions, it outlines how they navigated systemic homonegativity and heterosexism in their educational institutions. The article captures the developmental struggles LGB tertiary-level students faced as they moved through a variety of homo-traumatic experiences in the education system. It begins by clarifying use of the term homonegativity and defining the educational environment within which LGB university students operate.

Using the conceptual framework of discourse and identity (Benwell, 2006; De Fina, 2011; Jones, 2023; Kaufmann & Powell, 2014), the article reviews how LGB students negotiate personal and sociocultural identities under, on the one hand, the influence of contemporary conceptions of the well-integrated gay self and, on the other, wider Jamaican/Caribbean societal forces, such as religion and popular culture, that disseminate heterosexist discourse. Further, it examines how dominance hierarchies shape acceptable identity expression, marginalising and interpellating those who deviate from it (Bjørby & Ryall, 2008; Fasioli et al., 2018; Jagose, 1996).

Drawing from the narratives of the study's informants, the article crafts a profile of the homo-traumatic experiences of tertiary-level LGB students as they navigate their emerging sexual identities in a generally hostile environment, highlighting how they are cast as outsiders for not conforming to normative social identity expectations. The data reveal that for many LGB students, higher educational institutions are microcosms of the wider homonegative society and that campuses are extensions of previous educational levels where they were subjected to homonegative trauma.

Contextualising homonegativity

The term 'homonegativity' is often associated with a better known one, 'homophobia,' which is typically used to describe negative feelings and attitudes towards homosexuality and LGB people. While both terms share a set of foundational heterosexist values (Cowell & Saunders, 2011) and embody the collective sentiments associated with what is considered 'acceptable' and 'appropriate' gender and sexual expressions (Herek et al., 2009), O'Donohue and Casselles (1993) argued that the term 'homophobia' was definitionally difficult to operationalise. Later efforts to clarify definitions of the term have focused more on the challenge posed by its '-phobia' suffix, which in psychiatry and psychology typically denotes a mental disorder characterised by fear, anxiety and anger that is amenable to remedy through therapeutic intervention (Murphy, 2006; Negy & Eisenman, 2005). Consequently, homophobia could suggest a mental disturbance

based on an irrational fear of or anxiety over homosexuality and same sex attracted people (Wright, Adams, & Bernat, 1999). The term has also been criticised for its inadequate categorisation of anti-gay attitudes and failing to correctly represent the consequences of stigmatisation against same sex attracted people (Haney, 2016). Thus, while homophobia and homonegativity "likely overlap so much that it is difficult to separate them" (Negy & Eisenman, p. 292, 2005), each comes with a distinct set of connotations – one being viewed as an affective, the other a cognitive, reaction.

Given the challenges with defining homophobia, some scholars have, in recent years, recommended use of the term 'homonegativity' in its stead. Homonegativity refers to "the indifference, hostility, oppression and the overall lack of social, cultural and institutional support that [non-straights] experience as a consequence of their insertion into a predominantly heteronormative social ethos" (Jung & Smith, 1993, p. 120). Manifestations of homonegativity have also included "enacted stigma, whereby people experience acts of violence and unequal treatment (e.g., harassment), and perceived stigma, including concerns of rejection and negative treatment" (Logie, Lacombe-Duncan, Nakia, Ryan & Ramsay, 2016, p. 2). Scholars such as Cowell and Saunders (2011) have argued that in the Caribbean, non-acceptance of homosexuality might be better understood as 'homonegativity' rather than 'homophobia' because the rejection stems from ingrained heteronormative values, unlike homophobia which is based on intense fear or aversion. Negy and Eisenman (2005) define homonegativity as negative attitudes, beliefs, and actions towards non-heterosexual people. In the Caribbean, this homonegativity is evident through strong emphasis on heterosexuality within the culture. This pressure often leads LGB people to remain closeted due to fear of violence, discrimination, family rejection, homelessness, and results in mental health problems such as depression and suicidal ideation (Bourne et al., 2012; Chadee et al., 2012; Clark, 2005). These factors significantly impact how LGB people in the Caribbean form their identities and integrate into society.

Because the current article aims to capture the range of discriminatory sanctions meted out to LGB students, it seemed more appropriate to avoid use of the term homophobia, which is considered limiting, largely internalised, subjective and intrapsychic. Homonegativity is preferred as it is more expansive, observable in its objective externalisations and manifestations, and applicable to diverse, negative expressions towards those who are or are perceived to be LGB.

Discourse and identity

This article uses discourse and identity as its conceptual framework, viewing discourse as the process of meaning-making through social interaction (Bamberg et al., 2011) and identity as being defined by psychological states, emerging from individual constructions of self but also from people's sense of belonging to particular social groups by virtue of those constructions (Benwell & Stokoe, 2006). In this regard, the article treats sexual orientation, a form of embodied identity (Fausto-Sterling, 2019), as being embedded in the discourse frames of shared values, beliefs, and language which disproportionately benefits some groups while marginalising others (Strear, 2017). Furthermore, when sexual orientation is divided into subcategories of heterosexuality and non-heterosexuality, power dynamics become central, with "regulatory institutions of heteronormativity" (Jagose, 1996, pp. 99-100) shaping individual thoughts, beliefs and behaviours (Foucault, 1984), as well as influencing social systems.

Psychological theorists, following different sub-disciplinary trajectories, have typically studied identity using personal versus social lenses, "focusing on different identity facets, using different assessment methods, and addressing different implications of identity" (Crocetti et al. 2022, p.162). The focal points have been developmental psychology, on the one hand, and social psychology, on the other. The difference relates to the interior gaze on the self versus that from the exterior of the community (Taylor, 2009). In the former, based on Eriksonian and neo-Eriksonian perspectives, "identity is mainly conceptualised in terms of the processes by which individuals commit to meaningful life domains and, thus, arrive at a personal synthesis of different identifications and experiences of personality" (Crocetti, Albarello, Meeus & Rubini, 2022, p.162). By contrast, social psychology perspectives, drawing on the work primarily of Tajfel and Turner (1979), conceptualise identity as individual membership in social groups through various forms of attachment. This way of perceiving identity "has mainly been related to social and collective outcomes, such as intergroup attitudes and discrimination" (Crocetti, Albarello, Meeus & Rubini, 2022, p.162).

Traditional approaches to the study of discourse and identity focus on the role of social praxis and interaction as the primary contexts within which identity is negotiated. This is because psychological perspectives on identity, often seen as contingent, fragmented and discontinuous (Giddens, 1991), become more productive when applied to social interaction. Indeed, it is in interactive spaces that identity is (re-)instantiated and reinforced through acts of communication such as naming and labelling. Moreover, that socially constructed self is what individuals narrate or against which normative or alternative identitarian narratives are

raised (Bamberg, De Fina & Schiffrin, 2011; De Fina, Schiffrin & Bamberg, 2011).

The contextual locations of identity include family and wider social circles in which everyday interactions take place such as educational establishments. Writing from the US context, Cerezo et al. (2020) observed that even within a larger community such as that comprising a sexual and gender minority, membership of sub-groups was critical to positive identity negotiation. Such niche communities, they contended, provided resources and socio-emotional support not available in the broader community. They noted, for example, that same sex oriented African American men often sought support and validation within the House/Ball community, which reflected their intersecting identities of race, sexual orientation, and gender expression. Similarly, they argued, many African-descent lesbians relied on the social support of African American gay men and lesbians to cope with feelings of isolation related to their sexual orientation.

The work by Cerezo et al. joins a body of research that suggests that belonging to a minority community with a strong sense of its own identity can protect individuals from the negative psychological consequences of stigma and discrimination. Summarising existing studies on identity and community, they zeroed in on the fact that family and social groupings played critical roles in fostering overall positive identity experiences for sexual and gender minorities. Ethnographic studies from various parts of the world and on different population groups have validated the perspective that minorities in close association with their own members experienced fewer mental health issues (Diamond and Ally, 2022; McNamara and Muldoon, 2013; Verkuyten and Lay, 1998). The support that comes from being in community seems to outweigh any negative impact from the stigma of being a devalued minority (Dane, 2005). Relying on work by Branscombe et al. (1999), Dane contended that identifying strongly with one's minority group can lessen the harm caused by negative stereotypes.

Thus, anchored in the social lifeworld, identity evolves from the bonds shared between individuals who perceive that they have a community of recourse and with whose members they share a number of salient commonalities. For LGB people, one of these is the problematique of their concealable stigmatised sexual orientation and gender performance (Quinn et al., 2017). In this regard, while LGB otherness is often constructed against an all-encompassing moral, social, physical and – in cases like Jamaica, national – norm, it is also heavily impinged by the question of how individual awareness of sexuality influences the navigation of social spaces and ultimate liberation from the negative effects of antigay social bias. According to Sedgwick (1990), part of that liberation requires that self-recognition be shared with others, what is described as being 'out.' In contexts such as North America and Western Europe, 'coming out' has come to be viewed

as the canonical pathway towards the healthy integration of sexuality into personal identities. For Sedgwick, the act of coming out constituted the performance of naming one's gayness in the presence of others. Thus, discourse plays a crucial role in the construction of gay and lesbian identities. Yet, in the context of the struggle against a dominant heterosexist social narrative, beyond self-recognition, gay and lesbian identity is one forced into existence through social contestation and mobilisation (Schneiberg & Lounsbury, 2007).

The flip side of the narrative that celebrates gay visibility through self-recognition and coming out is that which implicitly or explicitly critiques the closet. Relying on Foucault, Sedgwick (1990) described the closet, like coming out, as constituting a speech act. While being out comprised speech acts that were "strangely specific", he noted that 'closetedness' was a performance "initiated by the speech act of a silence – not a particular silence but a silence that accrues particularity by fits and starts" (p.3). Accordingly, the closet, specifically in North American media artefacts of the late 1980s and the 90s, became a trope on LGB erasure or disempowerment. Big screen movies such as 'Broke Back Mountain,' the cable series 'DL Chronicles' and E. Lynn Harris' series of novels (Invisible Life, Just as I am etc.) problematised it, bringing into sharp focus and for a wider audience the man at its centre who presented as heterosexual but slept with other men in secret (on the 'down low' or colloquially, the DL) (Copeland, 2016; Robinson, 2008). His inability or unwillingness to live his same sex desires out and proud was depicted not only as posing a threat to the health of women through the transmission of disease but also as a kind of personal identitarian failing, and betrayal of the broader gay community (Robinson & Vidal-Ortiz, 2013).

In summary, the contemporary gay and lesbian community, like many other minority groups, perceived the attainment of greater levels of visibility not merely as one of the key markers of its successful counter to stigmatising and discriminatory social narratives but also of successful integration of sexuality into personal identities. It is these identities that became political and ultimately politicised in the interest of the marginalised community, serving as the initial battleground in a war of marginalisation and erasure where presence mattered. Consequently, the extent to which LGB people's self-acceptance corresponded to their freedom to navigate social spaces with few negative consequences was viewed as an indicator of positive change in the social landscape and improvement in the macro-context within which identity is negotiated.

Drivers of homonegative discourse in Jamaica

Historically, attitudes and behaviours that might be classified as homonegative have been features of Jamaican reaction to homosexuality and LGB people. While the culture of homonegativity has been primarily discursive, where LGB people or those suspected to be are ridiculed, bullied or terrorised, this is sometimes characterised by a call to action (Farquharson, 2005) which can sometimes end in social and physical consequences, including violence. Numerous reports have been documented of LGB people being terminated from their jobs or facing housing insecurity, and in extreme cases, being stoned or beaten (Human Rights Watch, 2014).

Two dominant sociocultural factors underpin Jamaican homonegative discourse: religion and, particularly, dancehall music. Jamaica's deeply religious character, shaped by a specific brand of Evangelical Christianity, has been identified as a key driver of homonegativity (Boxill et al., 2011). Religion, as a socialising force, has long exerted a powerful influence on Caribbean societies' conceptualisations and views of appropriate and acceptable sexual identities and behaviours (Lazarus, 2012, p. 121). Accordingly, Perkins (2020) pointed to it as a powerful force defining national moral standards, including strong objection to non-heterosexuality and reflecting core Christian beliefs across denominations. Gutzmore (2004) argued that Jamaica's extreme homonegativity was fuelled by a religious ideological imperative based on the bible, which declared "homosexuality to be an abomination . . . a vile affection . . . unseemly . . . [and] not natural" (p. 10). This imperative derived from a literalist and incomplete reading of the Sodom and Gomorrah story in Genesis 19 (Perkins, 2020), and the condemnation of male same sex activity in Leviticus 18:22 and 20:13 as well as portions like Genesis 1:28 (Hewitt, 2016). Homosexual practice was therefore understood as sinful and punishable by God, and those participating in it, notably males, should expect to bear the consequences of their actions sometimes in socially executed 'batty-judgements,' violent mob attacks involving the stoning, beating, and even killing of gay men (White & Carr, 2005). In fact, Christian-influenced homonegativity is "raised to the level of national duty" (Perkins, 2020, p. 60), with Judaeo-Christian ethics, disseminated through evangelism and institutions such as the family, education, and popular culture (Tafari-Ama, 2006) serving to reinforce it. Ironically, even dancehall artists whose lifestyle and music often radically deviate from conventional Judaeo-Christian values, recourse to religion to justify their strong opposition to homosexuality.

Christianity has, thus, played a pivotal role in forging consensus among Jamaican social institutions – from law to popular culture – to oppose homosexuality (Charles, 2011). This derives from the fact that, as Charles has posited, the discourse

template for the rejection of the homosexual themata, "persistent images generated historically through routinized social interactions which shape the social thinking of Jamaicans and guide their reactions towards homosexuality in the culture" was produced by the country's colonial church. It was this template that is reflected in dancehall's violent opposition to homosexuality. In the evolution from church to popular culture, Charles noted, "the homosexual themata . . . became aggression" (p. 16). Hope (2009) echoed this perspective, asserting that the homonegative group think of the Jamaican culture has been translated into dancehall lyrics through "a cultural dialogue of gendered identity that draws on the historical and cultural legacies of [the country]" (p. 100). These gendered narratives, Helber (2012) argued, resulted in dancehall's deification of a masculinity that "glorifies violence and polygamy" (p.117). Consequently, West and Cowell (2015) proffered, the genre became a means of "policing the borders of Jamaican masculinity, encouraging heterosexuality and polygamy, and discouraging cunnilingus, anal sex, and homosexuality" (p. 297). Suggesting that vernacular forms of respected masculinity were achievable through dancehall music, Hope claimed that the artform provided men lacking in socioeconomic status with the capacity to elevate themselves to don-like positions. In this way, dancehall riding on the back on Christianity, ended up playing a major role in purveying anti-gay discourse and becoming a source of its ideological weaponisation against those deemed to have breached the code of Jamaican masculinity (Couzens, et al., 2017).

Methodology

Descriptive Phenomenology

The objectives of this qualitative research project were to identify and analyse the nature of tertiary institutions as socially and culturally organised environments that purveyed particular kinds of discourse about their LGB students. A qualitative method was employed to capture the subjective 'lifeworld' of informants, providing valuable data on their day-to-day realities and a deeper understanding of the dominant discourse frames that governed and against which their sexual identities were interpellated in the educational environment. As Berg (2004) outlined, qualitative research allows for the exploration of meanings, and subjective realities that cannot be captured by quantitative measures.

The specific approach used was qualitative or descriptive phenomenology, a method particularly well-suited for this kind of study as it allowed for in-depth exploration of the subjective and personal 'lived experiences' of participants. Finlay (2009) explained that descriptive phenomenology aims to grasp and share the

subjective aspects of participants' lives, including their "emotions, motivations, symbols and . . . meanings" (p. 475). Descriptive phenomenology defines the essence of an individual's lived experiences, seeking to clarify otherwise vague meanings through the description of experiences specifically as well as their interpretations (Neubauer, Catherine & Witkop, 2019). In this regard, the lead researcher immersed himself into the lifeworld of the LGB students and alumni, learning their language, the meanings they assigned to experiences, and attempting to grasp, translate and share from an 'insider' perspective how the experiences impacted them.

Although the number of studies on LGB students' lived experiencing has grown over the last decade, the still limited number of existing studies necessitated a research method that minimised assumptions and biases (Valentine et al., 2009; Ellis, 2008). Descriptive phenomenology emerged as the approach of choice due to its capacity to capture the essence of lived experiences, as opposed to pre-conceived notions (Finlay, 2009). This is particularly crucial when studying Jamaican LGB students, a group that has hardly been researched. Without a grounded understanding, researchers risk drawing unsubstantiated conclusions based on cultural stereotypes (Valentine et al., 2009; Ellis, 2008). Bogdan and Biklen (2007) stressed the importance of an open mind in the research process and emphasised learning from participants' subjective knowledge to avoid such pitfalls. As Finlay suggested, descriptive phenomenology allows researchers to "blur the boundaries between art and science" , (2009 p. 476) by employing rich descriptions to capture the intricate layers of lived experiences.

Approach

In-depth interviews were conducted as one data gathering method. A purposive or judgmental self-selected sample, primarily recruited via student referrals, comprising students who self-identify as LGB, formed the body of conversational partners. Owing to the general national climate of hostility towards LGB individuals, a snowballing technique was used to recruit informants. For purposes of confidentiality, research participants were asked to approach known LGB peers, and those interested in participating in the study gave permission for their names and contact information to be shared with the researcher for follow-up.

Participants

The data for this study was gathered from LGB participants who were either attending, had discontinued or graduated from one of five higher education

institutions in Kingston, Jamaica, within five years of the time of conducting the study. Details relating to participants are outlined in Table 1 below. Pseudonyms were used for participants, except for those who explicitly indicated that they preferred to use their given first names. Instead of stating the names of the institutions, descriptors have been used. The sample included 28 participants, 12 registered self-identified LGB students and 16 self-identified LGB alumni. Among the registered students were five lesbians, three gay males, three male bisexuals and one female bisexual. Among the alumni were one lesbian,13 gay men, and 2 male bisexuals.

Data Collection

This study utilised an in-depth semi-structured and unstructured interview schedule. The unstructured interview consisted of open-ended questions about students' developmental and family history, their lived experiences as a LGB college student, factors that informed or influenced their coming out as LGB, and the forming of their LGB identity. The interviews also explored students' perceptions of campus climate toward LGB students and behavioural or attitudinal variances toward them.

With the participants' permission, interviews were digitally recorded, and a third party who possessed no knowledge of the participants' identity transcribed the recordings. The completed transcript along with interview notes were sent to interviewees for review and modifications, where necessary.

Table 1. Details relating to LGB student participants

#	Respondent	Gender	Sexual Identity	Student status: Current /Alumni	Institution
1	Alicia	F	Lesbian	Current	Polytechnic
2	*Shennae	F	Lesbian	Current	Polytechnic
3	*Sherae	F	Lesbian	Current	Polytechnic
4	*Lamoya	F	Lesbian	Current	Polytechnic
5	*Shauna	F	Lesbian	Current	Polytechnic
6	*Crystal-Ann	F	Lesbian	Alumni	Polytechnic
7	Nico	M	Gay	Current	Polytechnic
8	Elijah	M	Gay	Current	Polytechnic
9	George	M	Gay	Current	Polytechnic

#	Respondent	Gender	Sexual Identity	Student status: Current /Alumni	Institution
10	Tim	M	Gay	Alumni	Polytechnic
11	Snape	M	Gay	Alumni	Polytechnic
12	Nate	M	Gay	Alumni	Polytechnic
13	Ramone	M	Gay	Alumni	Polytechnic
14	*Denzel	M	Gay	Alumni	Polytechnic
15	Adidas	M	Gay	Alumni	Polytechnic
16	CJ	M	Gay	Alumni	Polytechnic
17	Smith	M	Gay	Alumni	Polytechnic
18	Natasha	F	Bisexual	Current	Polytechnic
19	Adidas	M	Bisexual	Current	Polytechnic
20	Alex	M	Bisexual	Current	Polytechnic
21	Jeffrey	M	Bisexual	Current	Polytechnic
22	Dario	M	Bisexual	Alumni	Polytechnic
23	Sean	M	Bisexual	Alumni	Polytechnic
24	Anthony	M	Gay	Alumni	Private, Church Affiliated University
25	*Kemar	M	Gay	Alumni	Paramilitary/Polytechnic University
26	*Andre	M	Gay	Alumni	Paramilitary/ Polytechnic University
27	Sage	M	Gay	Alumni	Paramilitary/ Polytechnic University
28	Dave	M	Gay	Alumni	Teachers' College

*Respondent preferred to use their real name.

Findings

Many students view entry into tertiary education as a personal developmental milestone and a rite of passage as they transition from adolescence to adulthood. For LGB students, however, the transition is typically not smooth, and they face several obstacles because of their stigmatised personal and social identities (Jackson & Mohr, 2016; Camacho, Reinka & Quinn, 2020). As a result, some drop out while others remain and experience disengagement, undergoing and enduring various forms of homonegative treatment from fellow students, faculty and other staff, leading to stress, loss of confidence, depression, suicidal ideation and isolation.

Jamaican LGB university students, for the most part, grow up experiencing in

their institutions of learning, the same kinds of prejudicial and discriminatory attitudes that other LGB individuals in the wider society face (Campbell, 2018). Generally, educational institutions have tended to reflect rather than resist society's heterosexist discourse, which marginalises individuals who identify as or are perceived to be LGB. Below are samples of the responses from study participants relating to the homonegative and heterosexist discourse that defined their educational journey, categorised according to thematic areas:

Gender non-conformity in high school (pre-university):

It was in high school that many informants said they first experienced bullying for displaying what their peers saw as gender nonconforming behaviour:

> "The bullying started in first form. I used to fight. I got suspended for fighting about twice. They used to post things about me online . . . about me being gay. It was just about looking at me and seeing how I dressed and seeing how I walk, and them saying you know, that this girl is gay. Persons stopped talking to me because they didn't want to get labelled for talking to me. It was terrible. The rumors" (Alicia, lesbian).

> "I was a little bit more effeminate than everyone else . . . a little softy" (Sean, bisexual)

> "I couldn't understand what they meant when they said I was acting like a girl. As far I was concerned, I was acting as masculine as I could . . . Sometimes I guess they see different" (Ramone, gay)

Informants shared that homonegativity was sometimes experienced at the hands of their high school administrators. Shenae narrated a story about her and another female student being found in a compromising position on her high school's campus:

> "The Vice Principal (VP) came over saying we should come with her to her office . . . The entire school came following behind us saying we're in trouble. We went to the office, and it was horrible. The two VPs were there, a male and a female. The female VP mocked us. As a matter of fact, she was like, 'so you want to get married to a girl?', and I said, 'yes I would'. She laughed a lot. Then the male VP, he was very rude. He said, 'I hope you grow up to one day experience being fucked by a man'. I felt . . . I can't find the word. And that was somebody that I looked up to. I was in uniform. I was just a student. I was a good student, so I didn't expect it. He lost my respect there and then –all of it! I could not see him the same way" (Shenae, lesbian).

Homonegativity in higher education

Informants shared that they entered higher education anticipating a reprieve from the discrimination and harassment they experienced in high school. They anticipated that university would be a welcoming and inclusive space. Soon however, they were disappointed by the realities they encountered:

Anthony for example said that when he got to university, he expected to have escaped the homonegativity of high school, but that was not the case. Ramone had similar sentiments. Sharing his disappointment, Ramone said:

> "Before going to university, I would have always heard that university is somewhere where you can go. When you start university, you don't have to worry about all this that you would have faced during high school, because it's more mature people that goes there. Persons on staff, they would have been more accepting because you have a diversity of culture coming to university" (Ramone, gay).

Verbal assaults

LGB students are often the victim of verbal assaults:

> "You'd be walking by and people like, 'watch the fish' or 'batiman'" (Snape, gay).

> "You would be in the cafeteria or in the library and you would hear, 'we don't want any fish here', and 'batty man fi dead' (gays should be killed), and 'mi no want dem bwoy ya roun' ya' (I do not want those *t*ype of boys around me). Remarks like those. And of course, you know, that sort of impacted me" (Anthony, gay).

> "There was a girl in my class, she would always say, 'mi no like batiman' (I do not like gays), or 'batiman fi dead' (gays should be killed). Or she would say, 'I would never talk to somebody who a batiman' (Andre, gay).

Dancehall lyrics were sometimes used as the vehicle for conveying verbal abuse:

> "A lot of times too when persons might say whatever words at me, sometimes it might not be actual words, but they sing a song that is anti-gay" (Denzel, gay).

> "Dancehall music, saying for example, all of these nasty things like, you know, "batiman fi dead" (gays should be killed) (Alex, bisexual).

Homonegativity towards lesbians

Informants' reports have suggested that lesbians and bisexual females are more tolerated on university campuses than gay or bisexual men. There were instances shared by informants, however, that revealed the nuances of the antigay interactions that lesbians must confront.

Lesbians shared experiences of heterosexual males being hostile towards them because they indicated a lack of interest in their advances. Sherae said she has been subjected to verbal abuse:

> "He said I was 'wasting away', and asked me, 'how yaa go briid?' Yu kyaahn a gi dat tu uman, wa kain a sopm dat? 'A kyaahn uman a fat yu op so' 'yaa wies aal a dat pan uman, wai yu wud a tek op wahn uman? Aal unu naa notn bout unu iihn" (how are you going to get pregnant? You can't give yourself to a woman, how could you do something like that? A woman can't be the one taking such good care of you. You're wasting all of that on a woman, why would you decide to be with a woman? People like you have no respect for yourselves) (Sherae, lesbian).

Lesbians who are 'butch' or masculine presenting seemed to encounter harsher treatment compared to 'lipstick' or traditionally feminine-presenting ones. Shenae, for example, shared her experience of being stigmatised because of how she presented:

> "One semester I had a morning class. It was the custom for the group to have a short time of devotion before the start of the class. I was asked to do the closing prayer, but just as I was about to pray, a girl said, 'because you're gay, you can't pray for us" (Shenae, butch lesbian).

> "The lecturer asked, 'You sure you want to do nursing? You don't look like a nurse'. Comments like that play on your mind and makes you think twice" (Shenae, butch lesbian).

> "People have scorned me before. They legit skin-up their face (they grimace their face). It was almost like high school all over again. In my first year at [name of HEI omitted] it was such a struggle because people used to point their nose down at me and say things like, 'wach da likl lezbiyan gyal de!' (look at that lesbian girl) . . . or they don't talk to me" (Alicia, lesbian).

Presumed heterosexual males also seem to be more accepting of lesbians and bisexual females over gays and bisexual men. Their acceptance is demonstrated through sexual advances, either promising that a sexual encounter with them

would result in an orientation change to heterosexuality, or expressing their fetish desires to engage in group sex with more than one female:

> "Some of the guys took it upon themselves, Jamaicans especially, took it upon themselves to be like, 'oh, that's not right. I will make you like guys alone'. That was when they were talking with friends. When they're talking to me in front of people. But if they were speaking to me alone, they would be like, 'It's fine if you bring another girl in your room, you know . . . yeah bring another girl, bring two girls" (Crystal, lesbian).

Classroom homonegativity

Some LGB students not only feel like imposters in classrooms but also that they must hide their sexual identity:

> "Once you put on this uniform you officially take on this career's persona. So, you have to live, eat, sleep and breathe this career persona, without thinking of expressing other parts of your life. So, some university programmes or faculties it is ok to embrace all of your *self* –including your sexuality, while in others, there are aspects of your self that must remain invisible" (Shaune, lesbian).

> "There were instances when I might want to ask a question in class, or I want to see something, because I know that they may mock how I talk or how I say it, I just usually keep to myself and wait until I'm in a small circle with my friends, I'll ask a question or try to see the lecturer after" (Denzel, gay).

> "I take the back bench for the most part because persons have laugh and give certain reactions when I talk. If I absolutely have to talk, because I'm answering a question or have a presentation to make, I try not to talk a *certain* way" (Ramone, gay).

In higher education institutions, it appears that there are specific programmes that have their own culture grounded in heteronormativity. For some programmes, sexual identity is a nonissue, while for others apparent sexuality determined acceptance and treatment. Informants shared, for example, that there are programmes with courses that were believed to be more open to non-heterosexuality than others:

> "It was annoying to hear how they perceive some of us sometimes . . .. There was a definite perception that gays should not be in that faculty as they were not macho enough and were not cut out to do certain things . . . . They thought that

> gays were out to get all the men, and gays should do media or business courses because engineering is seen as too macho for gays" (Sean, bisexual).
>
> "Courses that are not open to gays are 'the manly degrees.' And if you are gay, better believe you have to be thuggy or masculine to survive" (CJ, gay).
>
> "To be gay and a cadet . . . it did not fit in with the prestige and high level of respect in being a cadet . . .. But it wasn't hard to maintain a *straight image*. If you were gay and you came into marine and professional studies, because that was paramilitary section . . . because of the stress physical training, the marching, all of that, honestly it basically would have turned you into a man. Even if you had a little feminine side, honestly with all that training, trust me it wouldn't show to be honest" (Kemar, gay).

Although for the most part LGB youth "face the same challenges as their heterosexual peers" (Institute of Medicine, 2011, p.142), because of their sexual orientation, their lived experiences are markedly different. Compared to other minority groups, LGB youth are not raised in communities "where their identity may be shared and positively reinforced; instead, they are more likely to face negative reactions and hostility to their emerging minority identity" (Equality and Human Rights, 2010, p. 9). As a result, the process of sexual identity formation for LGB youth is unique and particularly challenging. LGB youth who "self-identify and disclose their orientation [face] obstacles and difficulties . . . that may affect their ability to accept their orientation, to be accepted by others, and to achieve healthy sexual development" (Scott & Walsh, 2011, p. 26).

Developmental profile of Jamaican tertiary-level LGB students

Following is a summary of the progressive educational life events which provide a snapshot of the lives of Jamaican higher education LGB students, as informed by the participants in this study. The profile is not meant to be representative of every LGB higher education student's lifeworld but may serve as a starting point for working with and providing support for LGB students within educational spaces in the Jamaican or wider Commonwealth Caribbean context. Identity and discourse serve as the lenses through which the realities of the informants in the study are analysed and converted into a developmental profile, which has start and end points: pre-higher education and higher education.

Morgan (2013) has noted that self-identity development in sexual-minority youth progresses from "awareness of difference in childhood, recognition of same-sex attraction during early adolescence, [to] the original assumption of a

same-sex identity label in late adolescence" (p. 55). This framework is crucial in interpreting the data gleaned from the informants and is useful in crafting the following developmental profile of LGB higher education students. The analysis draws on the fact that informants stated that they encountered antigay discourse early in life before or as they became aware of their sexual orientation. As this orientation became clearer, they were inadvertently forced to navigate the complex process of accepting or denying themselves, how to respond to the dominant antigay discourse around them and finally, how to deal with the question of overt visibility as a marker of a fully integrated sexual identity.

Pre-higher education

For the informants in this study, the transition from secondary school to higher education was a critical juncture in their personal and identity development, given the stress that the former represented for them. It was at the secondary level that they were most likely to be marked by adverse childhood experiences (ACEs). As they progressed through the secondary system and became, with the onset of puberty, more aware of their otherness (same-sex attraction), some began experiencing bullying by peers or teachers and other staff members who suspected they were LGB. The fact that they were minors reporting to adults who deemed manifestations of the sexual dimensions of their personality as deviant and in need of correction seemed to have been one of the more important factors that put informants under stress. They lived with the fear of being outed, socially excluded, the subject of rumours within the school and the surrounding community (mainly in the case of rural Jamaica), victimised through cyberbullying, and even physically assaulted, or having their lives threatened. The result would have been toxic stress which could have manifested as depression, isolation, and suicidal ideations.

Considering that at the pre-higher education level students would have been taught the fundamentals of the discourse on deviance and its accompanying sanctions through agents of socialisation such as religious education (RE) classes (compulsory in most Jamaican secondary schools) and morning devotional activities (usually mandatory), where Christian scriptures are read and presented as the authoritative guide for living an upright life, they would have learnt early how to self-censor their same sex sexual expressions. Their classmates, by contrast, would have been oriented into roles as future gatekeepers in the heteronormative superstructure. This suggests that some LGB students who were aware of their same-sex attractions were susceptible to developmental crises as they matured in a hyper-homonegative environment, particularly if they displayed gender non-conforming behaviour or were suspected of not demonstrating the

appropriate behaviour associated with the heterosexist logic. Further, they were at high risk for bullying by peers who had been onboarded as 'standard bearers' of heteronormativity.

In summary, responses from informants in this study suggested that high school was a place where their lack of autonomy and dependence on the school made them vulnerable to adverse events. This vulnerability emerged as they became aware of their sexual attraction and as others in the learning community began to develop suspicions about it. The dominant condemnatory discourse regarding same-sex attraction added to their stress, as peers were converted into bullies and gatekeepers of the prevailing norms. Additionally, they were subjected to a pervasive corrective homonegative discourse from administrators and teachers.

Higher education

Based on the narratives from study participants, higher education was expected to be an escape from the trauma of secondary school. It became part of their hope for respite from a constraining educational space and for a sense of belonging. Some informants assumed that a more diverse and more mature student population would have insulated them from the adverse events they experienced in secondary school. Unfortunately, based on their narratives, this was not typically the case. The pervasive homonegative discourse followed them through higher education, modified only to account for the fact that students at this level exercised more autonomy. What this meant, however, was that LGB students shared space with peers who had been schooled in homonegative discourse and who appeared less constrained in their actions as bullies and gatekeepers of heterosexism. It was here, too, that other values regarding heteronormativity, learnt most likely in community and through informal social networks, manifested. Thus, the fetishisation of women's bodies in polygynous settings became part of the discourse that lesbians encountered and navigated, in addition to the concern that they were failing to meet the heterosexist male need for control over women's bodies. At this stage, too, the treachery of gender non-conformity became a weightier concern for students, affecting their prospects for professional success. They in turn learnt the need for greater concealment of this aspect of their stigmatised identity and, especially those on traditional gendered professional pathways, negotiated with their environment in ways that made their sexuality less noticeable.

Just as at the pre-higher education levels, LGB university students faced victimisation and stigmatisation at the hands of their peers, faculty, administrators, and other campus personnel such as resident life staff. In fact, reports from informants confirmed that there were gay-restrictive spaces on higher education

campuses which strongly determined how open LGB students felt they could be and the degree to which they felt a sense of belonging in their educational community. As a result of the nature and degree of homonegativity experienced, some students withdrew from specific higher education institutions, feeling that they could no longer endure the harsh treatment meted out to them in the various contexts of life on campus.

In summary, while the LGB student informants found limited space for sexual identity affirming action at the tertiary-level because their institutions provided them some room for manoeuvre versus those at the secondary level, the sense of belonging that comes with identity formation might have been lacking in multiple areas. For instances, the educational community seemed to have perpetrated discourse that suggested that some professional endeavours were clearly off limits for individuals marked as LGB, and prescribed which kinds of spaces were reserved for specific members of the LGB community. Especially noteworthy was the privileging of a heterodominant masculinist narrative that created male spaces that gay men were to be excluded from, and that determined which other more appropriate spaces they should occupy.

Resolution

Having experienced the trauma associated with secondary education, and attempting to navigate tertiary education, the LGB informants then entered a phase where many of them attempted to resolve the conflict between their sexual orientation and familial and societal values. A variety of outcomes mark this phase, including informants conforming to social forces, emancipating themselves from heteronormativity and thereby embracing a lesbian, gay or bisexual identity, or remaining in a state of psychological inertia.

With the commencement of higher education, some informants experienced greater self-acceptance and better integration of their sexual orientation into their identity. However, even so, data from the study suggested that the most enduring discourse impacting their identity was that emanating from religion. Some informants had carried over from pre-higher education levels an affiliation with religious beliefs that impinged on how they viewed their same-sex attraction. This ended up being the most significant determinant of how they resolved their identity questions. For some, no conflict existed between their sexuality and their faith, which held great significance for them, providing a set of values and a channel through which to connect with a higher power. Others, on the other hand, internalised the implicit conflicts between their religion and sexuality, leading to an incomplete resolution of their identity crisis. Among these last

were informants who continued to engage in their religion, especially if they were enrolled in a religiously affiliated institution that 'loved the sinner but hated the sin' [of homosexuality]. These students ensured that their stigmatised sexual identity was carefully concealed and practised the utmost discretion in their same-sex activities. It was also not uncommon for them to have attempted to change their sexual orientation through reparative therapy.

There were also those informants who relinquished ties with religion in general and Christianity specifically as a value system. Others reframed their belief systems, making spirituality of greater importance to them than membership in a Christian denomination. It was also not uncommon for these informants to join congregations that were explicit in their acceptance of same sex attracted people. It was noteworthy that informants who adjusted their religious beliefs to accommodate their sexuality successfully rid themselves of the long-held shame about their attraction. However, they reported still feeling guilt over engaging sexually with someone of the same sex.

Conclusion

What is known about LGB people in Jamaica should be expanded to include sub-groups such as students who are bound to heteronormative institutions with regimes that are culturally informed by social forces such as religion and normative gender beliefs that reinforce antipathy towards homosexuality. The exploration in this article highlighted the role of educational spaces in sustaining hegemonic heteropatriarchal discourse which militates against wholesome LGB identity integration. Given that current knowledge about LGB higher education students in Jamaica is limited, this exploration opens the door to more meaningful conversations not only about the realities of being LGB in Jamaica but also about the kinds of discourse that might buttress LGB identity formation. Further, it paves the way for universities and colleges to become active agents of change as well as serves as a platform for new research that might inform the development of targeted support services such as faculty and staff education sessions on LGB issues, sensitivity training, and the establishment of safe spaces and support networks in Jamaican tertiary learning environments.

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Common Errors Made by Students Pursuing a Tertiary Level Media and Communication Programme

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Abstract

Information in journal and newspaper articles has emphasised the generally weak writing skills prevalent among tertiary-level students in Jamaica. This is also the experience of different lecturers of writing modules at the University of Technology, Jamaica (UTech, Ja). Scholars have highlighted the need for Jamaican students to write English well and recommended that Jamaican tertiary institutions "Prepare graduates who are work-ready with enviable communication skills." Against this background, a mixed method study was conducted to ascertain the main types of writing errors made by students in two modules in the Bachelor of Arts in Communication Arts and Technology (BACAT) programme at UTech, Ja. A literature review was also done for possible reasons contributing to the students making those errors. The researchers reviewed 75 assessment scripts from 75 students. The most common errors, based on frequency of occurrence, were run-on sentences, tense shifts, subject-verb agreement, and fragments. The errors were syntax in nature, suggesting likely contributing factors such as interference, competence, and interlanguage development. The data gathered show that it is essential to determine effective strategies in assisting students in identifying, correcting, and avoiding the errors identified while considering the possible causes. In this way, students can be better equipped with skills in improving their writing skills.

Keywords: Writing Errors, English Language, Mixed Methods Jamaican, Creole, Media and Communication Students, University Students, University of Technology, Jamaica

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Introduction

The Jamaican population speaks Jamaican Creole (JC) and Jamaican Standard English (JSE) (Jamaican Language Unit, 2007; Devonish & Carpenter 2007). Although English is the de fac*t*o official language of the Caribbean country, the majority of Jamaicans speak Jamaican Creole (JC) (Devonish et al, 2007; Patrick, 2014; Devonish & Walters, 2015). Only a small percentage of the population speaks English as their mother tongue (MoEYC, 2001; Shields-Brodber, 1997, Jamaican Language Unit, 2007). Jamaican Creole is an English lexicon Creole which shares a large portion of its vocabulary with English (Patrick, 2014, Nero & Steven, 2018).

For years, educators have lamented that Jamaican students are making errors when required to produce English Language texts. Jamaica's 2001 Ministry of Education Youth and Culture (MoEYC) draft language policy noted that students entering schools are more likely to use JC forms than they are to use JSE forms (MoEYC, 2001). The Ministry also pointed out that this is due to the bilingual language situation in Jamaica (MoEYC, 2001). This problem is seen from the primary to the tertiary level (MoEYC. 2001). To compound the problem, some students cannot distinguish between English and JC because the languages are related. For some speakers, there is no clear difference between the two languages (Devonish et al, 2007; Bailey, 1966). In addition, Nero et al. (2018) pointed out that for most Creole speaking students, English "is neither a mother-tongue nor a foreign language" (p.14), making it difficult for them to "perceive English as a second or foreign language because their oral language is dominated by a largely English lexicon (albeit with syntax akin to West African language)" (Nero et al. 2018, p. 24).

To matriculate into university in Jamaica, students are mainly required to prove English Language competence by passing English Language in examinations such as the General Certificate of Education (GCE) or Caribbean Secondary Examination Certificate (CSEC) examinations. At the University of Technology, Jamaica (UTech, Ja.), the minimum entry requirements for students into the BACAT programme are five GCE/CSEC subjects including English Language (University of Technology, Jamaica, 2022). While most of the students in the BACAT programme have passed English Language at GCE/CSEC level reflecting

English Language competence beyond the secondary level, they are still making grammatical errors in their writing assignments.

The students in the BACAT programme at the University of Technology, Jamaica are required to take four writing courses: Writing Workshop I, II, III and IV (UTech, Ja., n.d). The BACAT programme is a media and communication programme (UTech, Ja, n.d). Annually, more than 400 students are enrolled in the programme. This study targeted two of the writing modules in the programme, namely Writing Workshop I and III. According to the Writing Workshop I syllabus, the course seeks to improve students' general writing skills. The topics covered in the course include sentence and paragraph construction, paraphrasing as well as citation of sources. In the Writing Workshop III module, the focus is on the expository and persuasive genres which are commonly used in the communication and media industry. Students are taught how to write texts such as advertising copy, feature articles, press briefs, press releases and opinion pieces (The Office of Teaching and Learning, 2021). For this research study, assessments done by students enrolled in semester 1 of Writing Workshop I and III of the 2021–22 academic year were reviewed.

Each year, educators at the University of Technology, Jamaica complain about the many errors made by students in the programme. Some of these errors include subject/verb agreement and run-on sentences. Several research studies have been conducted analyzing writing errors made by students at varying education levels in Jamaica (Burris & Burris-Melville, 2020; Lattibeaudiere, 2021; Kennedy, 2017; Smith et al., 2015; Milson-Whyte, 2015). However, not much research has been done identifying the most common types of writing errors made by students enrolled in a media and communication programme, with possible explanations for these errors. This research study seeks to fill that gap in the literature through the following research questions:

RQ1: What are the top three common writing errors made by students in the media and communication programme?

RQ2: What are some of the reasons students are making these errors?

RQ3: What are possible corrections for these errors?

RQ4: What are some lessons that could be learnt from this study to guide educators?

Identifying errors in students' English texts is not novel. Educators usually instruct students to consult grammar books to correct these errors. This research study is of significance to the practice of writing instruction because it provides a different approach to a problem which affects students not only in Jamaica but

other countries with similar language situations. The study was designed on the premise that the students already have some level of English Language competence. By pinpointing these errors, the researchers acknowledge that the students have some level of English Language competence, and some work needs to be done to resolve the problems identified. A resource document was designed from the research study. See Appendix for excerpts from this resource document.

Literature Review

Jamaican Linguistic Context and Influence of Jamaican Creole on Writing

Kennedy (2017) and Lattibeaudiere (2021) explore how Jamaican Creole influences formal writing among university students, causing syntax errors and deviations from standard expression. They emphasize the challenges students face due to the blurred lines between Jamaican Creole and English, affecting language education and leading to ongoing struggles with grammar and punctuation, even after passing exams like CSEC English. Both Kennedy (2017) and Lattibeaudiere (2021) underscore that Jamaican Creole, often the primary language spoken at home, clashes with the English-based curriculum in basic schooling, causing difficulties in code-switching. Milson-Whyte (2015) suggests an approach that recognizes this unique linguistic situation, advocating for a focus on how both Jamaican Creole and English impact students' speech and writing, particularly in teaching Academic literacies for creole-influenced speakers. These findings collectively emphasize how the interplay between Jamaican Creole and English significantly shapes students' language use and educational challenges.

Writing Challenges Faced by UTech, Ja. Students

Burris and Burris-Melville (2020) conducted a meticulous examination of target inconsistencies prevalent in academic writing papers submitted by University of Technology, Jamaica (UTech, Ja.) students. Their analysis highlighted discrepancies and inconsistencies within these academic papers, shedding light on nuanced challenges concerning writing accuracy and precision. By delineating these inconsistencies, the study emphasized the critical need for targeted interventions and pedagogical strategies aimed at refining writing skills among UTech, Ja. students in media and communication programs.

Similarly, in her doctoral dissertation Burris-Melville (2020) conducted an extensive investigation into the multifaceted challenges encountered by undergraduate students in academic writing within a Jamaican university context.

This dissertation delved deeply into the intricate landscape of writing challenges faced by students, providing a comprehensive understanding of the diverse array of obstacles hindering effective academic writing. Burris-Melville's work not only identified these challenges but also proposed targeted interventions and strategies essential for enhancing writing proficiency among students in media and communication programs at UTech, Ja.

The collaborative work authored by Telfer et al. (2022), represents a significant milestone in addressing the learning needs of UTech, Ja. students. This collaborative effort meticulously profiles the learners at UTech, Ja., shedding light on their diverse needs and challenges, particularly within the realm of writing. The study underscores the crucial importance of a tailored and accessible self-access learning center specifically designed to address writing challenges encountered by students in media and communication programs. It signifies a forward-thinking approach aimed at providing comprehensive support to enhance writing skills and academic success among UTech, Ja. students.

Pedagogical Interventions

Several researchers have proposed pedagogical interventions to address writing errors among Jamaican university students. These interventions includes targeted grammar workshops, peer-editing exercises, and the integration of culturally relevant writing assignments to bridge the gap between students' linguistic backgrounds and formal academic writing. Milson-Whyte (2015) explains that stakeholders should push for an approach to teaching that recognizes Jamaica's unique language situation. With specific reference to the teaching of Academic literacies for creole influenced speakers, she points out that an observation of the specific language context, will aid researchers and educators in focusing primarily on how both codes influence our students' speech and writing. In essence, the Jamaican Creole and Jamaican English both work to influence not only the speech, but also the writing of students.

Through the years, there have been various approaches taken in the teaching of grammar to students which have in turn impacted the role that grammar plays in the language classroom. Sysoyev (1999) highlights "a rapid shift of research and practice from audiolingual and grammar-translation methods to the exploration of communicative language teaching, and much attention has been paid to focusing on global and integrative tasks, rather than on discrete structures". Regarding communicative language teaching, Sysoyev (1999) recommends that it should be based on both form and meaning coming together to produce an integrated approach to the teaching of grammar. For him, this would play the double role of

assisting students in communicating with others in the language while passing their tests at school; this second role tends to focus more on the form. Therefore, an approach developed by Sysoyev (1999) to respond to this integrated approach in the language classroom is The EEE method that is based on the concepts of exploration, explanation, and expression.

Richards et al. (2001) conducted a study involving English teachers which confirms that an integral part of language learning entails the teaching of grammar. Furthermore, the respondents were generally in support of a communicative approach to the teaching of grammar although there were several who believed that a more precise use of the language was greater through a direct grammar teaching approach.

As it relates to another approach in teaching grammar, Osborn (1999) recommends that grammar should not be approached as a set of rules, because it goes beyond that. Instead, she views grammar as "a natural and necessary means toward the goal of using language more advantageously" (pg. ix). Consequently, although the teaching of grammar is integral to language learning, the focus should be placed on the overall use of the language and not so much the acquisition of grammar rules.

Meanwhile, Nunan (1998) states that for some individuals, language learning utilises a linear model whereby a learner must master one concept before another can be introduced. Therefore, a student, for example, would have to first master the simple past tense before the past perfect or past continuous tenses could be introduced. However, Nunan (1998) proposes an organic approach whereby learners are exposed to various language concepts at the same time without placing any great emphasis on mastery. Consequently, students will be able to determine the appropriateness of a grammar or language structure based on the context in which they desire to use it and not based on a list of arbitrary rules. Nunan (1998) incorporates the organic approach through techniques such as the use of realia and providing students with opportunities for exploration of the language so they can identify the relationships that exist for form and context.

Bryan (2010) puts forward certain principles in the teaching of English in a Creole-speaking environment. The targeted students are at the secondary level; however, these principles are still relevant to the tertiary level and where relevant, adaptations can be made. The principles are the planning principle, the input principle, the awareness principle, the culture principle, and the authenticity principle.

- The planning principle – emphasises on the creation of an environment conducive to learning English as well as teaching that is interactive.

- The input principle – highlights on the linguistic input which allows students a greater opportunity to interact with the language.
- The awareness principle – tasks the facilitator with providing language activities that assist the students in recognizing language codes; thereby helping students to identify differences and similarities between their native tongue and the target language.
- The culture principle – uses the language as a springboard for incorporating a broader view of the culture associated with the language and includes the way of life and beliefs of individuals.
- The authenticity principle – explores contexts reflecting real life as well as the realities of the students.

Methodology

A mixed method study was conducted to identify the common types of errors made by students in the tertiary level media and communication programme at the University of Technology, Jamaica. The scripts from 75 participants were initially used in the study. The participants were randomly selected from a group of 157 students from two courses spread over three cohorts during the semester 1 2021–2022 academic year. One cohort was in the Writing Workshop III course. The other two cohorts were in the Writing Workshop I course.

One assignment was selected for each course. In Writing Workshop, I, a reflective essay based on a list of options was prepared by the students. For this study, the final major assessment (Writing Practice 2) was analyzed. Students were required to submit a short reflective/analytical essay consisting of between 350–400 words based on options given. Students were required to use Gibbs' reflective cycle as a framework to the content of the essay that they collated. In the Writing Workshop III module, the feature articles produced were reviewed for this study. The students were required to watch any one of three pre-selected public events online and use the material to produce a feature news item. The students were expected to write a 500 words news feature (exposition) on any aspect of the selected event. Students were required to write these assessments in English. However, in the case of the news feature, the students were expected to use inserts from JC speakers, if necessary. These quotes were exempt from the study. Writing Workshop I is one of two writing courses offered to first year students, while Writing Workshop III is one of two writing courses offered to second year students. No such writing courses are offered in the third and fourth year of the programme. The rationale for selecting these two courses was that

they captured students' ability at the beginning and end of the duration of the writing courses. The assessments also provided enough material for the analysis of writing errors. The study was conducted between September 2021 and February 2022. The students were taught the courses for a period of three months, between September and December 2021. The assessments were reviewed and analysed between January and February 2022.

The scripts were selected after the lecturers marked each script from a pool submitted by each class. The first 25 scripts were selected from each pool. As previously stated, there were three lecturers. Thus, there were three pools of 25 scripts. Only one error was recorded from each script. Where one error occurred twice in a single paper, it was recorded once. Twenty main errors were identified from the assessments, and these errors were coded and input into Microsoft Excel. A frequency table with the errors was produced, showing numbers and percentages. The top three errors were determined based on the percentage of students who made those errors or the percentage of scripts with those errors.

In identifying the errors, expert knowledge was used. Chase & Simons (1973) pointed out that experts are those people who develop proficiency in a field over a period of ten years. Ward, Hodges, Starkes & Williams (2004) stated that it takes 10,000 hours to develop high level of proficiency in a field. All three lecturers have worked in roles involving writing English and producing media texts for more than ten years. This includes experience in teaching general writing for all three lecturers and media writing for two of the lecturers. This has also extended to more than ten years, fulltime and parttime. They relied on their expert knowledge and consulted prescriptive grammar books to identify the errors. In addition, based on marking papers in these courses for years, the lecturers were familiar with the types of errors made by students. After they identified the errors, the types of errors and their corresponding examples were written in a google drive document which could be accessed by all three lecturers. They were cross-checked by each of the lecturers to ensure that they were in fact errors and that the errors matched the type named. The lecturers then reviewed the entire document in a few sittings. The errors occurring the most were selected. In the end, 20 errors were selected.

All ethical requirements of the university were adhered to during the study. Ethical approval was received from the University of Technology, Jamaica Research Ethics Committee. Students were anonymous. No student can be linked to any script, and each script was given a number. After recording the number, the error found in that script was written beside the number and then used to form the dataset.

Results & Discussion

The results for the research study are below:

RQ1: What are the top three common writing errors made by students in the media and communication programme?

Table 1: 20 types of common errors found in the scripts

Types of errors	Frequency	%
Run-on sentences	16	21.33
Punctuation	11	14.66
Tense shift	10	13.33
Fragments	6	8.00
Subject/verb agreement	6	8.00
Colloquialism	3	4.00
Capitalization	3	4.00
Redundancy	3	4.00
Parallelism	2	2.66
Spelling	2	2.66
Awkward sentences	2	2.66
No explanation for technical terms	2	2.66
Using superfluous words without providing meaning	2	2.66
Incorrect pronouns	1	1.33
Incorrect use of article	1	1.33
Phrasal verbs	1	1.33
Homophones	1	1.33
Incorrect analogy	1	1.33
Vague expressions	1	1.33
Consonant cluster	1	1.33
Total	**75**	**100**

Note: Table 1 above shows all the errors made by students in the programme. Based on the results from the analysis of the scripts, the researchers found 20 main types of errors. Table 1 above also shows that more than 20% of the scripts examined had errors with run-on sentences. Almost half of the examinations contained the top three errors.

The three common syntactic errors found in this study are run-on sentences, tense shift, subject-verb agreement, and fragments which accounts for 50.6 % of errors in this study. Overall, 16 of 75 scripts have run-on sentence errors which

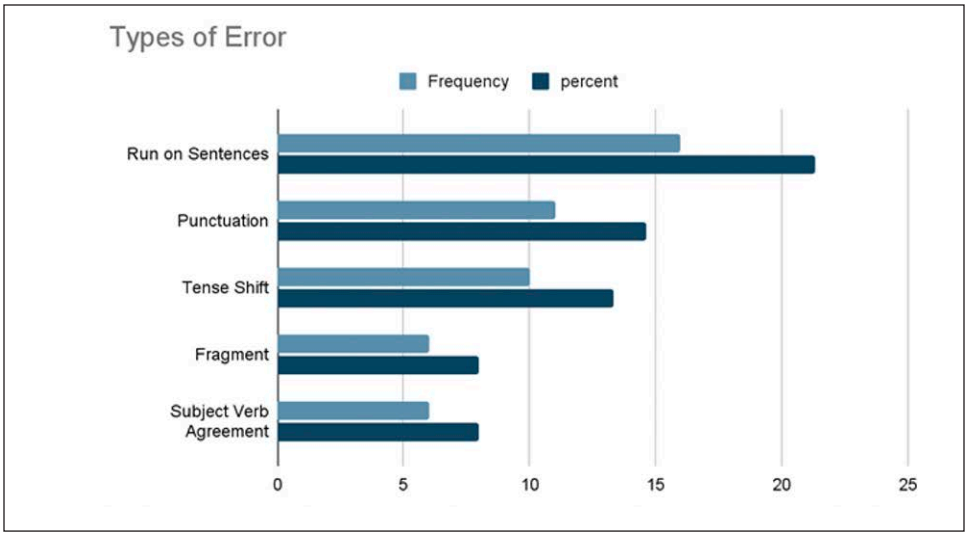

Figure 1. Types of Syntactic Errors

accounts for 21.3% of the scripts. Fragments are seen in 6 of the 75 scripts which account for eight percent. Additionally, 6 of the 75 scripts have subject-verb agreement errors which account for eight percent. Finally, 10 of the 75 scripts have examples of tense shifts which account for 13.3%.

Figure 1 shows the top errors found in the study. Run-on sentences account for 16 of the scripts and 21.3%. Both fragments and subject-verb agreement account for 6 of the scripts and eight percent. The most common errors discovered by students at the tertiary institution in this study are syntax errors such as run-on sentences, fragments, subject/verb agreement, and tense shifts. The top four syntactic errors from this study, ranging from highest to lowest are as follows: run-on sentences, tense shifts, fragments, and subject-verb agreement. Run-on sentence errors are the most prevalent error seen by students in this study, then tense shifts, followed by fragments and subject-verb agreement.

RQ2: What are some of the reasons for students making these errors?

In countries where the official language and the national language have similarities, their language situation is often complex. This similarity leads to no clear demarcation between the languages operating within that space. So, we are left with a situation where persons know a lot about morphemes but not necessarily the semantics of the morphemes. This results from the fact that meaning is derived from both cultural experiences and context. Jamaica is no different as its official language is Jamaican English while its national language is Jamaican Creole, an English lexified language. This results in most Jamaicans knowing a lot of English

words but not necessarily knowing the English meanings. Jamaican English is a separate language from Jamaican Creole. The areas where they differ are in syntax (sentence structure), morphology (word formation), semantics (meaning), and phonology (speech sounds) to a lesser extent; these all contribute to the complexity of the language. Situations where students are unsure of the differences between the two languages, are unaware that there are two separate languages operating side by side or have inadequate exposure to the English Language often tend to display various kinds of errors in the English Language. Consequently, interlingual and intralingual interference often account for errors in the target language.

In Jamaican Creole, plural marking is different from Jamaican English. In English, plural is marked by the addition of a bound morpheme [s] attached to the noun in regular forms while in Jamaican Creole, an independent marker / dem/ comes after the noun. An example of this is 'the boys' in Standard Jamaican English versus 'di bwai dem' in Jamaican Creole' Subject-verb agreement errors often occur because students associate all /s/ suffixes as plurals; however, the third person singular subject has the verb ending in /s/ and the possessive morpheme uses the /'s/. Overgeneralization can result in students being unable to differentiate when the /s/ morpheme is used for pluralization, with the verb for third person singular subject or even possession. Students who are unable to identify singularity or plurality in relation to the subject are likely to experience subject-verb agreement errors. Tense shifts generally occur when a particular tense starts a sentence and halfway through another, tense is used. The most common form is when someone moves from either the present to the past or any other tense. This error is the third highest error seen in this study. Tense shift errors occur because of a mismatch between time and space. Both interference from the native language as well as the complexity of the target language account for tense shift errors.

There are several factors which may account for the syntactic errors observed from the 75 scripts analysed in this study. Four factors which seem like possible reasons are interference, competence, performance, and interlanguage development. Students' first language impedes the learning of the target language as structures and elements are transferred from the native language to the target language. Students who have limited or inadequate input of the target language will display challenges with competence. Moreover, students who have little, or no linguistic knowledge of the target language's grammar and vocabulary may display these errors as well. Another possible reason for this is students who also have difficulty differentiating between their native language rules and that of the language being learned. The syntactic errors that occur in this study can be because of the differences between the target language and the native language.

The notion of 'leaky grammar' often accounts for the negative transfer that results when the native language impedes by providing incorrect forms in the target language. This can be seen in the following examples: The car spun out of control I thought that was it! and how many times, when finding yourself in a difficult situation, you heard something like, "You just need to go somewhere, change your environment, and meet new people?"

Two types of errors observed from this study are misinformation errors and omission errors. Subject-verb agreement and tense shifts are examples of misinformation errors. Run-on sentences and fragments are examples of omission errors. These two types of errors account for the syntactic errors seen in this study. Students learning a second language will display errors both from interlingual and intralingual interference. In fact, interference, competence, performance, and interlanguage development are factors that account for errors. Misinformation and omission errors are seen in this study.

Syntactic errors in writing are often because of a mismatch between a speaker's native language and the targeted language. These are reflected in instances such as run-on sentences, fragments, subject-verb agreement, and tense shifts which are seen in students' writing. Factors such as inadequate grasp of the use and functions, absence of particular features in their native language, a mismatch between meanings and structures, overgeneralization, and a mismatch between space and time result in syntactic errors.

RQ3: What are possible corrections for these errors?

A resource document was created based on the results of the study. Excerpts from that document can be seen in Appendix 1. Table 2 below, provides examples of the errors as well as ways in which the errors can be corrected.

The researchers believe that since students already have some degree of English Language competence, instead of sending students to consult grammar books, educators can conduct research in their different courses to determine what the common errors made by their students are and focus on the correction of these errors. This would in turn help them to have the requisite information to properly assist their students in mastering the English Language.

Educators can also teach the structure of language; therefore, English could be taught as a second language in schools. This technique will help students have a clear delineation of the different syntactic structures between Jamaican English and Jamaican Creole. The rules of English grammar would be highlighted, and the mismatch between the first language and the target language would become clearer to students.

Table 2: The top three common writing errors made by students in the BaCAT programme

Common writing error: Run-on sentence **Example:** Fashion design brings people together there are persons who have similar interests in fashion and fashion designing. **Correction:** Fashion design brings people together. There are persons who have similar interests in fashion and fashion designing.
Common writing error: Subject-verb agreement **Example**: Students at the University of Technology, Jamaica, and the University of the West Indies, Mona shares their online learning experiences…" **Correction:** Since the subject is 'students' the corresponding verb is 'share'.
Common writing error: Tense shift **Example:** My passion for cooking continues to grow every time I make something new. It was a way of rewarding myself when I accomplished something or a good distraction whenever I needed a breather. **Correction:** My passion for cooking continues to grow every time I make something new. It is a way of rewarding myself when I accomplish something or a good distraction whenever I need a breather.

Another solution to solving this problem is using the common errors observed by educators and focus specifically on them, for example, the areas of subject-verb agreement, run-on sentences, fragments, and tense shifts. Finally, educators could involve students in the learning process by having them create short presentations on the problem areas which include identifying, correcting, and avoiding the error along with a practice activity. The researchers feel that these solutions can help to strengthen students' language competence and aid in the mastery of the English Language.

RQ4: What lessons could be learnt from this study to guide educators?

There are important lessons to be learnt from the current research study. The most common errors identified can be used as a starting point to help educators be aware of the critical areas they need to focus on in their pedagogical instruction. Although many Jamaican students are bilingual, they are unable for the most part to differentiate between the structure of both languages due to interlingual and intralingual interference. Therefore, some considerations need to be included in course preparation to minimise negative transfer of the mother tongue. This can be achieved by clearly articulating the rules of English, focussing on the more frequent areas that students struggle with, and demonstrating how an English as a Second Language programme might be of benefit to students in the Jamaican context Lecturers who are well-informed on the most common syntactic errors of English Language can use the resource guide in the appendix as well as their

expert knowledge to guide their students with the requisite knowledge that is needed to bridge the gap between their first language and the target language to improve language competence and performance. This study is not only of benefit to classroom teachers, but also syllabus designers and test creators by providing valuable information for devising appropriate materials that target the problem areas in writing, as well as incorporating effective teaching techniques such as teaching English as a second language and constructing tests suitable for different groups of learners at different levels of instruction.

Conclusion

This research focused on three common types of errors made by students in a media and communication tertiary level programme. Although this study does not reflect the errors of all media and communication students, it does give some insight into common syntax and syntactic errors made by some of the students in the programme. Based on the 75 samples analysed, the three main errors were syntax errors, namely, run-on sentences, tense shifts and fragments which also had the same frequency as subject-verb agreement. Some possible contributing factors for these errors were interlingual and intralingual interference as well as some students having insufficient knowledge about the complexities of the target language. The results of this study also raise important questions about the English Language skills students possess on entering the programme, the level of exposure in writing and using the target language outside the classroom setting, and the best strategies to be applied to address the deficits based on the limited hours assigned to writing courses each semester.

Further Areas of Research

Additional research could be conducted in the areas below:

- The approach used in teaching English Language skills to students at both the primary and secondary levels to determine where intervention needs to take place before their pursuit of tertiary studies.
- The possible impact that could be made on reducing the frequency of these errors if strategies for teaching English as a Second Language were incorporated more in course delivery.
- The likelihood of these errors being unique to media and communication students in order to find out if university-wide writing courses should also take a similar approach in zeroing on these errors in their course delivery.

Appendix

Excerpts from the resource document created from the research study

COMMON ERRORS MADE BY UTech, JAMAICA BaCAT STUDENTS . . . AND HOW TO CORRECT THEM

RUN ON SENTENCES

This was the most common type of writing errors identified in the research study. Examine the examples below. Each sentence has at least two complete independent clauses masked as one complete thought. To identify a run on sentence, proofread your document. Check each sentence to determine if it is ONE complete thought or TWO complete ideas packed into one sentence.

Examples

a) Fashion design brings people together there are persons who have similar interests in fashion and fashion designing
Better version: Fashion design brings people together. There are persons who have similar interests in fashion and fashion designing.

b) The car spun out of control I thought that was it!
Better version: The car spun out of control, and I thought that was it!

c) It was a beautiful Saturday like no other, the day was just about perfect
Better version: It was a beautiful Saturday like no other; the day was just about perfect.

d) I always kept my thoughts bottled in, I never opened up to the idea of expressing myself to other people, but after I started writing, I began communicating.
Better version: I always kept my thoughts bottled in; I never opened up to the idea of expressing myself to other people but after I started writing, I began communicating.

e) In hindsight, I realized that we may have won if I had considered my last item purchase more carefully and opted for a defensive one that would allow me to not only survive the rival carry's onslaught but punish him for committing to a position far from any allies.
Better version: In hindsight, I realized that we may have won if I had considered my last item purchase more carefully and opted for a defensive one that would allow me to not only survive the rival carry's onslaught, but punish him for committing to a position far from any allies.

f) The prime minister was quite understanding as he came backstage saying it's all nervousness because he had seen me performed over the internet already and I did a great job and he knew I know the national anthem, I laughed and told him thanks for that.
Better version: The Prime Minister was quite understanding. Upon meeting me backstage he explained that he was willing to look beyond my nervousness, because he knew my worth; having seen me perform on the internet. Despite my slip up, he congratulated me and stated that he knew that I was familiar with the National anthem. I then laughed and expressed gratitude for his sentiments.

INCORRECTLY PLACED PUNCTUATION

This was the second most common type of writing error identified in the research study. Punctuation marks guide sound in your writing (Kessler and Duncan, 2000). Here are a few errors under this heading:

Incorrect placement of apostrophes

Sometimes students place apostrophes in the incorrect position. In example 1, the apostrophe shows possession. The internet belongs to her friend. Therefore the apostrophe is placed in front of the letter 's'. In example 2, the apostrophe also shows possession. However in this case, the resources belong to both parents so the apostrophe is placed after the letter 's'.

Example 1:

a) Her friends internet was down.
Better version

b) Her friend's internet is down

Example 2:

a) I shouldn't have wasted my parent's resources to send me to school that semester, my indecisiveness could have been resolved by speaking to them about my issue.
Better version 2:

b) I shouldn't have wasted my parents' resources to send me to school that semester. My indecisiveness could have been resolved by speaking about my issue.

Incorrect placement of commas

Commas create clarity in your writing by inserting a pause between ideas. However when badly placed, they can cause confusion. Read the examples below. Reread the sentences labeled better version with the pause. Can you hear the difference?

Example 1:

a) At the end of the trip the host instructed us to all form a trust circle on the island
   Better version 1:

b) At the end of the trip, the host instructed us to form a trust circle on the island

   OR

c) At the end of the trip, the host instructed all of us to form a trust circle on the island

Example 2:

a) Though being confident can be a very good thing it also can be bad as we may sometimes lack preparation.
   Better version:

b) Though being confident can be a very good thing, it also can be bad as we may sometimes lack preparation.

Is it it's or its?

This is one of the most common type of errors made by students in the programme. Both 'it's' and 'its' are pronounced the same. Students are encouraged to learn the difference between the two of them. There is no getting around it. It's means it is or it has. Meanwhile, its is a possessive denominator which mean that 'it' (a thing) belongs to something. One way to determine if you want to use it's or its is to read the target sentence aloud, replacing its or it's in the sentence with it is or it has. If it makes sense, then use accordingly.

Example 1:

a) When something bad happen, its normal to focus at first on the worst aspects, such as pain, injury, and other consequences.
   Better Version 1:

b) When something bad happens, it's normal to focus at first on the worst aspects, such as pain, injury, and other consequences.

Unnecessary semicolon

The semicolon resembles a period on top of a comma. It is used to separate two independent clauses. In example 1, a question mark is required for the first thought, not a semi-colon. The second idea is added after the question mark.

Example 1:

a) Isn't it true that, drunk driving is a serious crime; ironically, many motorists still participate in this act carelessly
Better version 1:

b) Isn't it true that drunk driving is a serious crime? Many motorists still participate in this act.

TENSE SHIFT

When you move from one grammar tense to another for no apparent reason in a written piece, a tense shift can take place (Gaetz & Phadke, 2006). Rule: The period of time you are referring to determines the particular grammar tense that is to be used. Additionally, look out for time phrases such as "last year, three months ago, later on, today, next week, and in the future" to guide you in determining which tense would be appropriate. Some tenses can be used in more than one time period, for example, the present tense can be used for both an event in the present and in the future. See the table below for examples of time periods and appropriate tenses:

Table showing time period and relevant tenses to be used.

Time Period	Examples of Tenses to be used
An event in the past	simple past, past continuous, past perfect
An event in the present	simple present, present perfect, present continuous
An event in the future	future, simple present, present continuous

Example 1: How many times, when finding yourself in a difficult situation, you heard something like, "You just need to go somewhere, change your environment, and meet new people?"
Better Version: Have you ever heard the statement, "You just need to go somewhere, change your environment, and meet new people."?

Example 2: Second year Bacat students did and is now doing practical modules online such as Introduction to Communication Arts and Technology 1 and 2 along with Communication Studio 1.

Better version: Second year BACAT students have been doing practical modules online.

Example 3: My passion for cooking continues to grow every time I make something new. It was a way of rewarding myself when I accomplished something or a good distraction whenever I needed a breather.

Better version: My passion for cooking continues to grow every time I make something new. It is a way of rewarding myself when I accomplish something or a good distraction whenever I need a breather.

Example 4: Sometimes we forgot how strong and awesome we are inside but journaling and reading over what you wrote reminds you.

Better version: Sometimes we forge**t** how strong and awesome we are inside, but journaling and reading over what you wrote reminds you.

Example 5: I got on board with great trepidation and prayed and prayed that everything goes right.

Better version: I got on board with great trepidation and prayed and prayed that everything would go right.

Example 6: While most drivers often give little to no indications as it pertains to where they are heading.

Better version: [Omission of while] Most drivers often give little to no indications as it pertains to where they are heading.

Example 7: When I told my truth I've never felt so free and I've realized that the ability to be free was truly up to me.

Better version: When I told my truth, I had never felt so free. I also realized that the ability to be free was truly up to me.

Example 8: Since the start of COVID-19 in March of 2020, I feel as if I have this huge burden on my shoulders, I'm unable to interact with my friends and family like I'm used to and that makes me stressed

Better version: Since the start of the COVID-19 pandemic in March of 2020, I have felt (or have been feeling) as if I have this huge burden on my shoulders. I've been unable to interact with my friends and family like I'm used to, and that makes me feel stressed.

Example 9: The bus then turns on Maxfield avenue and made a sudden stop, then someone yells "Man A fyah ina di bus"; at least that's what I heard.

Better version 10: The bus then turned on Maxfield avenue and made a sudden stop, then someone yelled "Man A fyah ina di bus"; at least that's what I heard.

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Addressing Learning Disabilities in the College English Classroom

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Abstract

Trends indicate that an increased number of students with learning disabilities are currently enrolled in universities. Most teachers of English cannot accurately determine such cases, and students themselves may also be unaware. This study, therefore, sought to establish whether there is some basis for further research into the need for more accessible testing for learning disabilities among tertiary level students in Jamaica. The research questions sought to ascertain whether students were aware of any possible learning disability they might have, the extent to which they were willing to be tested for a learning disability, as well as the extent to which they were willing to disclose any such learning disability to teachers. Any correlation between the respondents' perception of teacher assistance and their perceived proficiency in college English Language skills was also investigated. A cross-sectional survey was done in which 5-point Likert type questionnaires were distributed to 210 students. There were 158 respondents of which approximately 48% were male and 52 % female. Data provided by these respondents were analyzed using descriptive and inferential statistics. Findings reveal that almost a third of the participants (29.8%) did not know whether they had a learning disability, while 8.2% reported that they did. An overwhelmingly positive attitude to being tested for a learning disability was found; however, willingness to disclose, though highly positive, was not as strong. There was a weak, positive correlation between students' perception of the quality of teacher assistance and their perceived proficiency in college English skills. The study concluded that the overwhelming willingness of the respondents to be tested and the fact that only 62% were sure they did not have a learning disability may warrant larger scale research into the need for more robust focus on testing college students for learning disabilities.

Keywords: Learning Disability, College English, Jamaica, College Students

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Introduction

The situations that present challenges to the teaching and learning of English in the Jamaican context are many and varied. As evidenced by Brown Coote, 2019, Bryan, 2010, Lodge, 2017 and Virtue, 2013, the struggles students experience learning and using English in our Creole-speaking society are apparent from the primary through to the tertiary level of education. A search of various academic databases for research on addressing the struggle many students exhibit in mastering specific English Language skills at the tertiary level in Jamaica has revealed that learning disabilities as a possible factor has largely been ignored. There is limited research on learning disabilities in the Caribbean, as observed by Anderson Morgan (2021), and the paucity of such research addressing college-level students in Jamaica is particularly significant. In spite of the apparent dearth of research on learning disabilities as a possible factor impacting tertiary level students' English Language skills in Jamaica, Singley (2017) reveals that learning disabilities (LD) and/or attention-deficit hyperactivity disorder (ADHD) are among the major categories of disabilities at 4-year colleges and universities.

Although trends indicate that an increased number of students with learning disabilities are already enrolled or seeking to enter universities (Adams, 2021), the stigma attached to learning disabilities still exists, rendering some students unwilling to disclose their condition (Abdullateef, 2023; Adams, 2021). The National Center for Learning Disabilities (2015) reveals that only a quarter of students in the United States who received help for their disabilities in high school acknowledge in college that they need the same assistance.

Some students may also be unaware of a learning disability. According to Pottinger, LaHee and Asmus (2009), ". . . many students do not access relevant resource help because they and the faculty are not aware of disabilities that can be 'hidden'" (p.3).

The Mico CARE is a facility well known for providing assessments for learning disabilities in Jamaica; however, most teachers of English cannot accurately determine possible cases of learning disabilities, unless they have specialized training in this area. Exacerbating the problem are general university privacy policies regarding disclosing students' disabilities, which have effectively kept the presence of learning disabilities among students below the radar. It is, therefore,

not surprising that attempts at finding solutions to problems encountered in the teaching of English at the college level rarely take learning disabilities into consideration.

The Nature of Learning Disabilities

According to Eissa (2018), The American Psychiatric Association Diagnostic Statistical Manual of Mental Disorders, 5th edition (APA DSM-5) provides the following diagnostic criteria for the possible presence of a learning disability:

1. Inaccurate or slow and effortful word reading
2. Difficulty understanding the meaning of what is read (e.g., may read text accurately but not understand the sequence, relationships, inferences, or deeper meanings of what is read).
3. Difficulties with spelling (e.g., may add, omit, or substitute vowels or consonants).
4. Difficulties with written expression (e.g., makes multiple grammatical or punctuation errors within sentences; employs poor paragraph organization; written expression of ideas lacks clarity).
5. Difficulties with mathematical reasoning (e.g., has severe difficulty applying mathematical concepts, facts, or procedures to solve quantitative problems) (p. 108).
6. Difficulties mastering number sense, number facts, or calculation (e.g., has poor understanding of numbers, their magnitude, and relationships; counts on fingers to add single-digit numbers instead of recalling the math fact as peers do; gets lost in the midst of arithmetic computation and may switch procedures).

The DSM-5 (2013) indicates that for the diagnosis of a specific learning disorder (SLD), difficulties in one or more of the above areas should be substantial and quantifiably below those expected for the individual's chronological age. The difficulties must also have persisted for at least 6 months and have caused significant interference with academic performance, as confirmed by standardized achievement and comprehensive clinical assessments.

Learning disability should not be confused with intellectual disability although they may co-occur. As outlined by the World Health Organization's ICD-11 (2022), individuals with intellectual disorders typically present with limitations in academic achievement as a result of significant generalized deficits in intellectual functioning, whereas learning disorders are characterized by persistent difficulties in learning academic skills expected for one's chronological age. The Individuals

with Disabilities Education Act (1999) published by the US Office of Education, further emphasized that learning problems which result primarily from visual, hearing or motor impairments, mental retardation, emotional disturbance, environmental, cultural or economic disadvantage are not regarded as learning disorders. Jamaica's Ministry of Education and Youth also outlined the important point that learning disability is not synonymous with a lack of intelligence, as some children diagnosed with a learning disability possess above average intelligence (Ministry of Education &Youth, 2023).

Pottinger, et al., (2009), in a study conducted at the University of the West Indies, Mona, revealed that "Learning disabilities cause academic under-achievement as opposed to general low achievement, and carry a prevalence rate of 1.5 to 10%, average of 2.6%, among college students." (p. 1). Further, Robinson (2016) discovered that the most common learning disability in Jamaica is dyslexia. Interestingly, the Disability Act of Jamaica, as promulgated by the Jamaica Council for Persons with Disabilities (2022), does not mention learning disabilities.

College English

College English is used in this study as a generic name for the general education course/module designated in some universities as English for Academic Purposes, Academic Writing, Communication, Freshman Composition, Academic Literacy, etc. A description of the course called English for Academic Purposes on the website of the University of the Commonwealth Caribbean indicates that the goal of the course is to develop fundamental skills among students in reading and communicating in English Language. The University of the West Indies, Open Campus (2023) also describes the English for Academic Purposes course as "designed to provide a firm base for Communication courses and for courses in English for Special Purposes" (para. 1).

I have witnessed and participated in reviews of the college English modules at the University of Technology, Jamaica. These modules have evolved with name changes from Communication to Academic Writing and, more recently, to Academic Literacy for Undergraduates (among other college English modules). The fundamental feature of developing students' understanding and application of Standard English for the academic context and the world of work is, noticeably, embedded in both Academic Writing and Academic Literacy for Undergraduates.

Significance of the Study

While we research and analyze the challenges manifested in the teaching and learning of English, we should not ignore any possible contributory factor. Learning disability among young adults is a critical and real issue that not only technical/vocational institutions, but also universities must face as more and more students with learning disabilities are entering college. This study should, therefore, provide valuable research in the area of learning disabilities at the college level in Jamaica, especially its implications for the teaching and learning of English. The results should also alert the administration and faculty of the University of Technology, Jamaica as to whether any action may need to be taken to better cater to students with learning disabilities.

Research Questions

1. Do students know whether they have a learning disability?
2. To what extent are students willing to be tested for a learning disability?
3. To what extent are students willing to disclose a learning disability to teachers?
4. Is there any significant relationship between the students' perceived proficiency in college English and their perception of teacher assistance?

Literature Review

Learning Disabilities that Affect College English Outcomes

Executive function and lexical-semantic knowledge are two areas in which persons with learning disabilities exhibit deficits (Hall et al., 2017). Executive functioning refers to the combination of cognitive processes that produces skills such as, paying attention, remembering information, planning, organizing and problem solving. Deficits in lexical-semantic knowledge manifest in semantic errors in both production and comprehension of words and sentences (Hall et al., 2017; Race & Hillis, 2015; Raymer, 2023).

Dyslexia and dysgraphia are also learning disorders that commonly manifest in problems with comprehension and expression. They have been grouped together by the Diagnostic Statistical Manual of Mental Disorders (DSM-5) under the category of "Specific Learning Disorders" (Vlachos & Avramidis, 2020). Dyslexia is a disorder with processing language and may cause difficulty with reading, spelling and writing (National Council for Learning Disabilities, 2015). Dysgraphia, though not as widely discussed as dyslexia, is reported to be quite common.

This learning disability typically presents in children as difficulties with spelling and grammar, poor handwriting or trouble putting thoughts on paper (Bach, 2015). Bach reports that though there are a number of persons who do not make a distinction between dysgraphia and dyslexia, a study done by the University of Washington identified "structural white matter and functional grey matter differences in the brain between children with dyslexia and dysgraphia, and between those children and typical language learners." (p.1).

According to the Dyslexia-SPELD Foundation of Australia (2015), dysgraphia can be a language based or a non-language-based disorder. Dysgraphia that is caused by a language disorder may be characterised by the person having difficulty converting the sounds of language into written form. A person with dysgraphia may struggle to form written sentences with correct grammar and punctuation, exhibiting common problems such as word omission, incorrect word order, incorrect verb and pronoun usage, as well as word ending errors. Also, people with dysgraphia may speak more fluently than they write.

Prevalence of Learning Disabilities Among College Students

A learning disability may be self-reported by college students, or it may be detected and the student willingly undergoes an assessment by clinicians appointed by the university, but whether the case is the former or the latter, the rise in university matriculation by students with learning disabilities has become noticeable over the years (Adams, 2021; Hadjikakou & Hartas, 2008; Vickers, 2010). As Vickers (2010) submitted, if one were to scan an undergraduate lecture hall at any U.S. college or university, the odds are that 2 out of every 100 students there has some type of learning disability such as dyslexia, Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder. Hadjikakou & Hartas (2008) revealed that research estimates that 8-10% of students attending a higher education institution are registered with a disability, with learning difficulties being the most commonly reported disability. They posited that this increased participation in higher education has been supported by legislative changes, inclusive education practices, the use of ICT and accessible facilities and programs, as well as an increasing belief among students with disabilities that higher education maximizes their opportunities for employment and independent living. However, as the population of college students with learning disabilities shows a marked increase from the first decade of the 21st century, many of these students continue to encounter challenges in the areas of self-esteem and self-efficacy, suggesting a need for more research to address these areas (Adams,2021, Duke, et al., 2019).

Methodology

Research Design

This study employed a cross-sectional research design, which involved survey questionnaires being distributed among the target population.

Sampling

From the population of first year male and female students of the University of Technology, Jamaica, random stratified sampling was utilized to target an average of thirty persons from each of the seven faculties at the main campus of the university. The rationale for targeting first year students is that core college English modules at the University of Technology, Jamaica are required to be first attempted during the students' first year. Stratified random sampling was chosen to ensure that the smaller faculties were represented.

The University of Technology, Jamaica Integrated Student Administration System (ISAS) was searched to determine the average number of students in a typical first year seminar/class in each faculty. This worked out to be an average of 30 students.

Instruments

The instrument used in this research was a questionnaire with sections as follows: Section A – demographic questions; Section B – 5 point Likert-type items, plus a 3 point question and a dichotomous question. The 3 point question directed participants to select "Yes", "No" or "Don't know" to the question "Do you have a learning disability?". The dichotomous question sought to ascertain if participants would be personally willing to test for a learning disability. The 5-point Likert-type items consisted of statements which required respondents to enter a selection ranging from "Strongly Agree" to "Strongly Disagree". Statements related to the participants' convictions regarding participants' perception of their proficiency in college English Language skills participants' perception of the quality of teacher assistance whether or not students should generally be willing to test for a learning disability, whether or not students should be willing to disclose any learning disability to their teachers.

Data Collection

Clearance was sought from the University of Technology, Jamaica Research Ethics Committee, and 210 questionnaires were self-administered to first year students across the seven faculties. The classes were visited, and permission sought from the lecturers to introduce the research to students. Students were advised that their participation was anonymous and non-compulsory, and their consent to participate would be indicated by taking a questionnaire from the envelope, completing and returning it. They were reminded that they had to be registered for a college English module or had already taken one in order to participate in the research. Students were asked to respond to the questionnaires at the end of their class and return them to the envelope or to take home the questionnaires and return their responses to the researcher's office by the end of the week.

Data Analysis

The data collected was imported into SPSS, and descriptive and inferential statistics were generated. For research questions 1, 2 and 3, descriptive statistics were employed. Spearman correlation was computed to answer research question 4.

Results

Two hundred and ten questionnaires were distributed among first year students at the University of Technology, Jamaica, with 158 students returning responses, thereby producing a response rate of 75%. The respondents were almost evenly divided by gender with 47.7% (n= 73) males and 52.3% (n=80) females. Their ages ranged between 16 years to 30 and above, where the majority fell in the 20–24 years age range (61.7%, n=95).

Table 1: Age range of respondents

Age Range	Frequency	Percent
16–19	14	9.1
20–24	95	61.7
25–29	20	13.0
30 and above	25	16.2
Total	**154**	**100.0**

Awareness of Learning Disability

RQ 1: Do students know whether or not they have a learning disability?

When asked if they had a learning disability, more than half of the respondents (62%, n=98) said they did not, while 8.2% (n=13) reported that they did. Almost a third of participants (29.8%, n= 47), however, were not sure whether or not they had a learning disability. Table 2, below, presents the descriptive statistics.

Table 2: Do you have a learning disability?

Responses	Frequency	%
Yes	13	8.2%
No	98	62%
Don't Know	47	29.8%

Willingness to be tested

RQ 2: To what extent are students willing to be tested for a learning disability?

When responding to the statement that sought to ascertain their convictions as to whether or not students in general should be willing to get tested, more than 90% of the respondents (91.8) agreed to some degree – (39.2%, n=62 strongly agreed with the statement and 52.5%, n=83 agreed). The remaining 8.2% (n=13) were not sure whether students should be willing to get tested or not. On a personal level, when asked if they themselves were willing to get tested, 84.1% (n=124) of participants responded that they would be and 15.9% (n=24) said they would not. Table 3 below presents the results for the questions on respondents' willingness to personally discover if they have a learning disorder as well as whether students should generally be willing to discover their status.

Table 3: Responses to "Students should be willing to find out if they have a learning disability" and "Would you be willing to be tested for a learning disability?"

Students should be willing to find out if they have a learning disability		
Responses	**Frequency**	**%**
Strongly agree	62	39.2
Agree	83	52.5
Undecided	13	8.2
Disagree	–	–

Strongly disagree	–	–
Would you be willing to be tested for a learning disability?		
Yes	127	84.1
No	24	15.9

Willingness to disclose a learning disability

RQ 3: To what extent are students willing to disclose a learning disability to their teachers?

In measuring respondents' willingness to disclose a learning disability to their teachers, measures of central tendency were computed. The results of the analysis, N=151; M=1.21: SD=.410 suggest that there was low variance among the responses and that participants were largely positive towards disclosing whether they had a learning disability. Overall, more than three quarters (78.8%) were willing to disclose while 21.2% had negative attitudes toward disclosing.

RQ 4: Is there a significant relationship between students' perceived proficiency in college English skills and their perception of teacher assistance?

Perceived College English Language Skills

The variable "Perceived College English Language Skills" was created as an aggregation of Likert type items 1 through 5 on the questionnaire, which sought responses on different aspects of college English Language skills such as essay writing and reading comprehension. In assessing their perceived proficiency in English Language skills, 75% (n=114) of participants in the study reported that their language skills were average. A mere 11.2% (n=17) thought their skills were excellent and 13.8% (n=21) assessed their college English Language skills as being weak.

Teacher Assistance and Language Skills

Teacher assistance refers to the average quality of assistance towards mastery of college English Language skills that the participants thought they received from teachers. Figure 3 below shows how students perceived teacher assistance. Almost half of the participants (47.4%) perceived that they received moderate assistance, while 41% thought it was maximum assistance and 11.5% thought teacher assistance was minimal.

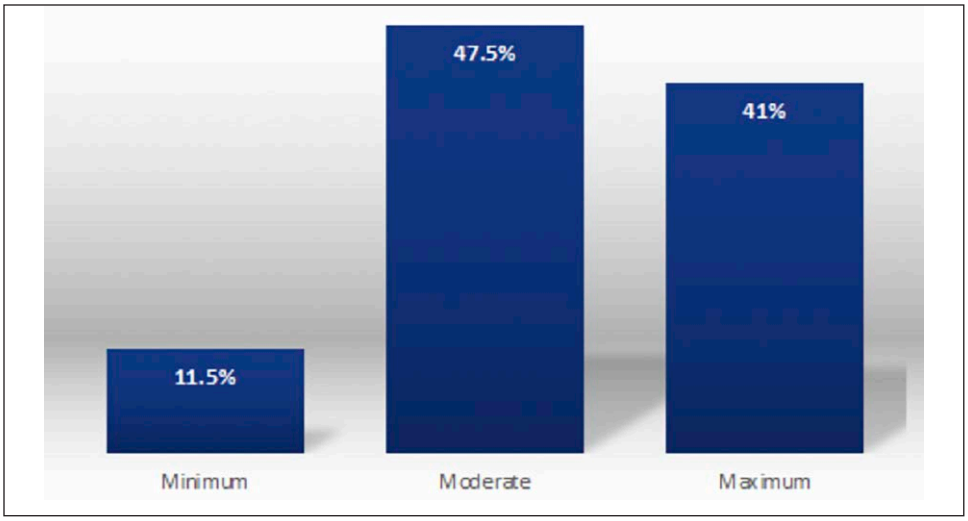

Figure 3: Perceived Assistance from Teachers

Note: An illustration of the respondents' perception of the effort that teachers expend to assist them with their English Language skills

A Spearman's correlation was run to determine the relationship between the respondents' perception of teacher assistance and their perceived proficiency in college English skills. There was a weak, positive correlation between perceived teacher assistance and perceived proficiency in language skills [r= .178, p <.01]. This could indicate that an increase in perceived/noticeable teacher assistance may lead to improved perception of their English Language proficiency

Table 4: Correlation of Perceived Teacher Assistance and Perceived English Language proficiency

Correlations				
			Perceived Teacher assistance	**Perceived English Language Proficiency**
Spearman's rho	Perceived Teacher assistance	Correlation Coefficient	1.000	.178*
		Sig. (2-tailed)	.	.030
		N	156	150
	Perceived English Language Proficiency	Correlation Coefficient	.178*	1.000
		Sig. (2-tailed)	.030	.
		N	150	152

Discussion

As was previously stated, this research was undertaken to fill the gap left by the dearth of research on learning disabilities at the college level in the Caribbean, as well as to prompt further research. The findings should also alert administration and faculty of the University of Technology, Jamaica to any action that may need to be taken regarding equipping staff and faculty to be better able to cater to the needs of students with learning disabilities. Approximately 30% of the respondents stated that they did not know if they have a learning disability, and 8% revealed that they do have a learning disability. The fact that only 62% were sure that they do not have a learning disability may indicate that there might very well be a need to conduct larger research on addressing learning disabilities college-wide.

Students' willingness to be tested for a learning disability was very high, although the support decreased when the question entered the realm of personal testing. Approximately 92% supported the statement "students should be willing to get tested for a learning disability", while there was 84% support for "would you be willing to get tested". The fact that support for testing for learning disabilities was high, whether as a general philosophy or as a personal willingness, is an indication that quite a number of students take this issue of learning disabilities seriously.

Willingness to disclose a learning disability to teachers was also highly positive, with more than three quarters (78.8%) willing to disclose. These findings do not support the literature coming out of North America indicating students' reticence in disclosing a learning disability. According to The National Center for Learning Disabilities (2015) only a quarter of students in the United States who received help for their disabilities in high school acknowledge in college that they need the same assistance. Cultural differences in the relationship between Jamaican teachers and students may account for the willingness of the respondents in this research to disclose a learning disability to teachers. Disclosure of learning disabilities to education practitioners with the resultant support has been proven to be instrumental in students' ultimate success (Mytkowicz & Abrahams, 2018).

Limitations exist in relation to the fact that the variables, "Proficiency in College English Language Skills" and "Teacher Assistance" were based on the students' perceptions, but the aim of this study was not to determine causation. There was positive correlation between perceived teacher assistance and perceived proficiency in language skills, though weak. As the results revealed, this could indicate that an increase in perceived/noticeable teacher assistance may lead to an improvement in students' perception of their English Language proficiency.

Therefore, despite the limitations where students' actual proficiency and teachers' actual assistance were not measured, it is important to note that perception has played a major role in self efficacy and achievement among students (Adams, 2021).

Conclusion & Recommendations

According to the literature, an increasing number of individuals with learning disabilities are accessing higher education. Students with learning disabilities are present in Jamaican universities, as they are elsewhere; however, such disabilities may remain hidden. The latter may be a result of fear of stigmatization or unawareness of the condition. It is instructive that in this small-scale study, 8.2% (n=13) of respondents reported that they had a learning disability and almost a third (29.8%, n= 47) did not know, while only 62% (n 98) were sure that they did not have a learning disability. My recommendation is that there should be collaboration between faculty and administration to conduct a larger scale research on learning disabilities at the University of Technology, Jamaica.

The findings of this research also indicate that the majority of participants supported testing for a learning disability as well as disclosure to their teachers. These findings could indicate that provision of more accessible clinical assessment for learning disabilities among college age students/young adults in Jamaica is a viable undertaking. Currently, such services in Jamaica exist mainly for children.

The teaching and learning of English in the Jamaican context is already encumbered with many challenges. Thus, a provision of resources and support that would enable faculty to detect genuine cases of learning disabilities and devise strategies to cater to the needs of such students, should contribute to a reduction in failure rates and frustration among this population in the college English classroom.

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ICT Integration as Reflected in the Written National Standards Curriculum for Mathematics, English Language and Integrated Science

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Abstract

Information and Communication Technology integration in curriculum is being promoted in the Jamaican school curriculum as one of the means of developing the necessary 21st century skills. This paper reports on a study that sought to examine how Information and Communication Technology (ICT) is integrated in the written curriculum documents of the grade seven National Standards Curricula (NSC) of Mathematics, English Language, and Integrated Science. The study took the form of a qualitative document analysis of the associated curriculum documents and was undergirded by the use of the Substitution, Augmentation, Modification, and Redefinition (SAMR) theory. Data was collected through analysis of the written curriculum for the three subjects and analysed using document and thematic analyses. The review of the three curriculum documents revealed an inconsistent inclusion of ICT attainment targets and objectives and limited to non-inclusion of ICT in assessments. Recommendations are therefore offered in this paper for the review of the documents to ensure better integration of ICT and alignment among the suggested ICT attainment targets, objectives, activities, and assessment across the three curricula.

Keywords: ICT Integration, NSC Curriculum, Intended Curriculum, Document Analysis

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Introduction

The advent of the 21st century has brought about numerous changes to multiple facets of life including schooling and its curriculum. Such changes have been expanding due to globalisation and the use of Information and Communication Technology (ICT). Within Jamaica, the Ministry of Education Youth and Information (MOEY & I) has the responsibility for shaping schooling and its curriculum to reflect changes in society that are beneficial to the development of its populace. Furthermore, in keeping with the achievement of SDG 4 which targets quality education, the development of ICT competencies through the school curriculum is seen as a necessary means to help improve learning outcomes (Roofe & Baldwin, 2020).

The curriculum can be viewed as the DNA of schooling that reflects the needs of the society. These needs drive both the quality, and the relevance of the offerings provided through the curriculum of schools (UNESCO, 2015). Curriculum is the avenue for developing the knowledge, skills, and attitudes that a country seeks to inculcate in its populace. Curriculum as defined by Toombs and Tierney (1993, p. 179) is "what is taught" and "a plan for learning" reflective of a documented, systematic approach to learning. As the plan for learning in primary and secondary schools in Jamaica, the National Standards Curriculum (NSC) was implemented in schools in 2016 and is the national curriculum used across Jamaica for grades one to nine. A crucial element of this curriculum is the integration of ICT. ICT integration and use however requires the development of new competencies to effectively utilise various types of media (Voogt & Roblin, 2012; Koh et al., 2015). Twining et al., (2020) cites OECD (2018) defining competencies as knowledge and values that students possess both of and about things, and as tangible goals that students should achieve. Appropriate integration of ICT to achieve the development of this knowledge and values therefore require integration of these competencies at two levels (i) the appropriate integration of these competencies in the intentions of the written curriculum document and lesson plans, and (ii) in how lessons are delivered through teacher and student classroom interactions to facilitate the development of these competencies.

Purpose of the study

The purpose of this research was to determine how ICT was integrated in the written formal grade seven National Standards Curricula (NSC) for Mathematics, English Language, and Integrated Science. This was important to determine if the

ICT integration goals of the MOEY & I were met in the development of this new curriculum. This is the first phase of a larger study which sought to examine ICT integration in the curricula of the disciplines of Mathematics, English Language, and Integrated Science. The study being reported in this paper was therefore guided by the research question: How is ICT integrated across each written grade seven curriculum of the selected disciplines Mathematics, Integrated Science and English Language?

Literature Review

The impact of the COVID-19 pandemic has the capability of changing the trajectory of 21st century needs, and it is believed that it will thrust ICT integration even more into the spotlight (Charland et al., 2021). Information and Communication Technology (ICT) is defined by Ghavifekr and Rosdy (2015) as the use of computer-based software or hardware in the instructional process. The sudden shift to online learning by various institutions of learning during the COVID-19 pandemic has reinforced the need for a flexible curriculum which includes the use of in-person and online teaching (Jonker et al., 2020). As attempts are made to reinvent the curriculum for the 21st century, the competency-based approach can be a blueprint. Noddings (2007) stated that curriculum should be designed around the new competencies that are required for success in the era of globalisation. To achieve these 21st century competencies, the curriculum should be focused on developing critical thinking skills for students to meet the demands of the new jobs that require higher level thinking (Alismail & McGuire, 2015). Voogt and Roblin (2012) concur that to achieve the desired 21st century competencies, the curriculum must be reinvented to accomplish these.

In reflecting on the requirements for the 21st century, Prensky (2014) posited that true curriculum reform requires moving beyond improving performance in specific subject areas. Prensky (2014) believed that the changes that have taken place in the 21st century necessitate changes to the curriculum for education to keep pace. However, after curriculum reforms are implemented, monitoring and evaluation are critical to determine if the reforms are effective (Wotela, 2017).

Integration of ICT in the Curriculum

Designing curriculum in the 21st century requires an intentional effort to integrate ICT, if the curriculum seeks to be relevant (Konig et al., 2022). The Substitution, Augmentation, Modification and Redefinition (SAMR) by Puentedura (2013)

theory serves as a valuable means for developing a deeper understanding of ICT integration in curriculum and is often used as a theoretical framework for designing 21st century curriculum. SAMR theory provides an understanding regarding the role that technology plays in augmenting learning. This theory is based on four levels at which ICT can be integrated in the curriculum to serve different roles. These are substitution, augmentation, modification, and redefinition.

Substitution is the lowest level of technology integration where technology is used as a substitute for previously utilised activities. At this level, students may take notes on their mobile devices or laptops instead of writing the notes in their notebook. At the augmentation level, minimal improvements are made to the substitution use; for example, adding images to the notes typed on the devices or links to improve the functionality of the notes taken. The substitution and augmentation levels are collectively defined as the enhancement level where the technology is used to functionally improve the existing tasks that can be completed without the use of technology (Hilton, 2016).

At the modification level, the activities are redesigned using the technology. As such tasks at this level requires skills of analysis, synthesis, and evaluation. Technology is used at this level to move beyond improving tasks to significantly redesigning tasks. One example of an activity pitched at the modification level is the use of a video where students analyze what is happening in the video. Such activities are designed to increase interaction among students with the use of technology. The final level is redefinition which allows for a development of activities that could not be accomplished without technology (Romrell et al., 2014). The last two levels of the model are termed transformational because students can engage in entirely new activities that would not be possible without the use of the technology (Hilton, 2016).

The SAMR model is therefore seen as one means of incorporating and assessing how technology is incorporated on a spectrum. On one end technology is used as a one-to-one replacement for traditional tools and on the other end used to enable experiences that are impossible without it (Hilton, 2016). Even though there have been positive reviews of the SAMR model, it is not without its detractors. Blundell et al., (2022) intimated that the model neglects other variables in the education process. For instance, Blundell et al (2022) argue that the context or the environment in which education is offered is important when considering technology integration. This is because context can shape how an idea is implemented and the effectiveness of its implementation. When using the SAMR theory it is critical to recognise that the levels are not discrete and are meant to be suggestions of how ICT can be integrated.

Materials & Methods

Ethical approval to conduct the study was granted from both the Ministry of Education Youth and Information and the Ethics Committee, University of the West Indies, Mona. This study took the form of a document analysis using a curriculum review checklist. Bowen (2009) outlined that document analysis is a research method that involves the systematic review of documents to obtain data. The document analysis process involved finding, analysing, and integrating the data gathered from the documents (Bowen, 2009). This was done to achieve a comprehensive and accurate description of how ICT was integrated in the written curricula of Mathematics, English Language, and Integrated Science. A curriculum review checklist was created by one of the authors using guidelines from Mayring (2002), and Puentedura (2013). The checklist was validated through experts in the field of curriculum and piloted using a sample of documents prior to its use. Mayring (2002) outlined six criteria that should be utilised when conducting a document analysis. In addition to these criteria, the checklist sought to identify the levels of ICT integration as outlined by Puentedura (2013) by identifying the objectives, key skills, and assessments in the written curriculum. Taking into consideration Mayring's criteria, the first three questions on the checklist related to the authors of the NSC documents, date of the documents, and the intended audience.

The next set of questions sought to determine the topics in the documents with general and specific references to the use of ICT or technology in the documents to determine the level of ICT integration according to Puentedura (2013). The focus of the review was on the inclusion of the word technology or ICT-related content such as digital tools and media rich resources, including videos, digital media, PowerPoint presentations, graphic organiser, or any other resources that are synonymous with the use of ICT.

Data Analysis

The constant comparative data analysis method (Glaser, 1965) was used in deriving codes and themes (Bowen, 2009; Clarke & Braun, 2013; Maguire & Delahunt, 2017) to determine how ICT was integrated. The codes were identified first by examining each document with the help of the QDA Miner software, then examining codes across documents. Once codes were developed categories of codes were then established for each document then across documents followed by the comparison of codes and categories across documents to derive themes (Erlingsson & Brysiewicz, 2017).

Results

The results are presented using sub-headings. First an overview of the documents is presented followed by the themes derived for the research question.

Overview of the curriculum documents

In adhering to Marying's (2002) six guidelines for document analysis, the various components of each document were analysed. This included analysis of authorship for all three curriculum documents, welcome messages, the acknowledgement pages, purpose of each document, philosophical statements, and units that comprise each curriculum. It was determined that several technocrats from the Core Curriculum Unit from the MOEY & I spearheaded the effort to write the curriculum. The main purpose of these messages was to highlight the importance of the NSC. All messages though communicating the purpose of the NSC differently all spoke about the importance of the NSC for the revitalisation of the education system.

The philosophical statement of the English Language curriculum was examined to determine the framework that was utilised to develop the curriculum. The curriculum did not explicitly include the use of the word ICT, but reference was made to the development of 21st century skills. This was reflected in statements such as;

> The 21st century skills of communication, collaboration, critical thinking and creativity are also fully embraced and are promoted through the methodologies of simulations, group/peer-work, problem-based tasks and adequate allowance for exploration and innovation (English Language curriculum document p xiv).

This statement aligns with the use of ICT and seems to indicate that the government's goal was to create an integrated curriculum to promote the development of 21st century skills. To achieve the objectives of integration and to foster the development of 21st century skills the document also stated that the Progressive Language Teaching model was one of the philosophical underpinnings for the development of the Language programme from grades 1–9.

In the philosophical statement for the Integrated Science curriculum, reference was made to the shift in society to becoming more technologically centred. This was used as the rationale for the importance of utilising technology in the grade seven Integrated Science curriculum. As stated in the curriculum document, one of the main functions of the Integrated Science curriculum was to help students become more information technology literate.

For the Mathematics curriculum document, a portion of the philosophical statement reads,

> Internet access has so changed the information landscape, and technological developments have so revolutionised the means available to either create or solve problems (Mathematics curriculum document p xv).

This sentence seemed to indicate that the curriculum was intentionally designed to take full advantage of the internet. This was observed throughout the written curriculum based on the resources suggested for use in the various units of the curriculum. Three themes emerged from the analysis of the curriculum documents, and these are outlined in detail below. The themes are: Uneven distribution of ICT Attainment targets and ICT Objectives across Curricula; Differing Levels of ICT Integration Across Curricula and Limited Requirements for ICT Use in Assessment Across Curricula.

Theme 1: Uneven distribution of ICT Attainment Targets and ICT Objectives Across Curricula

The ICT attainment targets in each curriculum document indicates the expected outcome/target and how each target is defined by the MOEY & I. They provide guidance to users of the document on how ICT is utilised in the curriculum. Within the curriculum documents attainment targets are outlined to align with the strands of each curriculum.

The NSC English Language curriculum was designed with ICT attainment targets embedded within each unit of instruction. Of the individual strands that were outlined for the three terms, 20 of these included the use of ICT attainment targets; four strands included the use of communication and collaboration target; nine strands included the research, critical thinking, problem-solving and decision-making target; nine strands included the use of the designing and producing target, and nine strands included the use of the digital citizenship target.

The specific ICT objectives as a category that were included in the English Language curriculum were tailored to the strand that it was associated with. It is believed that the inclusion of ICT objectives provided greater direction to the teacher as to how to implement or integrate ICT in the teaching and learning processes. Only six out of the 29 strands included the use of specific ICT objectives. Of the six ICT objectives listed, two referred to using digital tools to conduct research; two highlighted using digital content to obtain information; one referenced using the internet to post literary pieces to a website and the last spoke to using ICT tools to prepare reports. This seems to indicate that ICT was

not being utilised in a uniquely transformative way since all the tasks outlined could be conducted without the use of ICT.

Regarding the Integrated Science Curriculum reference was made to ICT integration multiple times throughout the document. This was most notably in the form of ICT attainment targets. These ICT attainment targets were listed twice in term one, four times in term two and three times in unit three. Each unit in the curriculum included the use of all four ICT attainment targets attached to it. Of the 13 units identified in the curriculum all but three included the use of learning outcomes that referred to ICT in one form or the other. The language utilised for inclusion of ICT in the learning and teaching activities, key skills desired from students, and the learning outcomes were similar. The terms used included utilising graphic organisers to create digital documents, digital content, conduct internet search, create digital images, collaborate online, and create multimedia content.

After careful analysis of the Integrated Science curriculum, it was observed that there were no ICT objectives grouped as a category used across any of the strands that formed the three units of the grade curriculum. Even though references to ICT were made throughout the document, both in the guidelines and applications, no specific ICT objectives were stated.

Unlike the English Language and the Integrated Science curricula documents, there were no ICT attainment targets attached to any of the units in the mathematics curriculum. Of the 11 units listed, five did not incorporate any form of ICT integration in either the teaching and learning outcomes, key skills, or assessment criteria. There were no ICT objectives as a category utilised across any of the strands that formed the three units of the grade seven Mathematics curriculum. Even though references to ICT were made throughout the document in the activities and applications, no specific ICT objectives were stated.

Although references to ICT applications were made in some areas of the Integrated Science and Mathematics curricula, there was no reference made to a category called ICT objectives in the written documents. ICT objectives would assist in helping teachers understand how these could be incorporated in lesson plans. The English Language curriculum however, included the category of ICT objectives with specific instructions on how these were to be achieved.

Theme 2: Differing Levels of ICT Integration Across Curricula

Most of the teaching and learning activities that referenced the use of ICT in the English Language curriculum were pitched between the augmentation and the modification levels, according to the SAMR model. The activities referenced

included: post online; create using electronic media; create graphic organisers; join online book club; create wiki, and post pieces online. Teachers were told to "remind students to follow guidelines to promote healthy use of ICT tools" (p. 45). The lack of specific guidance to the teachers was surprising considering the large number of ICT attainment targets and the numerous teaching and learning activities that utilised ICT. The resource list positioned at the end of each unit included the use of recorders, graphic organisers, podcasts, internet, web quest worksheets, and computers which aligned with the ICT teaching and learning activities.

The activities in the Integrated Science curriculum were mainly pitched at the modification and redefinition stages according to the SAMR theory. The curriculum included the use of collaborative activities with the integration of ICT, an example of which is an activity including contributing to a wiki. In the unit cells and organisms, under the heading guidance to the teacher, it was suggested that a micro projector or a multimedia projector be utilised to support the teaching of cells. Under term three, unit one, for the topic sexually transmitted infections and drugs, the teachers were advised to utilise PowerPoint presentations as a teaching tool. The inclusion of teaching and learning activities that integrated ICT, highlighted an intentional effort to combine the use of technology and content to improve the pedagogy of the teachers. The activities included are in line with the constructivist philosophical framework which encourages the development of 21st century skills by Jamaican students.

There were two units that included a separate category of ICT integration, these were, sexually transmitted infections and drug abuse. These categories included: instructions to use word processing software and use email; utilise various electronic means of portraying the message; use wikis and blogs; use of digital story software; use online postings; create posters using digital drawing tools and share information through discussion forums. The limited use of a separate ICT integration category was surprising, given the concentrated use of ICT attainment targets throughout the curriculum and the emphasis on ICT integration in the philosophy of the curriculum.

ICT-related resources were included in 10 of the 11 units listed in the Mathematics curriculum, and these included: specific mathematics websites such as mathisfun.com; Wikipedia; senteacher.org; mathopenref.com, and pbs.org. In addition to the websites, other resources named included: internet, computer/tablet/smartphone; GeoGebra files and software; calculator, and apps on profit and loss.

The teaching and learning activities seemed to have been pitched at the modification level which should help to increase the critical thinking required

for Mathematics. However, the resources utilised were primarily tied to the use of GeoGebra, which is a free Mathematics application that can be downloaded through a mobile device. If a teacher or student does not understand GeoGebra or does not fully appreciate the scope of the website, then he or she will be limited in how to do work for the unit that requires the use of GeoGebra. For the key skills listed in the curriculum, the following were highlighted: navigate digital content; manipulate software; use calculator/app/software and manipulate digital content. For the learning outcomes listed in the mathematics curriculum, the following were deemed to be relevant to this study: conduct investigation using digital content; use ICT tools to investigate measurement; manipulate software; use ICT tools to investigate and use appropriate software to explore coordinates. The addition of the ICT resources was a welcome inclusion which was different from the Integrated Science and the English Language curricula which did not have as many resources. It was not clear however that the resources and the teaching and learning activities as they were currently stated would have helped to revolutionise the curriculum as was outlined in the philosophical statement. This suggests a mismatch between intent and what was actually included to guide users of the curriculum.

Theme 3: Limited Requirements for ICT Use in Assessment Across Curricula

The use of ICT in the assessment was limited in the English Language curriculum because only three out of 29 strands included the use of ICT in the assessment criteria. The limited use of ICT integration in the assessment component of the curriculum has the potential to ultimately undermine the effort at ICT integration. The inclusion of ICT integration in formative and summative assessments can be two of the ultimate markers of whether ICT integration has taken place.

After careful analysis, it was found that none of the assessment criteria for any of the 13 units in the Integrated Science curriculum required the use of ICT. This lack of ICT requirement seemed to have been a contradiction to the philosophy of the curriculum which stated that one of the goals of the curriculum was to make students more information literate. This may be difficult to accomplish without an assessment component in the curriculum.

For the assessment criteria in the mathematics curriculum, there was one unit that included an ICT component in the assessment requirements. In unit one, students were asked to create models of area and perimeter using a particular software with the key skill of being able to navigate digital content. This was the only instance in the curriculum in which a specific reference was made to the use of ICT in the assessment.

Discussion

The integration of multiple ICT attainment targets in the three curriculum documents aligns with the philosophy of ICT integration and the development of 21st century competencies. The inclusion of the ICT attainment targets highlights the intention of the curricula writers and signifies the importance of ICT integration when the curriculum is to be implemented. The inclusion of these ICT attainment targets has helped to pave the path for curriculum reform (Prensky, 2014) in Jamaican schools. However, if the intentions of the curriculum developers are to be achieved when the curriculum is being implemented the curriculum documents needed to provide clearer directions to its users. For example, the ICT attainment targets were used almost like signposts to provide direction, but there was no evidence to suggest that they were meaningfully explained or contextualised appropriately to provide guidance to the users. Additional detail or documentation is needed to guide the teachers on how to implement these desired ICT attainment targets especially in the form of objectives and assessments. This guidance can in turn help teachers determine how to personalise learning for their students to develop the 21st century competencies (Keane et al., 2015).

Although stated to be important as the foundation to drive ICT implementation the ICT attainment targets were unevenly distributed across the three curriculum documents. For example, the English Language curriculum although replete with the use of ICT attainment targets, there are a limited number of practical suggestions to specific websites or applications. Additionally, the Integrated Science curriculum includes the use of the four ICT attainment targets in each strand but are organised in an ad hoc way. Thus, inadequate direction is provided on how to achieve practical application of the ICT targets as no specific websites are mentioned, neither is there instruction on how to achieve the ICT attainment targets outlined. While the Mathematics curriculum did not provide a list of ICT attainment targets, of the three curriculum documents it seems to be the most practical as it relates to the suggestion of specific websites and applications to be used for the various units.

The limited inclusion of suggested activities and applications across each written curriculum document will make it difficult to reconcile the gap between the intended and the implemented curriculum (Vass, 2017). Providing suggestions of specific websites and applications is crucial and can inspire teachers to positive actions such as undergoing training to ensure their appropriate use (Gislason, 2021). To achieve the desired 21st century competencies, all three curricula documents need to be meaningfully infused with ICT applications to fully achieve the benefits

that ICT has to offer. ICT integration can help to change the role of the teacher to that of facilitator, and the student can become the investigator. This utilisation of ICT can help to achieve the constructivist philosophy that is desired by the MOEY & I (Dianti & Atmanegara, 2018).

Additionally, the level of ICT integration across each curriculum varied tremendously. This variability was evidenced in the categories labelled activities, objectives, and assessment. The level of ICT integration referenced in this theme are the four levels outlined by Puentedura (2013). These are: substitution, augmentation, modification, and redefinition.

Table 1: Evidence of SAMR within the Curricula documents

ICT Level	Definition	Example
Substitution	The technology provides a substitute for other learning activities without functional change (Romrell et al., 2014).	Creating online posts
Augmentation	The technology provides a substitute for other learning activities but with functional improvements (Romrell et al., 2014).	Creating a wiki/blog
Modification	The technology allows the learning activity to be redesigned (Romrell et al., 2014)	ICT objectives in Integrated Science Curriculum
Redefinition	The technology allows for the creation of tasks that could not have been done without the use of the technology (Romrell et al., 2014).	Utilising the geogebra application in Mathematics

The inclusion of activities pitched across all four levels of ICT integration is critical to help students develop the desired 21st century competencies and work ready skills employers are seeking (Oudeweetering & Voogt, 2018; Alismail & McGuire, 2015; Keane et al., 2016). A variety of activities included in the curriculum can contribute to a diversity of teaching methodology which can help to improve learning outcomes (UNESCO-IBE, 2014). If the desired revitalisation of the education sector is to be accomplished the level of ICT integration must be such that the curriculum will lead the charge. ICT must be used creatively to accomplish this goal (Livingstone, 2019). The tools that are included in the curriculum should be meaningfully selected so that they contribute to the development of learner outcomes (UNESCO-IBE, 2014).

Further, the analysis of the three curriculum documents revealed limited requirements of ICT in the assessments thus minimising ICT integration in all areas of the curriculum. The limited use of assessments with required ICT tools will most likely not result in the transformation of the education sector that is

desired. If the curriculum is to be a tool, as described by Limited (2016) then it needs to be appropriately designed to provide the teachers with all the relevant information for use. The definition of the targets is insufficient without practical applications and explicit suggestions of how to achieve and assess the same. For the English Language curriculum, assessments which require the use of ICT were included in three out of 30 strands; while the mathematics curriculum had one assessment in the entire grade seven curriculum and the Integrated Science had none. To obtain the level of transformation that is being sought by the curriculum with the introduction of the desired 21st century competencies (Voogt & Roblin, 2012), it was thought that the inclusion of ICT in the recommended assessments would have a greater presence. The integration of ICT should span both the teaching and learning activities with an emphasis on assessments to determine if students are able to apply the ICT techniques that are taught. This will be a significant marker to determine if the development of 21st century competencies has been achieved (Alismail & McGuire, 2015; Reid, 2016).

One of the main ways to determine what a student knows is through assessment (Wang & Woo, 2007). Students' completion of assessments helps to demonstrate the desired competencies, thus assisting in providing an indication of the success of curriculum implementation (Alismail & McGuire, 2015; Williams-McBean, 2021). Students should be taught how to utilise ICT tools at the age-appropriate level with the demonstration resulting in formative or summative assessments. Specific assessment tools should be developed to determine if the students have learned the requisite skills that require the use of ICT (UNESCO-IBE, 2014). The use of ICT in assessment will further assist with making learner-centred adjustments to the curriculum (Vass, 2017).

Further, teachers should receive appropriate guidance on how to create assessments that include the use of ICT. The inclusion of ICT requirements for assessments will help students develop the real-world competencies that are sought by employers (Keane et al., 2016). If the curriculum is to be a plan for learning as Su (2012) intimated, then the written document must provide the level of detail needed to effectively guide the teachers in all the relevant areas. The teachers should not be left in the dark as to how to integrate ICT in the assessment component.The curriculum should be replete with suggested examples of how to integrate ICT in the assessment process to accomplish the objectives. This will simultaneously assist in accomplishing the objective of teaching students to be technologically literate (Yunus and Suliman, 2014).

In addition to the resources and infrastructure that are needed for both students and teachers to further assist teachers, perhaps the curriculum documents could

include more explicit statements about what professional development teachers may need to undergo to ensure that they can properly utilise the applications suggested. Suggestions such as these will help teachers understand what is needed to effectively plan lessons that include the effective use of ICT (Gill, 2017) and what is needed to achieve higher levels of ICT integration (Livingstone, 2019).

Conclusion

This study sought to analyse the integration of ICT in the intended National Standards Curriculum (NSC) of three subject areas. Based on the analysis of these documents the writers of the NSC Mathematics, English Language, and Integrated Science curriculum documents made a clear attempt to integrate ICT in its offering, with the inclusion of the ICT attainment targets. However, given the limited ways in which these targets are defined as it relates to stated objectives, key skills, and assessments more is needed in the ways ICT is included in each curriculum document to achieve greater levels of ICT integration and for students to develop 21st century competencies.

The curriculum unit within the MOEY & I should therefore revise the NSC documents to ensure uniformity across all curricula documents as it relates to how ICT attainment targets are outlined and integrated. IBE-UNESCO (n.d.) defines attainment targets as specific knowledge that learners are expected to acquire. The ICT attainment targets that were utilised in the curriculum documents were also not well defined. They need to be broken down into manageable components so that the teacher can readily identify when these targets are met. It is important for suggestions in the curriculum to be explicit to achieve the intended objectives (Bediako, 2019). The ICT targets need to be aligned with the objectives and assessments embedded in the curriculum. A teacher should be able to easily identify how the ICT attainment targets should be utilised for each strand and how these fit in with the content with specific instructions or explicit recommendations for implementation. Professional development would then be focused on training teachers on how to attain these targets (Bediako, 2019).

The NSC was developed and touted as a transformational tool. One of the goals of the curriculum reform that was embarked on and culminated with the introduction of the NSC was the intentional integration of ICT in curriculum delivery. For this to be achieved in the three subject areas in this study, there is room for improvement as it relates to the integration of ICT in the written curriculum. Additionally, for the curriculum to remain relevant the technocrats from the MOEY & I should ensure that the curriculum is reviewed regularly and

that the curriculum objectives, activities, assessments, etc. are in line with the competencies desired.

From our perspective we also argue that the NSC has been implemented for more than five years since its introduction in the Jamaican school system, hence it is our intention to complement the findings of the analysis of the documents with findings from case studies on the implemented curriculum. This we will achieve as we undertake further studies to explore how ICT integration is occurring in classrooms through the implementation of the NSC.

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Midwifery Students' Perception of Reintegration in the Clinical Area During COVID-19

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Abstract

The coronavirus disease outbreak which started in China and spread worldwide, was declared a public health emergency of international concern and later a pandemic. This placed fear into the minds of midwifery students who were being sent into the clinical space for their practicum. Due to the outbreak, the Government of Jamaica (GOJ) implemented measures to contain and prevent the transmission of COVID-19. Measures such as the closure of education institutions and the limitation of social gathering which changed how the healthcare professionals were to receive practical training in the clinical areas. The aim of this research was to ascertain what changes were made to the clinical rotation for the midwifery course of study due to COVID-19 and whether the protocols implemented affected the interaction among the staff members, patients, and students in the clinical space. Questionnaires which consisted of closed and open-ended questions were distributed to 17 fourth-year midwifery students at the Caribbean School of Nursing, the University of Technology, Jamaica. Interviews were also conducted with 10 fourth-year midwifery students. Data were then analysed using the Software Statistical Package for Social Sciences (SPSS) Version 21 and Excel Office 365; thematic analysis of the qualitative data was done. The findings revealed that 75% of participants stated that no changes were made to the clinical rotation while in the clinical space despite the GOJ's prevention and containment measures. Seventy per cent of participants reported that staff members, patients, and students adhered to the COVID-19 protocols. Qualitatively, students were mostly fearful to re-enter the clinical space, but

some saw it as their opportunity to learn first-hand and to give service to their country. It was recommended that provisions for transportation from the school could have been put in place for transportation to the clinical space and that periodic testing of students for the virus could have been done while they were in the clinical space.

Keywords: COVID 19, Midwifery Students, Clinical Area, Perception

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Introduction

The outbreak of the coronavirus disease (COVID-19) was first reported in Wuhan, China, in December 2019. It has since spread rapidly across China, Asia, the Middle East, Europe, North America, and other parts of the world. COVID-19 was declared a public health emergency of international concern on January 30, 2020, was classified as a pandemic. The COVID-19 pandemic has immensely affected all aspects of society. Globally, as of December 2020, there was reported 79,673,754 confirmed cases of COVID-19 and 1,761,381 deaths (WHO, 2020). In March 2020, the first COVID-19 case was recorded in Jamaica. 2,948 fatalities and 129,632 confirmed cases were reported by April 2022 (MOHW, 2022).

Since the outbreak of the disease, different governments around the world have implemented measures to contain and prevent the transmission of COVID-19. The World Health Organization published COVID-19 guidelines and protocols, which were adopted by the ministries of health of different countries. These protocols include information on signs and symptoms and prevention of and protective measures against COVID-19 (WHO, 2020). The Centers for Disease Control and Prevention reiterated that everyone should protect themselves and others to prevent the spread of the disease; such protection included proper hand hygiene, proper distancing, and use of masks; proper etiquette when coughing and sneezing; and isolation and decontamination of surfaces (Centers for Disease Control and Prevention, 2020). The success of the measures implemented is based on the people's adherence to prevention controls, which is largely influenced by knowledge, perception, and preventive behavior against COVID-19. However, adapting these preventive and control behaviors requires adequate knowledge, the right perception, and positive attitudes.

The rapid and undetected spread of COVID-19 and the relatively high mortality rate from COVID-19-related pneumonia combined to create the pandemic crisis,

which greatly impacted health, economics, and social life on a global scale. Massive medical manpower and resources have been invested in the prevention and treatment of severe pneumonia, increasing the burdens on and even threatening the exhaustion of healthcare systems across the world. Restrictions on normal life, trade activities, and travel, as well as lockdowns of cities and countries to prevent the spread of COVID-19, have severely impacted the world economy, threatening an economic depression. In addition to financial woes, psychological reactions such as fear of infection, uncertainty, worry, anxiety, and panic have been reported globally (Chen, 2020).

Knowledge, perception, and preventive behavior was considered in the planning of effective educational interventions for the coronavirus disease of the 2019 pandemic (COVID-19) and in increasing awareness about the health risks brought about by the disease. A constructive clinical learning environment with satisfactory possibilities for student learning and a focus on student learning needs is vital to nursing education. Clinical learning is carried out in complex health care settings, and students' experiences within the clinical context are of great importance to how and what is learned. The environment should motivate students to ask questions to achieve learning outcomes and contribute to their feeling of security while caring for patients (Croxon & Maginnis, 2009; Anderson et al., 2020).

The clinical learning environment and supervision of students play a crucial part in supporting student learning and are highly dependent on the relationship between student, preceptor, and nurse teacher. Nurse teachers have a multifaceted and important role in supervision, including supporting, motivating, problem-solving, and monitoring. Students have a responsibility to be active in their own learning, and preceptors and nurse teachers are both facilitators of and responsible for the students' learning in clinical settings (Hellstrom-Hyson, 2012).

Typically, in a pandemic, precautionary measures are maintained in the healthcare institutions and society at large to minimize and control the spread. Through collaboration between the schools of nursing and the Nursing Council of Jamaica, nursing and midwifery students were expected to re-enter the clinical space shortly after the emergence of COVID-19 in Jamaica. The coronavirus disease 2019 pandemic (COVID-19) has led to global disruptions in the clinical education of nursing students. In managing students return to the clinical setting, nursing students face the challenge of balancing education, service, and risk considerations. However, in order to fulfill the required training for their course of study, reintegration for clinical experience remained necessary. This study will determine the perception of midwifery students in re-integrating in the clinical area during COVID-19.

Purpose of the Study

To garner the views of the midwifery student on their experience in re-entering the clinical area for work during the COVID-19 pandemic.

Significance of the Study

This study will be of significance to both nursing and midwifery students, as they will have an insight into the possible challenges and action taken as it relates to the COVID-19 pandemic. The findings of the study are expected to help put plans in place to minimize or eliminate effects among clinical staff and students where counseling and appropriate measures are carried out on a case analysis. It will foster information, which can guide the preparation globally for any pandemic in the future and help in the advancement of nursing and midwifery school management, clinical leadership, and the teaching-evaluation approach during pandemics.

Research Objectives

1. To ascertain what changes have been made to students' clinical rotation for the midwifery course of study due to the coronavirus pandemic.
2. To deduce how the COVID-19 protocols affected the interaction between patients, staff, and students in the clinical area.

Research Questions

1. Were there changes to protocol for midwifery students' clinical rotation due to the coronavirus pandemic?
2. How have the implemented COVID-19 protocols affected the interaction between patients, staff, and students in the clinical area?

Literature Review

During the unprecedented times of the coronavirus, although the necessary focus has been to care for patients and the community, the emergence of the severe acute respiratory syndrome coronavirus disrupted the health sciences and medical education which required intense and prompt attention from medical educators re students' safety and continuity of clinical experience. The need to prepare future health professionals was moved into focus as the need surged in

the global emergency. The profound effects of coronavirus disease 2019 (COVID-19) changed how future health professionals are educated creating emphasis on infection control. COVID-19 presented practical and logistical challenges and concerns for patient safety, recognizing that students may potentially spread the virus when asymptomatic and may acquire the virus in the course of training during clinical rotation in the health care institutions (Rose, 2020).

According to a study performed by Kayalar (2020), the COVID-19 pandemic has suddenly accelerated the transition to distance learning education, and e-learning. Due to the pandemic 2019 crisis, there was a massive shift to online platforms and tools that make learning and skill development continue during the times. On the one hand, these instruments offer hope for the future, but they also provide concerning indicators. People who continue their formal education and those who have lost their education are given equal opportunities through lifelong learning, which also gives them the chance to finish their personal development, integrate into society, and become more productive.

Effect of COVID-19 on Student Mental Health

For university students' mental health has been a rising concern, with a significant number of students experiencing psychological distress. Mental health issues can significantly impair students' academic success and social interactions, affecting their future careers and personal opportunities. The rapid spread of COVID-19 and social distancing measures imposed across the country further affect the mental health of university students, which could be high in nursing and midwifery students since they are directly involved in the management related to the COVID-19 pandemic given their health training and area of study.

The fear of going out in the clinical areas where there is a possibility that they might get infected and can pass on the virus to their loved ones increased stress, anxiety, and depression among the nursing and midwifery students. With some healthcare institutions experiencing shortage of personal protective equipment, these fear and stress levels may increase. The limited personal protective equipment (PPE) and lack of routine testing may create anxiety and distress and have a tangible impact on the workforce. But the feeling of stress is an experience many students may likely go through; in fact, it is quite normal in a pandemic situation. Managing one's stress and psychosocial well-being during this time is as important as managing one's physical health (Kecojevic, Basch, & Sullivan, 2020).

COVID-19: Affecting the Learning Environment

Social distancing is the most effective preventative strategy since the emergence of COVID-19 pending the development of a vaccine, treatment, or both. By definition, this precludes students from gathering in learning studios, lecture halls, or small-group rooms. In response to COVID-19, health education faculty and schools in general quickly transitioned the entire curriculum to online formats that include content in the basic sciences, health systems sciences, and even behavioral sciences. Small-group formats convene online in virtual team settings, and clinical skills sessions may occur online or, in some cases, may be deferred (Kayalar, 2020).

Students have been compelled to adapt to a wholesale shift to online education delivery. And while some students will readily embrace this shift to e-learning, valuing its flexibility in geographical location and time, others may experience discomfort because of their limited digital literacy and access to the internet at home or absence of physical human engagement and camaraderie. Examinations have also transitioned to online settings (Townsend, 2020).

COVID-19 Affecting Students in the Clinical Environment

Ideally, in the clinical environment, the students are a part of the team as learners who require supervision. Formation of students' professional identity relies on teaching and role modeling in these settings as students learn to prioritize patients and aspire to altruism. With the emergence of a highly contagious pandemic, students may transmit the virus unknowingly or contract the disease. Other contributing factors that limit the role of students in this clinical environment include lack of COVID-19 testing, diminished value of education, with cancellation of surgical procedures and routine appointments and the transition to telehealth formats, and lack of adequate personal protective equipment (Rose, 2020).

In addition, cancelled clinical rotations will have significant negative educational effects on undergraduate learners, depending on the extent of the pandemic's effects. Nursing and midwifery students in their final year are likely missing their last opportunity for hands-on clinical training before graduation, and some may not be able to complete the required number of clinical hours or clinical experiences mandated for accreditation and completion of their course of study. Graduate training programs must accommodate and adapt to these disparities when reviewing their applicant pools.

Absence from the clinical front lines management during COVID-19 may risk nursing and midwifery students failing to capitalize on the unique educational opportunities presented by this pandemic and the symptomatic crisis clinical

interventions. Students might miss the chance to learn about a new clinical entity and its increasingly varied clinical presentations, crisis medicine, infection control measures, emergency preparedness, and ethics in the setting of scarce resources, public health and community response, communication in the setting of uncertainty and fear, and professionalism in the response to this singular situation. Trainees at all levels may miss the opportunity to stand alongside their teachers and peers to give care to those who need it most (Anderson, Turbow, Willgerodt, & Ruhnke, 2020).

Understanding the impact, the COVID-19 pandemic had on the nursing and midwifery students in the clinical area is significant because, due to the pandemic, many students who were in the clinical space were withdrawn from the health facilities due to the rapid spread of the virus. Many students were exposed to the stress associated with how and when they will complete clinical rotations to achieve required hours. Some may have become depressed due to the incompleteness of hours required for their nursing and midwifery programme. They also became anxious about getting infected and spreading the virus to their families. Much research and discussion states that due to COVID-19, many universities have closed and classes are held online due to stay-at-home and social distancing policies made by the government. And although the classes online are safer for students, most students cannot access classes due to internet connectivity issues.

In addition, if nursing and midwifery students were taken off practicum to prevent them contracting the virus during clinical care they will fail to capitalize on the unique clinical education opportunities presented by the pandemic. Students might miss the chance to learn about a new clinical condition and its increasingly varied clinical presentations and how best to care for a patient in a crisis.

Methodology

Research Design

A survey research design was utilized for the study. A mixed-methods approach with quantitative and qualitative data collection was employed. Mixed methods enable the use of inductive and deductive techniques and promote a more thorough comprehension of health issues and possible solutions (Harvard Catalyst, 2024).

Population

The population of this study comprises the fourth-year midwifery students in AY 20–21 at the Caribbean School of Nursing (CSON), University of Technology

(UTech) Papine campus. Information obtained from the year 4 class tutor is that the total number of students in the Bachelor of Science in Midwifery fourth year is 17. The year group, which comprises 17 students, would have been permitted to go out on clinical practicum during the pandemic in the AY 19–20 summer semester of 2020 and have been on practicum in semester 1 2020 AY 20–21 and semester 2 2021.

Inclusion Criteria:

- The currently enrolled Fourth-year midwifery students who are registered within the academic year (AY) 2020/21 and were a part of the previous third-year of AY 19-20.

Exclusion Criteria:

- Fourth-year midwifery students who were not part of the previous third-year in the AY 19–20.
- Fourth-year students who were not eligible for practicum in the AY 19–20.

Sample Size

Based on the information obtained from the midwifery year 4 class tutor, the total population size for BSM fourth year students is approximately 17 (N 4th year = 17). According to Raosoft (2007), the sample size of 17 (n = 17) calculated at a 95% confidence level with a 5% margin of error is estimated at an 85% distribution. The researchers decided to use a census where all 17 students were invited to participate in the study. Therefore, the sample size was 17.

Sampling Procedure

A questionnaire and a focus group interview were utilized as the data collection methods. The convenience sampling technique was utilized, where information was obtained from the class representative and class tutor for year 4 midwifery students. Students were invited to participate in the study, and the purpose of the study was explained to them. Participants were selected based on availability and willingness to take part.

A mutually agreed date and time were decided on for the focus interview and questionnaire distribution. They were informed of confidentiality and anonymity; the consent form and questionnaires were issued to participants over the age of eighteen (18) years who agreed to partake in the research. The consent forms were issued to participants, and they were sensitized via an introductory paragraph on the questionnaire as well as through verbal instruction. Questionnaires were

completed on the same day of distribution, as the researchers allowed five (5) to twenty (20) minutes for completion. However, a disadvantage of convenience sampling is that it's highly vulnerable to selection bias and influences beyond the control of the researcher. Focus interview was conducted with ten (10) students, using three main interview questions at a mutual time and place.

Data Collection Instrument

The primary method of quantitative data collection that the researchers used was a structured researcher developed questionnaire. The qualitative data was collected by a focus interview with ten (10) students. The structured quantitative questionnaire comprised of 12 questions that explored the perception of midwifery students in the clinical area during COVID 19. There was a mixture of closed and open-ended questions that was used to allow accuracy and validity of the research. The questionnaire required the students to select one answer of their choice as applicable to the questions or write a response best suited for the open-ended questions. The questionnaire was estimated to take approximately ten to fifteen (10–15) minutes for completion.

Three main interview questions were created to allow the participants to express their thoughts. The interview utilized methods and techniques of transitioning from the structured questions to unstructured probing questions as necessary for clarity during the interview.

The reason for using this method of data collection is that it permits the researchers to gather large amounts of information in a short timeframe and in a relatively cost-effective manner (Debois, 2019).

Validity and reliability

Credibility and generalizability of study findings are guaranteed by validity, which guarantees that the results appropriately represent the intended reality. To improve tools and procedures, a pilot test was carried out using five (5) nursing students at the CSON, UTech as they also experienced re-integration in the clinical space during COVID-19. In addition, a literature search utilizing a few sources to validate the results was carried out. The respondents provide information that can be easily converted into quantitative data from yes or no answers, allowing statistical analysis from respondents.

The consistency and stability of a measuring tool are referred to as dependability in research; high reliability denotes consistent and trustworthy results. Items that do not fit well with the overall standard and needed to be revised or eliminated were

found using an item analysis. Questions were standardized and all respondents were asked exactly the same questions and in the same order (Campbell & Connell (2021).

Data Collection Procedure

Initially, an email was sent to the Head of the Caribbean School of Nursing (CSON) and College of Health Science Ethics Committee seeking permission to conduct this research at the Caribbean School of Nursing, University of Technology, Papine campus. After permission was granted, the fourth-year midwifery students in CSON were contacted via class email, but initial communication was made to the group through a telephone call to the class representative. They were provided with the purpose of the study and assured that all information obtained would have been kept private and confidential, and no names or other identifying marks are required. A consent form was issued to be signed and returned via email to indicate their willingness to participate in the study. The questionnaires were created in Google Docs and sent to their class email for completion and submission. Follow up with two reminder emails during the week to request participation from eligible students who have not yet completed the survey was sent until at least 85% of the sample was obtained. The interview was conducted at a mutually agreed date and time via Zoom, whereby the session was recorded for analysis at a future date. Participants were informed of same.

The study was reviewed by the research supervisor on a weekly basis until its completion. Data collected was protected using passwords, which were only available and accessible to the researchers and the assigned supervisor.

Data Analysis

Data gathered from the questionnaires was analyzed through the use of Microsoft Excel software and SPSS version 21. The focus interview findings were arranged in themes based on the three main interview questions. Data was also presented in the form of pie charts, diagrams, and bar graphs, allowing the researchers to organize data in a logical and concise manner. Thus, making understanding data simple and easy.

Ethical Consideration

Ethical considerations can be specified as one of the most important parts of the research (Bhasin, 2020). Any research may be doomed to failure if this part of the research is not done accurately. As a result, many ethics organizations, such as

APA Ethics, offer general principles and specific guidance for research activities. The consent process for all individuals was voluntary to participate in the research with full knowledge of relevant risks and benefits. The participants were informed of the high level of confidentiality and anonymity that was maintained. To prevent situations of confidentiality breaches, effective security measures were taken to ensure all confidential records were stored in a secured area with limited access, and no identifiable links or participant markers were on the questionnaires. Respondents were provided with informed consent forms prior to completing the questionnaire and were also aware that they have the right to withdraw at any time during the survey or study without penalty. The research proposal, along with a letter, was sent to the College of Health Science (COHS) Ethics Committee seeking approval to carry out the research at the UTech, Ja. Upon receiving formal approval from the COHS Ethics, the data collection phase of the research began. At the end of the research once data analysis and the research report were completed, the responses received from participants were destroyed.

Results

Quantitative

A total of 17 full-time 4th year midwifery students at Caribbean School of Nursing, University of Technology, Papine campus were surveyed. Of the respondents, 17 (100%) were female. 13 participants (74%) were within the age range of eighteen to twenty-five (18–25). This was followed by 2 participants (13%) within the age range of twenty-six to thirty-three (26–33). And also, 2 participants (13%) were within the age range of thirty-four to thirty-eight (34–38), and no participants were within the range of thirty-nine to fourth-five (39–45).

Table 1: Gender and Age Groups of Participants

Gender	**(N %)**
Females	17 (100)
Males	nil
Age Group	N (%)
18–25	13 (74)
26–33	2 (13)
34–38	2 (13)
39–45	nil
Total	**82 (100.0)**

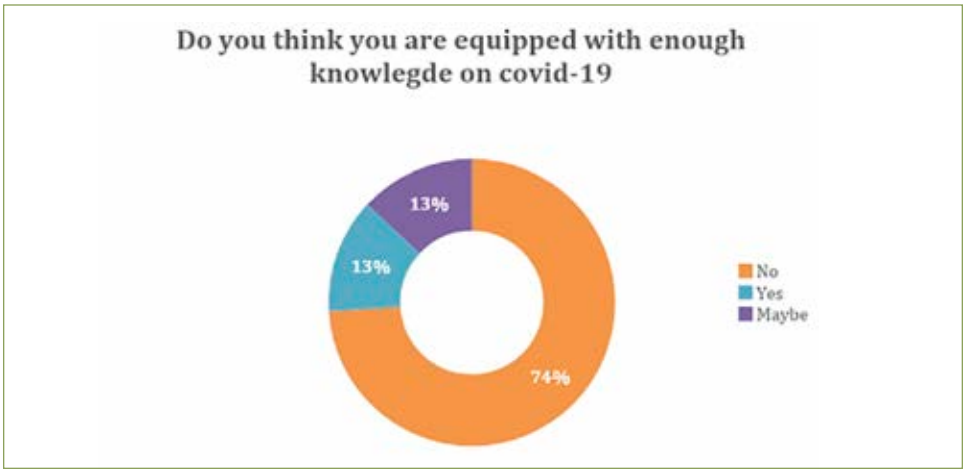

Figure 1. Knowledge of participants COVID 19.

13 (74%) of the participants thought they were not equipped with enough knowledge about COVID-19, while 13% (2) believe that they are equipped with knowledge, and 13% (2) are unsure of their level of knowledge concerning COVID 19.

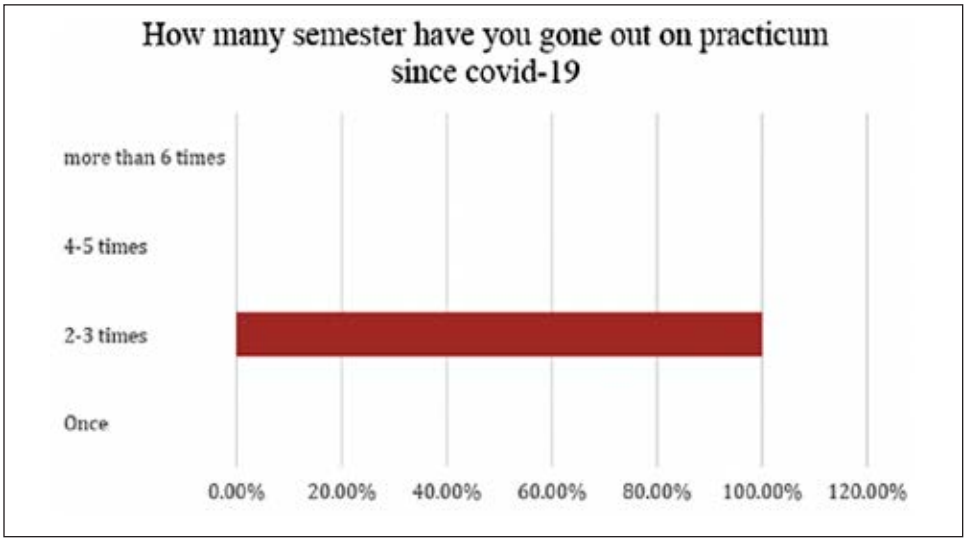

Figure 2. Number of semesters spent in the clinical area during the COVID-19

17 (100%) of participants indicated that during the COVID-19 pandemic they were assigned and interacted in the clinical space for two to three semesters.

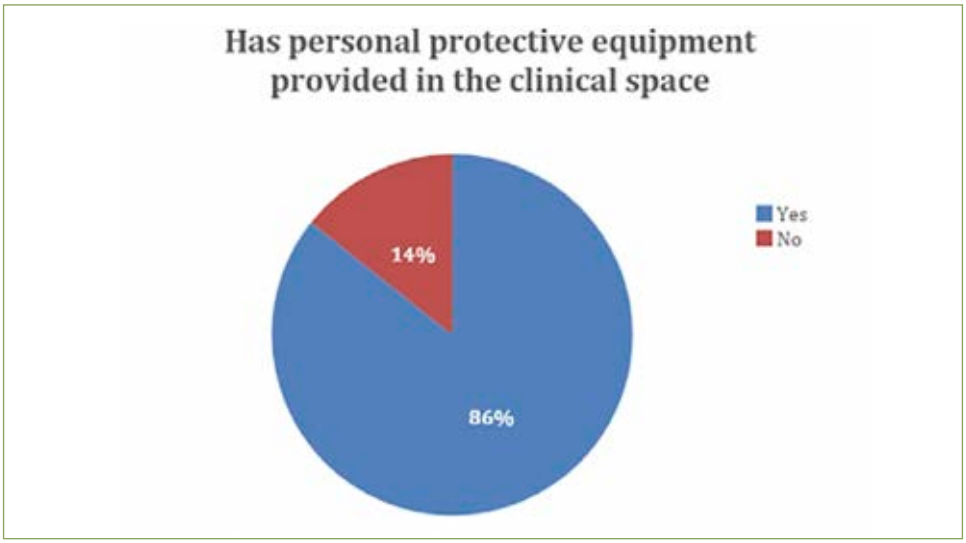

Figure 3. Provision of Personal Protective Equipment in the Clinical Space.

15 (88%) participants stated that at the health facilities assigned for clinical practicum, PPE was provided, while 2 (14%) stated that none was provided in the clinical space.

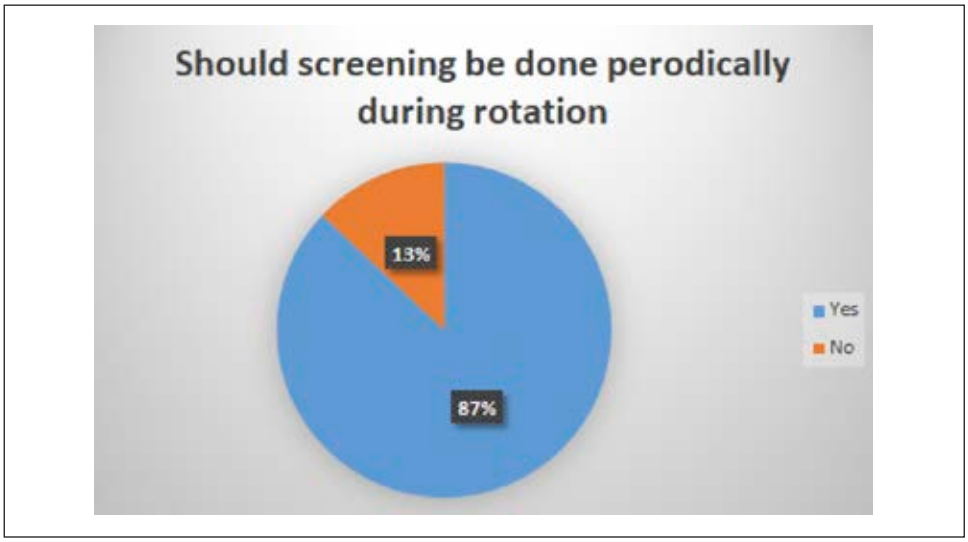

Figure 4. Should there be Periodic Screening for COVID -19 in the Clinical Space.

Screening is done to determine whether a person has or has had any signs and symptoms of COVID. 19.15 (87%) of the participants think that screening should be done periodically during the rotation, while 2 (13%) think that it should not be done periodically during rotation.

Figure 5. Was there training for students on use of Personal Protective Equipment?

13 (75%) participants stated that no training or guidance was given on utilizing the PPE when going into the clinical space, while 25% (4) state that training or guidance was given on using the PPE in the clinical space.

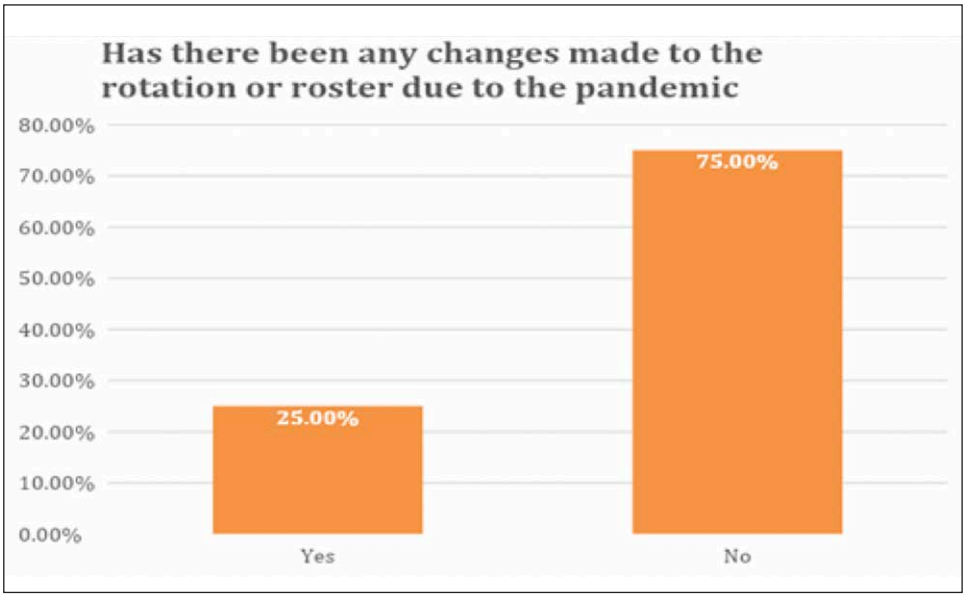

Figure 6. Changes made to the Rotation Roster due to the Pandemic.

13 (75%) participants stated that no changes have been made to the rotation based on COVID 19, while 4 (25%) state that some changes have been made to the rotation and roster during the pandemic due to requirements made by the government.

Qualitative

In order to find out how the fourth-year midwifery students felt about returning to the clinical space during COVID 19 in Jamaica, three structured questions were utilized, which eventually advanced to unstructured questions, allowing the participants to express themselves clearly. Based on the answers given by the participants, the researchers were able to identify three different themes for each question asked: a) Emotional and Physical well-being b) Importance of clinical rotation to future aspiration c) Duty to Country

Theme 1: Emotional and Physical well-being

All the participants felt that returning to the clinical space during COVID-19 would have a negative impact on their emotions and feared physical impact such as contracting the virus. However, most students understood the reason to return. Based on the responses from participants most felt surprised and scared as a response: "I was at first surprised." Other respondents said they felt either scared, anxious, or nervous. "I didn't want to go. "I was scared and nervous". "I did not feel prepared". "I didn't want to go although it would be a good experience to get clinical experience, but I was still scared of the outcome.". Other respondents, however, had mixed emotions. "I was in-different. I knew it would happen at some point, and that we needed to continue clinical practicum, this would be a learning experience", but I was prepared." "Honestly, I didn't want to, but I knew I had to, so at the end I had mixed feelings." Other respondents expressed no by the announcement but still did not want to go: "I felt that it wasn't a good idea given that the health department was already struggling with resources. I felt they could not handle students, hence why I didn't want to go. "I wasn't surprised; I did not want to be in the clinical space.".

Theme 2: Importance of clinical rotation to future aspiration

To achieve their aim of finishing their course of study, all participants agreed that work and clinical rotation were important. Five respondents feared risk of exposure: "I was apprehensive because of a lack of knowledge and uncertainty. I felt unprepared for this new change and feared exposure but knew I had to complete my clinical practice hours according to the curriculum.", "surprisingly, I was upset. I thought it was unfair for us to be out when we were students, and these conditions weren't favourable to us, especially when little was known about the virus and felt an alternative method to clinical hours completion was needed", "I

prayed that I wouldn't get infected and worse, that I didn't infect my family.", 'I wish we were tested periodically as the working in the clinical space during the COVID-19 had lots of unfamiliarity, "I take it day by day, because in the clinical space anything can happen, I try to prepare myself always for the worst." I fear the risk of exposure to myself and my family, but the more I continue, the easier the days became with the view of meeting my academic and professional goal.".

Unprepared for the experience "I felt upset because I didn't think enough was done for us the students to be sent out in a pandemic when we were still in the acute or beginning phase of it. In a country where resources were scarce"," my first thoughts were wow, this was quick. Then I wondered if I was mentally prepared to do this despite my desire to be a graduate midwife"

Theme 3: Duty to Country

All participants felt a need of duty to assist the country in the pandemic, but they were fearful of contracting the virus and spreading it to loved ones. When asked, can you describe the attitudes and approaches to work, of other people working with you at the time? Responses varied, but the researchers were able to identify that most students displayed a high sense of professionalism and carried out duties from observing other members of staff methods of implementation: "I have observed a new aseptic approach with patients. Doctors, nurses, and even janitors are a lot more vigilant with cleanliness." "Most are professional and adhere to the protocols of the hospital especially those carried out in pandemic training while others did what they want without compliance to the trained protocols." "Some professionals choose not to voice their opinion, but in observation of how they operated, their dedication and mode of offering care was inspiring."

When asked, tell me about your experience working in the clinical space during COVID 19?, students were eager to learn: "At first, I quickly realized this was a learning experience and I should learn to adapt to the changes." "Getting to see and partake in the care of patients during the pandemic was truly inspiring and has reaffirmed my decision in choosing midwifery as my profession." "Overall, what I keep reminding myself is that this is an unparalleled opportunity for me as a student midwife to assist Jamaica in a time of crisis and learn the principles of population health and emergency management."

Discussion

The study "Midwifery Students' Perception of Reintegration in the Clinical Area during COVID-19" was conducted at the Caribbean School of Nursing (CSON),

University of Technology, Jamaica (UTech, Jamaica), Papine campus, using a sample size of 17 students in the Bachelor of Science in Midwifery year 4. It consisted of full-time female students with ages ranging from 18 to 38 years old.

During the COVID-19 pandemic, new information was broadcast daily about the virus and the management protocols by the government and the World Health Organization (WHO). The majority of the students, 74%, felt that they were not equipped with enough knowledge on COVID-19 to be sent into the clinical space because it was a new outbreak. In addition, personal protective equipment (PPE), which includes a face mask and shield, gloves, long-sleeve gowns, and cover shoes that are used as barriers between the body and germs or viruses, is usually found in health care facilities. But during the COVID-19 pandemic, there were reports of shortage. 86% of the participants stated that the health facility that they went to for practicum provided PPE, while 14% stated that none was provided in the clinical space.

In addition, 75% of the participants stated that no guidance or training was given on utilizing the personal protective equipment in the clinical space, while 25% stated that a brief discussion was given. Although many may say that nothing has changed in the donning of the PPE in the prevention of spreading COVID 19. Secondly, due to protocol implemented by the government as pertaining to curfews, no changes were noted to the roster or rotation (DHS, UK, 2024).

From the open-ended questions asked, the researchers learned that the COVID-19 pandemic made students constantly aware of infection risks. The students demonstrated understanding for the reason why they had to return to the clinical areas but were still reluctant because of fear. During the rapidly evolving condition, clinical education was paused in many locations globally. Under these conditions, we found that overall, approximately one-third of students preferred not to return to the clinical education setting. Other students were simply shocked or surprised by the idea of student midwives returning to the clinical area. Students who preferred not to return to the clinical area appeared concerned about introducing possible risks to themselves, family, friends, and patients, as they were 'not trained' for pandemic management. The fear of going out in the clinical areas where there was a possibility that they might get infected and can pass on the virus to their loved ones increased stress, anxiety, and depression among respondents (Kecojevic, Basch, & Sullivan, 2020). However, the possible risk of exposure can be based on many factors, including, but not limited to, knowledge of the disease or consideration of personal underlying medical issues (Compton et al., 2020). Thus, it is unclear if students' personal risk assessment was based on an accurate understanding of COVID-19 or of their personal health. Students who vocalized

feeling happy to return to the clinical area felt it was a part of their professional responsibility and duty to help the members of society.

Students indicated that they were very conscious and aware regarding hand hygiene, the use of gloves, and the application of preventive measures, especially when students had to be in areas with possible COVID-19 positive patients. The daily responsibilities of healthcare staff during ordinary times are demanding, both mentally and physically. In the midst of the current and unprecedented public health crisis, it is natural for even the most resilient healthcare worker to become overextended by the sheer caseload of patients that require immediate attention for potentially life-threatening, communicable respiratory illness (Donning & Doffing, 2020). Students recognized the challenges in which the clinical placements operated and displayed a fair level of understanding for the changing roles of both the supervisor (nurses and doctors) and the preceptor.

Nevertheless, students indicated that it was difficult to find a place in the changing environment and the rapidly changing recommendations and rules. With a third of students having difficulty adjusting to this change, whether it be long periods in PPE or having to practice more frequently the global WHO protocols put in place. Others also voiced difficulty in the sense that they became overly sensitive to the symptoms of COVID-19 and sometimes came off as cold to patients. This may be consistent with the students' desire to be held to the high ethical standards of medical professionals and limit their personal exposure to infections. Understanding student responses under these conditions may identify a nuanced relationship between his or her perceptions of self-risk as a marker for severity of disease of patients and, by extension, the appropriateness of adding potential risk into the healthcare system, such as by having medical students return to a taxed clinical setting (University of Scranton, 2021). Additionally, students' goal orientation was examined, as 30% of students describe their placement during the pandemic as a driving mechanism for learning. The higher mastery goal orientation (overperformance or alienation) amongst the student population is consistent with that amongst other healthcare profession learners.

Study Limitations

Limitations of a study are unavoidable conditions that hinder or restrict the findings of the research. The following limitations arose in the study and are acknowledged by the researchers:

- The finding for this research cannot be generalized as the sample size is small, consisting of 17 students in one of four-year groups at the UTech, Ja.

- False information: Information given might not be true, especially information answered by the questionnaires and focus group interview.
- The structured items on the questionnaire might have limited the opinions of the respondents on the topic. However, the questionnaire was essential in gathering information that was relevant to the study conducted.

Conclusion

Going into the clinical space was a requirement of the Caribbean School of Nursing, UTech, Jamaica as guided by the Nursing Council of Jamaica blueprint for nursing and midwifery training. The clinical space rotation is used as a medium for all nursing and midwifery students to learn or refine skills taught. Nonetheless, going into the clinical space was an issue for the fourth- year midwifery students due to the fear of contracting COVID 19. 74% of participants for this study felt that they were not fully equipped with enough knowledge on COVID-19 to be sent out on practicum. The fear was driven by the thought of infecting their families and themselves, which made them anxious.

Personal protective equipment was provided, but this did not lessen the fear felt by the students and the need for mental support. In addition, no changes were made to the clinical rotation students were advised to work within the island-wide curfew time. While interaction among the staff, patient, and student had changed, most adhered to the COVID-19 protocol of wearing a mask and social distance. The positive aspect of going on practicum during the pandemic is that the student got the opportunity to learn hands-on how to operate during a pandemic or crisis.

Recommendations

In a pandemic or crisis, arrange for periodic screening for students on each rotation or shift. The suggested screening period should align with that which exists for health agency staff.

Where curfews are implemented by the country's government in a pandemic, to allow ease of accessing transportation for students to get to the clinical space for work and getting home safely, a school bus may be necessary.

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The Relationship Between Student Employment and Academic Performance:

A Case Study

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Abstract

Internationally, university students in the twenty-first century are working longer hours while studying. This can have implications for them completing their course of study within the time stipulated by the institution and the quality of the grades they attain. A few studies have investigated the relationship between long working hours and student academic performance in universities in developed countries, however, this is not the case in developing nations. This quantitative study that was done at a university in Jamaica, a developing country, investigated the relationship between the quality of the grades attained by students working in jobs related or unrelated to their course of study and the number of hours worked. Employment and academic data were collected on students enrolled in the module 'Advanced Programming'. The analysis of the dataset included descriptive statistics, correlation analyses, hypothesis testing, and visualization techniques. Key findings indicate that a significant number of employed students are working in jobs unrelated to their areas of study; there is a positive correlation between students working in jobs related to their course of study and passing the Advanced Programming module; hypothesis testing results reveal that the relationship between the number of hours worked and pass/fail is not statistically significant; correlation analysis indicates a positive but weak relationship between job relevance and Grade Point Average (GPA), and also a link between the age of the student and their GPA. The practical implication of this correlation warrants consideration in academic advising and career planning. This study sheds light on the complex relationship between

student employment and academic performance. The results also indicate that there was no significant impact of employment on module outcome. However, students and academic advisors may use these results to determine how they complete their course of study because employment affects the quality of grades and by extension overall GPA.

Keywords: Academic Performance, Grade Point Average (GPA), Student Employment, Jamaica

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Introduction

The challenges and changing dynamics facing university students worldwide have resulted in more students seeking employment while pursuing higher education. The impact of working while studying can have far reaching implications for students and employment (Sanchez-Gelabert, A., Figueroa, M., & Elias, M. 2017). Researcher Hovdhaugen, E. (2015) suggests that the likelihood of not completing tertiary studies is higher for students that have full-time jobs while studying.

According to the Planning Institute of Jamaica, students' success in their course of study is key to achieving our Vision 2030 goal of building the nations' economy (Planning Institute of Jamaica, 2009, p. 4). Education and training institutions, like The University of Technology, Jamaica (UTech, Ja), have the task to prepare individuals for effective engagement in the workforce, through training in skill areas like advanced computer programming.

Studies regarding how employment impacts student performance have been done by researchers in several developed countries, including Canada (Barber & Levitan, 2015), across Europe and North America (Smith, 2016; and Kocsis & Pusztai, 2021). However, there is a paucity of studies that investigate these issues from a developing country's context. Eighty-four percent (84 %) of the world's population lives in developing countries, yet they're underrepresented in literature (Amarante et al. 2022).

Studies conducted in the developed countries reveal that over the last decade, more students are employed than in previous decades, and students are working for longer periods of time (Kocsis & Pusztai, 2021; Logan et al., 2016; and Barber & Levitan, 2015). This could lead to students having less time for studying, which could potentially result in higher failure rates and eventually leading them to abandoning their course of study (Kocsis & Pusztai, 2021; Logan, et al., 2016; and

Barber & Levitan, 2015). Additionally, researchers suggest that another contributing factor to working students failing modules is the fact that many of them are employed in areas or jobs that are unrelated to their course of study (Simón et al., 2017).

As part of its efforts to achieve first world status by 2030, the Government of Jamaica has embarked on projects to develop programming skills among its younger population (OPM Communications, 2022; OPM Communications, 2022). The Advanced Programming students at UTech, Ja. who are generally between the ages of 17 to 30 years, are on the cusp of entering the national work force. Failure to develop the required competency due to the impact of being employed whilst studying would not auger well for either themselves or for the nation. When students fail modules, it not only puts additional financial strain on them, but can have far-reaching implications for the country's economic development. Students who fail to attain their college education could potentially not make as meaningful a contribution to the country's GDP as they would have been able to otherwise (Fernandez, 2015; & Yu, et al., 2010).

In this quantitative study we investigated the impact of work on the performance of full-time students in the School of Computing and Information Technology at a university in Jamaica. We investigated how employment impacts the academic performance of students enrolled in the Advanced Programming module at UTech, Jamaica.

Problem Statement

Advanced programming is one of the core modules and a crucial building block for students who are enrolled in the Bachelor of Science Course of study (BSc.) in Computing Programme within the School of Computing and Information Technology (SCIT). Since semester two of the 2019/2020 academic year over 30% of the students in at least one occurrence have failed the module. Anecdotal evidence reveals that each semester several of the students enrolled in the Advanced Programming module are employed, and the number seemed to have been increasing. Research suggests that there is correlation between students' employment and their academic performance.

The significance of the study

This study has both theoretical and practical significance. Theoretically, this study will add to the body of knowledge relating to the impact that employment has on the academic performance of students enrolled in tertiary institution in the context

of Jamaica as a developing country. The practical significance of this study is that it can support the development of a framework that could support administrators in the School of Computing and Information Technology in determining the modality, frequency and delivery methodologies. Also, academic advisors can use this information to help them when advising working students, especially those not working in areas related to their studies. Additionally, Programme Directors and Programme Leaders can use this information during their student information sessions.

Research Questions

The following research questions were formulated:

1. To what extent does the number of hours worked per week, impact students' academic performance (pass or fail) in the Advanced Programming module at UTech, Jamaica?

Sub-question 1: To what extent are students employed in areas related to their course of study?

2. To what extent is the module outcome (pass/fail) of employed students at UTech, Jamaica correlated to whether they are working in jobs related to their areas of study?
3. To what extent is the average GPA of students correlated to their age group?

Literature Review

In this section we will present a review of the relevant literature that reflects the state-of-the-art as it relates to the context of the study. Several studies have examined the impact of employment on the academic performance of students in developed countries. Many of those studies have found that there is an inverse or opposite relationship between employment and other student characteristics, and academic performance. However, some studies have suggested a positive relationship between employment and academic performance.

Studies in Higher Education Institutions

Studies in North America

Barber and Levitan (2015) investigated the impact of outside employment on Canadian journalism students' academic performance and emotional well-being.

Their survey revealed that 87% of students worked part-time, with 27% working 10–19 hours/week, 38% working 20–29 hours, and 30% working 30 hours or more. While 62% believed working negatively impacted academic performance, 25% viewed it as a positive experience.

Smith (2016) analyzed data from the 2010 US Census and found that 71% of undergraduates worked. He discovered that GPA was only negatively impacted when students worked over 20 hours/week. Students working 1-15 hours/week had a significantly higher GPA than those working 16 or more hours or not working at all.

Logan et al. (2016) examined the relationship between student employment and academic performance using data from a national survey of American college freshmen. They found that working over 20 hours/week negatively impacted GPA, while working on-campus had a positive effect.

Research in Central America

Rossi (2017) conducted a survey of 808 students in Chile to examine academic performance and its relationship with social variables, including employment status. No statistically significant relationship was found between academic performance and social variables.

Studies in Europe

Among the studies in Europe, Kocsis and Pusztai (2021) explored the effects of student employment in Hungary and neighboring countries. They found no effect on academic performance, but students doing study-related work were more likely to be academically productive.

Baert et al. (2018) assessed the primary orientation theory regarding the non-positive association between student employment and academic performance. They found a negative relationship between hours worked and academic performance only for students with a primary orientation toward work.

Neyt et al. (2019) suggested that student employment and education are substitutes; the researchers suggest that working reduces time for academic activities. They further posited that student employment seems to have a more adverse effect on educational decisions as it relates to continuing studies and enrolment in tertiary education than on educational performance, i.e., on test and exam scores.

At the University of Alicante, Spain, Simón et al. (2017) sought to analyze the effect of work on various measures of students' academic performance. They found

that many Spanish university students who work, often do so out of necessity, for long hours, in areas unrelated to the field of studies, and are more likely among the older students. They reported that working regularly does not appear to significantly impact academic performance.

Research in Australia

In metropolitan Sydney, Australia, Salamonson et al. (2012), surveyed 566 first year nursing students at baseline. They followed up at the end of the final year of their nursing program to examine how factors had influenced their academic performance. They found that the number of employed students increased from 70% in Year 1 to 84% in Year 3, and that the hours spent in paid work had a negative impact on their final year GPA.

Applegate and Daly (2006) surveyed students at the University of Canberra to test the effects of paid employment on the average grade obtained in second semester 2002. They found that paid employment had minimal effect on students' grades, with some instances of improved grades. However, working more than 22 hours per week tended to have a negative effect.

Research Gap

This review reveals that there is a paucity of study relating to this issue and its implication in the context of developing countries like Jamaica. The results of this study can help to fill this knowledge gap, as we investigated the impact of employment factors on the performance of students from a developing country's perspective in a university in Jamaica. The only paper found in the literature that looked at the age of employed students is that of Simón et al. (2017). Their work only suggested that in Spanish universities, older students are the ones who generally work. We examined the correlation between the students' age and their GPA. Our investigation in these areas can help to determine the extent of the need for learning and advisement intervention that guarantee successful learning outcomes for employed students.

Methodology

Research Design

A quantitative methodology was employed as it enables researchers to systematically investigate the relationship between variables through statistical

analysis (Bhandari, 2023). Quantitative methods are ideal when the investigation aims to monitor and evaluate a situation and for measuring and conducting impact analysis (Khandker et al. 2009). Quantitative studies usually begin with a wide area of professional or personal interest (Choy, 2014). It supports the redefinition of knowledge to support problem solving as it seeks to accurately measure an issue using experimental or non-experimental designs (Mohajan, 2020). This methodology was best suited for this study because the aim was to measure the impact that working long hours and studying would have on the student's overall grade. Quantitative data are used to establish correlations between selected variables and their outcome and facilitates the validation of previous results and allows the replication of previous analysis (Choy, 2014). Researchers can use varying explanations of the quantitative findings and compare them with earlier studies to unearth its wider significance (Choy, 2014). This study was centered around the gathering of data via a survey, and the statistical analysis of the data together with students' performance related data.

Population

The research population was 74 full-time students enrolled in the Advanced Programming module in the School of Computing and Information Technology, at the University of Technology, Jamaica.

Sampling Technique

A non-probability convenience sampling technique was used in this study, targeting all 74 students enrolled in the Advanced Programming module. This approach was chosen due to the lack of random participant selection (Stratton, 2021). All students in the module were invited to participate, with no exclusion criteria applied. The response rate was 95%.

Data Management

Data Collection

Data for this study was collected in two phases. In the first phase data was collected using a questionnaire comprising 19 questions. The questionnaire was created using Google Forms, which allowed the data which were collected as responses, to be automatically loaded into a Google Sheets Spreadsheet. The questionnaires were distributed electronically to each student in the Advanced Programming

module. The second phase of data collection was done at the end of the semester after the Advanced Programming students' module results had been calculated. It entailed extracting their module result, whether they passed the module or not, and their ID number from the school's module results repository. The ID number was used solely for matching the overall module result to the respondents' feedback to the questionnaire, which was done using a Spreadsheet formula to guarantee privacy. Once the formula was executed and the respondents' responses were paired with their module result, and before any analysis of the data was done, the identifying piece of personal data, i.e., the students' ID numbers, was deleted. This approach eliminated the need to go back to the students at the semester's end to ask for their module result, as the researchers already had access to that data.

Data Pre-processing

The steps followed by the researchers in retrieving and compiling the data and preparing the data for analysis were as follows. The researchers:

1. downloaded the Module results for all the Advanced Programming students from the schools ISAS platform and stored it in a Spreadsheet named AP Module Results 2022/23 Sem-2 ALL.
2. removed the year value from the students ID number.
3. downloaded the Google Sheets Spreadsheet containing the students' responses to the questionnaire.
4. renamed the downloaded Workbook to PDE Dataset (CIT3009-AY2022–23 Sem-2).
5. created a copy of the renamed Workbook.
6. inserted three columns Result, Grade, GPA.
7. created a new spreadsheet in the workbook and named it Results.
8. copied the data from the Student Code, Result, Grade, and GPA columns of the AP Module Results 2022/23 Sem-2 ALL Spreadsheet, to the Results Spreadsheet of the PDE Dataset (CIT3009-AY2022-23 Sem-2) Workbook.
9. used the following XLOOKUP formula in the inserted Result column to map the students Results, Grade, and GPA to their respective columns using their Student ID as the search/lookup value. =XLOOKUP(S2,Results!$A:$A,Results!$B:$D,missing,0,1)
10. transferred the dataset, minus the XLOOKUP formula, to another Workbook:
    a. Selected all the data in the Dataset spreadsheet, including column headings, using Ctrl + A.
    b. Copied the selected data using Ctrl + C.

c. Opened a new Workbook. Saved and named it.
d. Selected the first cell (A1) in the new empty Spreadsheet (Sheet1 by default).
e. Used Ctrl + Shift + V to paste only the copied values into the spreadsheet.

11. verified that the data transfer was successful by doing the following:
    a. selecting a cell that had a value P in the Result column. In the formula bar, only the value was seen.

    If the formula bar had contained the formula:
    a. Ctrl + Z or Undo was used to remove the pasted data and then use Ctrl + Shift + V to paste the values only. (The data was then saved in the spreadsheet).
12. Once the data transfer was successfully verified, the researcher deleted both the PDE Dataset (CIT3009-AY2022–23 Sem-2) and the Questionnaire Responses Worksheets.
13. The researcher then deleted the Student ID column, which contained the only piece of data that could have been used to link a response to a student. Data Coding

In this mainly quantitative study, coding of the data was done by the researchers. The column headings which represent variables were replaced with shorter labels, and the categorical data in the records were replaced with numerical values. Table B1 gives a list of the questions from the questionnaire, that became variables and their coded labels (See Appendix B). The last three items in the table are not questions from the questionnaire. They are column names taken from the calculated module results at the end of the semester and added to the dataset in phase two of the data collection process.

Data Analysis

This study involved Primary data analysis, which was carried out on data collected via a Google Form and stored in a Google Sheets document. The researchers evaluated employment related variables and their impact on the students' academic performance, primarily whether they passed the module, and their GPA. The data relating to students who did not pass the module were also examined to see whether there were identifiable factors that influenced their outcome. The data collected was analysed using the Python programming language's data analytics modules and libraries, which also facilitated the data being visualized.

Ethical Considerations

Ethical considerations in carrying out this research included: concerns about privacy, security, and transparency (Whitlock, 2018). The researchers endeavored to maintain privacy and security by observing best practices in how the data was collected, stored, and used. The researchers were also open with the prospective participants about the study's nature and how their data would be used.

Assumptions. It was assumed that the responses given by students were truthful and accurate.

Results

Descriptive analysis

The total number of participants in this study was 70 students. That number comprised 23 females and 47 males. Of the 70 students, 33 (approximately 47%) were employed and 37 students (approximately 53%) were unemployed. Of the unemployed Advanced Programming students at UTech, Jamaica, 27% were unemployed either because they tried finding employment but were unsuccessful in finding a job, or they were discouraged from seeking employment by their parents or spouse. The other 73% reported that they chose not to seek employment because they thought it would interfere with their studies. Two subsets of the dataset are shown below. In Figure 1: Coded dataset of employed students, and Figure 2: Sample of Coded dataset of unemployed students.

Research Question 1:

In answering research question 1: To what extent does the number of hours worked per week, impact students' academic performance (pass or fail) in the Advanced Programming module at UTech, Jamaica?, the analysis aimed to determine whether a significant relationship exists between the HOURS independent variable and the PASS_FAIL dependent variable. We first calculated the summary statistics for the HOURS variable.

Mean Hours Worked per Week: 4.969697

Median Hours Worked per Week: 6

Standard Deviation of Hours Worked per Week: 2.098881

The statistics showed that among the employed students, the average number of hours worked per week was approximately 4.97, with a median of 6 and a

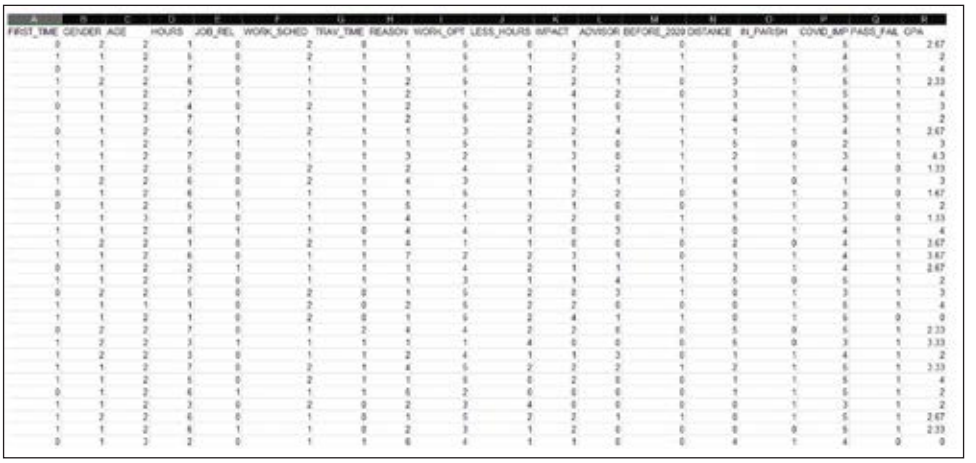

Figure 1: Coded Dataset of Employed Students

Figure 1 shows the dataset containing records relating to the employed participants.

A	B	C	D	E	F	G
FIRST_TIME	GENDER	AGE	WHY_NOT	ADVISOR	RESULT	GPA
1	2	1	1	0	1	3
1	1	2	2	1	1	4
1	2	2	2	2	1	3.67
0	2	2	1	1	0	1.33
1	1	1	1	1	1	4
1	1	2	1	2	1	2.33
1	1	2	1	1	0	0.86
1	1	2	1	0	1	3.67
1	1	2	1	1	1	2.33
0	2	1	1	4	1	3.67
0	1	2	1	0	1	3.33
1	1	2	2	0	1	2.67
1	1	2	1	1	1	4
1	2	2	1	0	0	0.86

Figure 2 : Sample of Coded Dataset of Unemployed Students

Figure 2 shows a part of the dataset relating to students who were not employed.

standard deviation of 2.099. Next the Correlation Coefficient of the two variables was calculated to quantify the extent of the correlation between HOURS and PASS_FAIL among employed students.

The Correlation Coefficient (Pearson) was calculated to be 0.1573692. This coefficient being close to zero indicates that there is a positive but weak linear

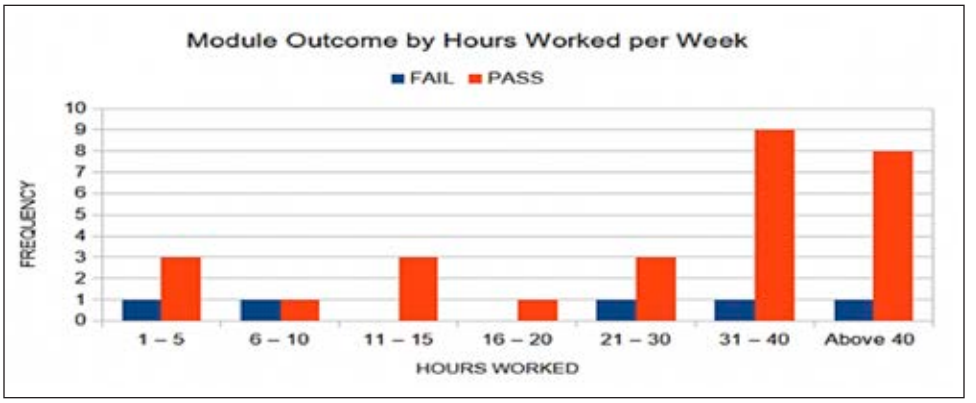

Figure 3: Module Outcome by Hours Worked Per Week

relationship between the two variables. The relationship was visualized using a bar chart as shown in Figure 3: Module Outcome by Hours Worked per Week.

From both the correlation coefficient and the bar chart we gathered that as HOURS increases, PASS_FAIL is more likely to be positive (pass) rather than negative (fail). While there is a statistically significant correlation, it's not strong enough to make meaningful predictions or draw strong conclusions.

Sub-Question 1:

To what extent are students working in areas of employment related to their course of study? To answer this question, we focused on the independent variable JOB_REL, which indicates whether a student's job is related to their area of study. The following method was used in the analysis:

- The proportion of students with related jobs was calculated by dividing the number of students with related jobs by the total number of employed students.

The analysis revealed the following results:

- Total number of employed students: 33
- Number of students with related jobs: 9
- Proportion of students with related jobs: 27.27%.

A bar chart was used to visualize the data representing the number of students in the two categories, i.e., students with jobs related to their area of study, and students with jobs unrelated to their area of study. This can be seen in Figure 4: Frequency of sample by job relation to course of study.

The calculated proportion of students with related jobs indicates the extent to which employed students in the dataset are working in jobs aligned with their

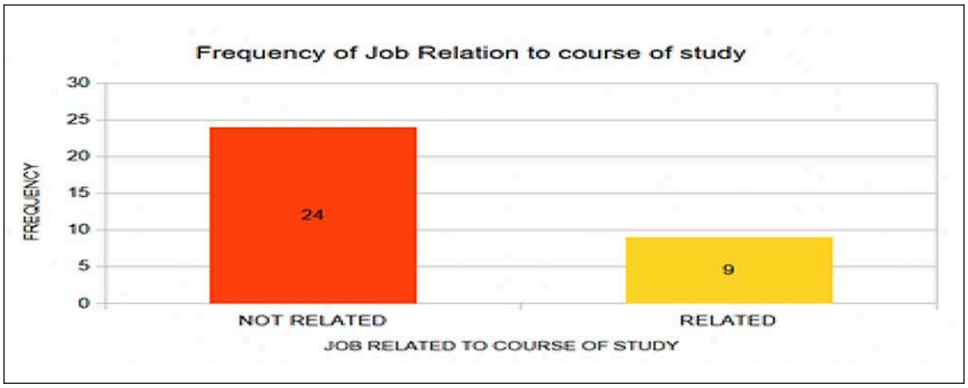

Figure 4: Frequency of Samples by Job Relation to Course of Study

area of study. The observed proportion of students with related jobs suggests that 27.27% of the employed students in the dataset are working in jobs that are related to their field of study. This suggests that most students who are working (72.73%) are not engaged in areas that are related to their area of study.

Figure 5 visualizes the distribution of the two categories of employed students, i.e., those whose jobs are related to their course of study, and those whose jobs are not related to their course of study. The categories are presented as percentages.

Research Question 2:

To what extent is the module outcome (pass/fail) of employed students at UTech, Jamaica correlated to whether they are working in jobs related to their areas of study?

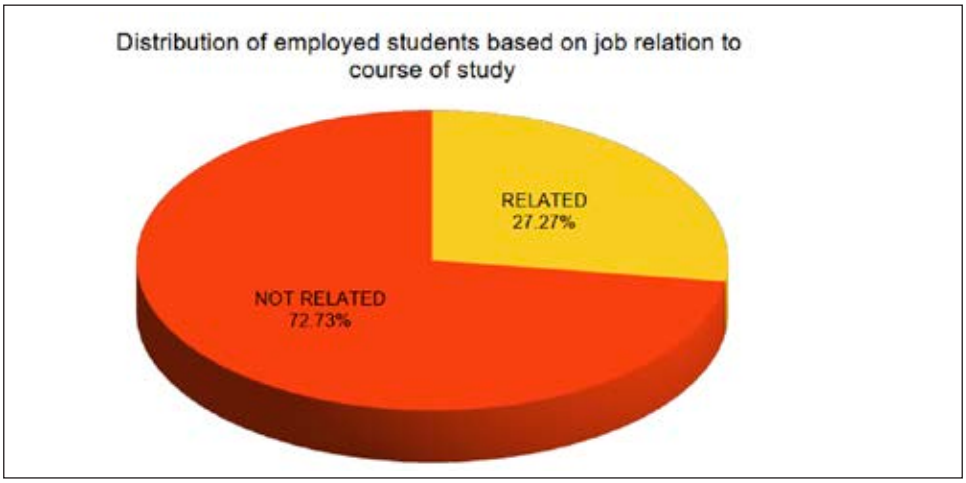

Figure 5: Distribution of sample based on job relation to course of study

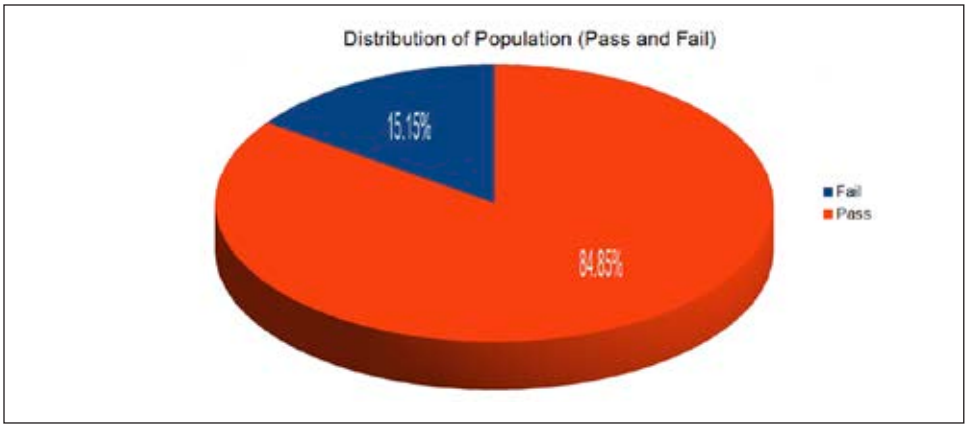

Figure 6: Distribution of Population (Pass and Fail)

In addressing research question 2 the analysis aimed to determine whether a significant relationship exists between the JOB_REL independent variable (indicating job relation to course of study) and the PASS_FAIL dependent variable (indicating module pass or fail). In analysing the data, it was visualized using a Pie Graph, as shown in Figure 6: Distribution of Population (Pass and Fail).

The pie graph in Figure 6 shows that of the employed students participating in the research, approximately 15% failed the Advanced Programming module, while approximately 85% passed the module. The researcher then visualized each slice of the Pie chart to gain better insight into the breakdown of the data. The slice representing students who had passed the module (85%), was visualized using a bar chart (see Figure 7: Distribution of Passes by Job Relation to Course of Study).

Figure 7 illustrates that most students who were employed and had passed the module were not working in jobs related to their area of study. However, further

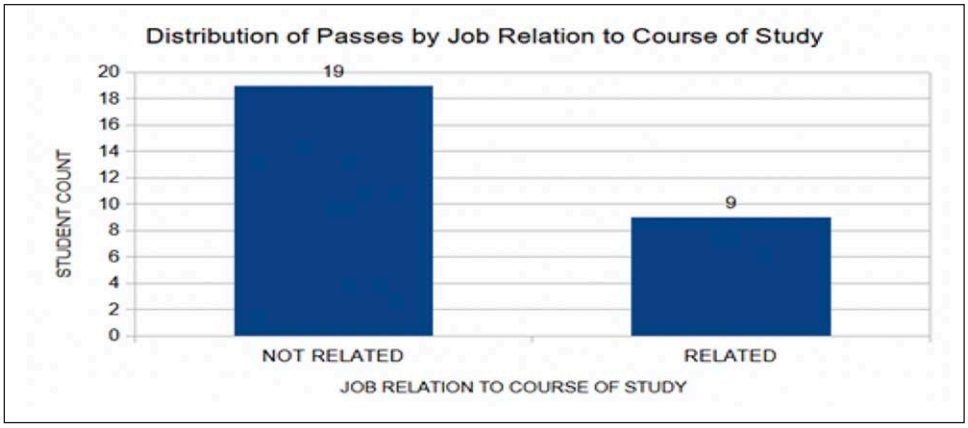

Figure 7: Distribution of Passes by Job Relation to Course of Study

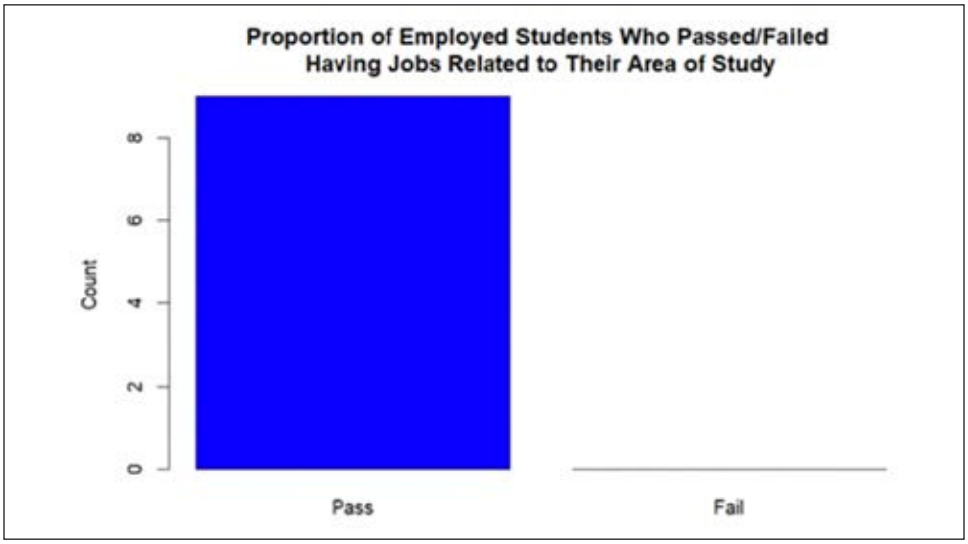

Figure 8: Proportion of Employed Students Who Passed/Failed Having Jobs Related to Their Area of Study

analysis revealed that among the students who were working in jobs related to their areas of study the pass rate was 100% (see Figure 8: Proportion of Employed Students Who Passed/Failed Having Jobs Related to Their Area of Study).

Conversely, among the working students who had failed the module, 100% of them were employed in jobs not related to their areas of study. This is visualized in Figure 9: Job Relation to Course of Study for Students who Failed.

Figure 9 shows that there were five employed students who failed the module. Those students account for approximately 15% of the employed student population, and 100% of students who failed. They were all employed in jobs not related to their course of study.

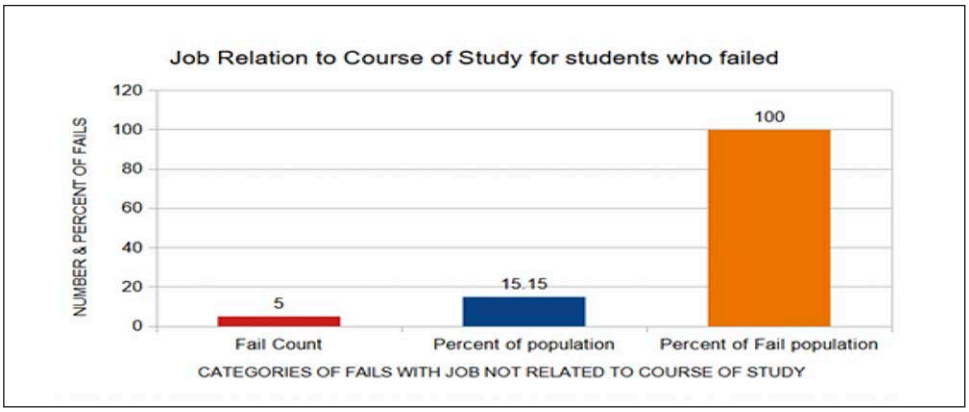

Figure 9: Job Relation to Course of Study for Students who Failed.

Other unaccounted variables or confounding factors could influence the observed relationship between JOB_REL and PASS_FAIL outcomes but are not accounted for in this analysis.

Research Question 3:

To what extent is the average GPA of students correlated to their age group?

In answering the third research question, the analysis aimed to investigate the correlation that exists between the dependent variable GPA, and the independent variable AGE. In performing the analysis, the researcher conducted a linear regression analysis, and visualization of the relationship using a line graph. The result of the linear regression analysis, which seeks to determine whether AGE has a statistically significant impact on GPA, are shown in Table 2 below:

Table 2: Linear Regression Analysis Result

Coefficients:				
	Estimate	**Std. Error**	**t value**	**Pr (>|t|)**
(Intercept)	5.50103	0.20966	26.24	0.0243 *
AGE	-1.44500	0.09705	-14.89	0.0427 *
Sig. Codes: 0 *** 0.001 ** 0.01 * 0.05 . 0.1 1				
Residual standard error: 0.1373 on 1 degrees of freedom Multiple R-squared: 0.9955, Adjusted R-squared: 0.991 F-statistic: 221.7 on 1 and 1 DF, p-value: 0.04269				

In Table 2, the intercept of 5.50103 indicates that when AGE is zero, GPA is 5.501. However, this interpretation may not be meaningful as age cannot be zero. The coefficient for AGE is -1.44500, indicating that for every one-unit increase in AGE, GPA is expected to decrease 1.44500 units. This coefficient is statistically significant with a p-value of 0.0427*, suggesting that AGE is a significant predictor of GPA. The regression model provides a good fit to the data with an Adjusted R-squared value of 0.991. This means that approximately 99.1% of the variation in GPA can be explained by AGE in this specific dataset. The F-statistic (221.7) is highly significant (p-value: 0.04269*), indicating that AGE has a significant impact on GPA.

The negative coefficient for AGE suggests that, on average, older students tend to have slightly lower GPAs compared to younger students. The large effect size suggests that there is a strong relationship between AGE and GPA.

The following findings were also observed:

- The students' ages in the dataset fell into three age groups: 17–20, 21–30, and 31–40.
- The average GPA for each age group represented by the AGE variable was calculated and found to be:
  - 17–20 years: 4
  - 21–30 years: 2.72
  - 31–40 years: 1.1

A bar chart was created to visualize the average GPA for each age group (see Figure 10: Average GPA of Students by Age Group). The plot shows that the average GPA of students falls significantly as age increase.

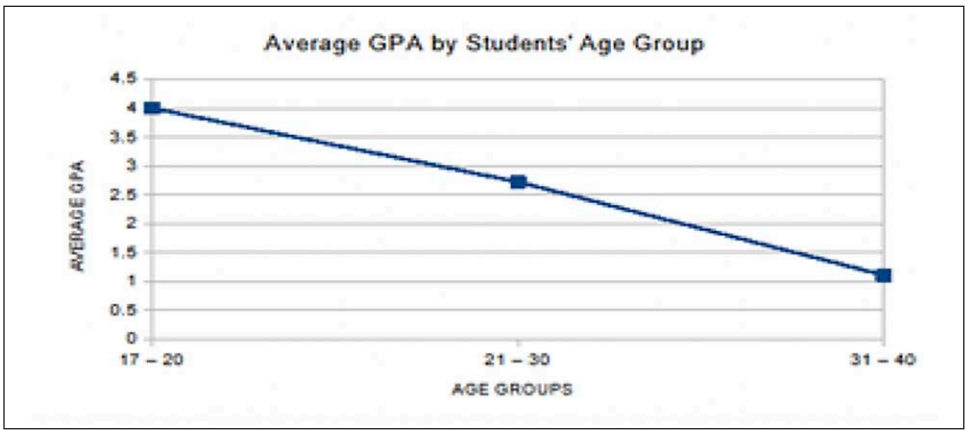

Figure 10. Average GPA of *Students* by Age Group

Summary, Discussion, Conclusions, and Future Study

Summary

This study sought to answer questions that would give insights into the impact that being employed may have on the academic performance of students enrolled in the Advanced Programming module of the BSc. in Computing, offered by the School of Computing and Information Technology, at the University of Technology, Jamaica.

There are several employment related factors affecting students' academic performance and many studies have been conducted in several regions around the world to gain better understanding of the issues. However, research findings

show that there is still much to be understood. The objectives of this study were to:

- Add to the body of knowledge relating to the impact that various factors of employment have on students' academic performance, in the context of Jamaica as a developing country.
- Support development of a framework that could assist the school's administrators in optimizing the modality, frequency, and delivery methods to enhance the academic performance of students who balance work and studies.
- Provide information that academic advisors can use to assist their advisees, and Programme Directors can use in their student information sessions.

Discussion

The employment rate of 47% among Advanced Programming students at UTech, Jamaica, is lower than the employment rates reported in the literature. Barber and Levitan (2015) found an 87% employment rate in a Canadian University; and Smith (2016) reported a 71% employment rate among US college undergraduate students. The relatively low employment rate among the UTech, Jamaica Advanced Programming students may be impacted by other variables, such as employment opportunity, that are not accounted for in this study.

The findings of this study align with previous research suggesting that working hours have a minimal impact on academic performance (Smith, 2016). The findings suggest a weak positive correlation between the number of hours worked and academic performance, indicating that students who work more hours tend to perform slightly better in the Advanced Programming module. However, the correlation was not strong enough to make meaningful predictions. This suggests that other factors play a more significant role in determining academic success.

The results show that only 27.27% of employed students work in jobs related to their field of study. This suggests a disconnect between the skills and knowledge gained in the academic program and the practical applications in the workplace. This finding has implications for the university's career services and industry partnerships, highlighting the need to improve employment rates in relevant fields. This is in alignment with the findings and suggestions of Salamonson et al. (2012). By addressing these issues, the university can improve student outcomes, enhance employability, and foster a more supportive learning environment.

The results show a significant negative correlation between age and GPA, indicating that older students tend to perform poorly in the Advanced Programming module. While correlation is not always attributed to causation, in this case the finding is noteworthy. Additionally, the regression analysis revealed

that age is a significant predictor of GPA, explaining approximately 99% of the variance in GPA. The significant impact of age on academic performance suggests that targeted support services, such as academic advising and mentoring programs, may be necessary to support older students in achieving their academic goals.

Conclusions

RQ 1: To what extent does the number of hours worked per week impact whether the students pass or fail the Advanced Programming module at UTech, Jamaica?

There is a weak but positive linear relationship between the number of hours a student works and whether they pass or fail the module. However, the strength of the relationship does not allow for its use in drawing a meaningful conclusion.

Sub-question 1: To what extent are students employed in areas related to their course of study?

The results suggest that most of the employed students are not working in jobs related to their area of study. That has implications for the extent to which students can improve their skills via applying their academic knowledge in their employment capacity. This suggests that job relevance to their course of study should be a key consideration by students seeking employment, who want to strengthen their academic performance.

RQ 2: To what extent is the module outcome (pass/fail) of employed students at UTech, Jamaica correlated to whether they are working in jobs related to their areas of study?

In relation to Research Question 2, it was found that students passing the module is impacted by their job function's relationship with their area of study. From our findings in which the data showed that of the employed students who failed the module, all of them were working in jobs not related to their area of study, it appears that there is a correlation between the work students who are employed are engaged in, and whether they pass the module or not. This is strengthened by the findings that of the employed students who passed the module, they were all employed in jobs related to their area of study.

RQ 3: To what extent is the average GPA of students correlated to their age group?

The more students' age increases the lower their GPA is likely to be. Students between the ages of 17 years and 20 years are expected to have the highest GPA; from age 21 years to 30 years, a sharp decline in GPA is anticipated, and steadily decrease as students exceed age 30 years.

Future Study

While this study provides valuable insights into the relationship between student employment and academic performance, there are several avenues for future research that can expand upon and complement our findings. The following areas represent promising directions for further investigation:

1. Longitudinal studies to track the academic performance and employment choices of students over an extended period. This could help determine the long-term effects of employment on academic performance.
2. A study that investigates how work-related factors such as stress can impact the performance of students who are enrolled in tertiary institutions and are not working in fields related to their course of study.
3. Research on the effectiveness of interventions and policies aimed at improving the academic performance of employed students can have significant practical implications.
4. Comparing the academic performance of employed students across different faculties, or institutions can reveal variations in the relationship between employment and academics.
5. Investigating these gaps and how they can be addressed could unearth additional findings. This could provide for better understanding of the complex interplay between student employment and academic performance and contribute to the development of strategies and policies that support student success.

Appendix A: Images Capturing Samples of The Cleaned Dataset

A	B	C	D	E	F	G	H	I	J	K
Is this your f	What is you	What was ye	What grade	Are you emp	How many h	Is your job r	Which of the	On average	Which of the	Given an opt
Yes	Female	17 - 20 years	A	No						
No	Female	21 - 30 years	C	Yes	1 - 5 hours	No	Rotational Shift	I work online	To pay school f	5
Yes	Male	21 - 30 years	A	No						
Yes	Male	21 - 30 years	B	Yes	21 - 30 hours	No	Rotational Shift	1 - 2 hours	To pay school f	5
Yes	Female	21 - 30 years	B	No						
No	Male	21 - 30 years	B	Yes	Above 40 hours	No	Regular 9 - 5	1 - 2 hours	To pay school f	5
Yes	Female	21 - 30 years	C	Yes	31 - 40 hours	No	Regular 9 - 5	1 - 2 hours	To take care of	5
Yes	Male	21 - 30 years	A	Yes	Above 40 hours	Yes	Regular 9 - 5	1 - 2 hours	To take care of	1
No	Male	21 - 30 years	B	Yes	16 - 20 hours	No	Rotational Shift	1 - 2 hours	To take care of	5
No	Female	21 - 30 years	B	No						
Yes	Male	31 - 40 years	B	Yes	Above 40 hours	Yes	Regular 9 - 5	1 - 2 hours	To take care of	5
No	Male	21 - 30 years	B	Yes	31 - 40 hours	No	Rotational Shift	1 - 2 hours	To pay school f	3
Yes	Male	17 - 20 years	A	No						
Yes	Male	21 - 30 years	B	Yes	Above 40 hours	Yes	Regular 9 - 5	1 - 2 hours	To pay school f	5
Yes	Male	21 - 30 years	A	Yes	Above 40 hours	No	Regular 9 - 5	1 - 2 hours	To take care of	2
No	Male	21 - 30 years	A	Yes	21 - 30 hours	No	Rotational Shift	1 - 2 hours	To take care of	4
Yes	Female	21 - 30 years	A	Yes	31 - 40 hours	No	Rotational Shift	1 - 2 hours	To take care of	3

Figure A1: Sample of the Cleaned Dataset (A–K)

The above figure shows a section of the cleaned dataset, between column A and column K in the Google Sheets Spreadsheet. While Figure A2 below shows a sample of the cleaned dataset, between column L and column V.

L	M	N	O	P	Q	R	S	T	U	V
Given an opt	I believe wo	Why are yo	How long ag	Were you e	How far fron	Do you live	On a scale	Result	Grade	GPA
		I choose to not	Never					P	B	3
Neutral	Agree		Never	No	I work online	Yes	5	P	B-	2.67
		I could not find	1 - 6 months					P	A	4
Agree	Strongly Agree		13 - 24 months	Yes	20 or more Km	Yes	4	P	C	2
		I could not find	7 - 12 months					P	A-	3.67
Agree	Strongly Agree		7 - 12 months	Yes	6 - 10 Km	No	5	P	A	4
Strongly Agree	Strongly Agree		1 - 6 months	No	11 - 15 Km	Yes	5	P	C+	2.33
Strongly Disag	Strongly Disagree		7 - 12 months	No	11 - 15 Km	Yes	5	P	A	4
Strongly Agree	Agree		Never	Yes	1 - 5 Km	Yes	5	P	B	3
		I choose to not	1 - 6 months					F	D	1.33
Strongly Agree	Agree		1 - 6 months	Yes	16 - 20 Km	Yes	3	P	C	2
Strongly Agree	Strongly Agree		25 - 36 months	Yes	1 - 5 Km	Yes	4	P	B-	2.67
		I choose to not	1 - 6 months					P	A	4
Strongly Agree	Agree		Never	Yes	20 or more Km	No	2	P	B	3
Agree	Disagree		Never	Yes	6 - 10 Km	Yes	3	P	A+	4.3
Strongly Agree	Agree		7 - 12 months	Yes	1 - 5 Km	Yes	4	F	D	1.33
Agree	Agree		1 - 6 months	Yes	16 - 20 Km	No	1	P	B	3

Figure A2: Sample of the Cleaned Dataset (L–V)

Appendix B: List of Questions and their Coded labels, Values and Coded values

Table B1: List of Variables and their Coded labels

Coded Labels	Questions from Questionnaire	Values	Coded Values
FIRST _ TIME	Is this your first time doing the CIT3009 module?	Yes No	1 0
GENDER	What is your gender?	Male Female	1 2
AGE	What was your age at your last birthday?	17–20 Years 21–30 Years 31–40 Years 41–50 Years	1 2 3 4
EXP _ GRADE	What grade are you expecting to achieve for CIT3009 at the end of the semester?	A B C D	1 2 3 4
EMP _ STAT	Are you employed?	Yes No	1 0
HOURS	How many hours do you work per week?	1–5 hours 6–10 hours 11–15 hours 16–20 hours 21–30 hours 31–40 hours Above 40 hours	1 2 3 4 5 6 7
JOB _ REL	Is your job related to your area of specialization within you course of study?	Yes No	1 0
WORK _ SCHED	Which of the following best describe your work schedule?	Regular 9–5 Rotational Shift Nights	1 2 3
TRAV _ TIME	On average how long does it take you to commute to work?	I work online. 1 – 2 hours More than 2 hours	0 1 2
WORK _ REASON	Which of the following best describe your MAIN reason for working?	• To pay school tuition fees • To take care of my other expenses • To take care of my family • To gain work experience • To repay a loan • Internship opportunity • To improve social skills	1 2 3 4 5 6 7

WORK _ OPT	Given an option I would not work while studying	Strongly Agree Agree Neutral Disagree Strongly Disagree	1 2 3 4 5
LESS _ HOURS	Given an option I would work fewer hours	Strongly Agree Agree Neutral Disagree Strongly Disagree	2 1 0 3 4
WORK _ IMPACT	I believe working while studying will make it harder for me to pass the CIT3009 module	Strongly Agree Agree Neutral Disagree Strongly Disagree	2 1 0 3 4
WHY _ NOT	Why are you not employed?	• I choose to not work because I think it will interfere with my studies. • I could not find a job. • I wanted to work but my parents/spouse were against it. • I did not try to find a job	1 2 3 4
ADVISOR	How long ago were you last in contact with your academic advisor?	1 – 6 months 7 - 12 months 13 - 24 months 25 - 36 months Never	1 2 3 4 0
BEFORE _ 2020	Were you employed before March 2020?	Yes No	1 0
DISTANCE	How far from your place of dwelling is your place of work?	1 – 5 km 6 - 10 Km 11 - 15 Km 16 - 20 Km 20 or more Km I work online	1 2 3 4 5 0
IN _ PARISH	Do you live and work in the same parish?	Yes No	1 0
COVID _ IMP	On a scale of 1 to 5, 1 being the lowest and 5 being the highest: How has the Covid-19 Pandemic influenced your decision to work?	scale	1 2 3 4 5
PASS _ FAIL	Result	Pass Fail	1 0
GPA	GPA		

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"Double Whammy?":

Unravelling Academic Writing Challenges Students Face in Remote Teaching and Learning

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Abstract

The novel Coronavirus (COVID-19) posed significant challenges for educational institutions worldwide as they were forced into a sudden transition from the traditional face-to-face learning environment to emergency remote teaching and learning. Although this new mode offered unprecedented opportunities for higher educational institutions, there were many challenges, especially due to the suddenness of its implementation. Furthermore, in addition to the well-documented challenges present in a typical college writing classroom, students were now forced to enter this unfamiliar territory. A descriptive quantitative design and some qualitative insights were used to investigate the challenges students faced during remote learning in their academic writing modules. The investigation captured results from two studies, each representing one of the academic writing modules. The academic writing modules were offered online from March 2020 when all educational institutions were mandated by the Jamaican government to suspend face-to-face learning. In the larger studies from which this paper is drawn, two separate surveys were fielded to understand students' experiences during the pandemic in their academic writing modules. Results indicated that the main problem students faced was technical challenges ranging from national shortfalls to personal difficulties. Additionally, mental health challenges and the disruption of social relationships were among the other major challenges students navigated during this period. However, for one writing module, many students indicated that they faced no challenge. It was concluded that the students were especially pressured as the pandemic introduced new difficulties to

an already demanding environment, however, they found healthy ways to cope. The university should swiftly address technical issues, enhance mental health support, improve campus internet facilities, offer more financial aid, upskill staff and students, and refine online learning models going forward.

Keywords: Academic Writing, Remote Teaching and Learning, University of Technology, Jamaica, COVID-19 Pandemic

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Introduction

March 12, 2020, marked a significant day for the Jamaican education system, as all educational institutions were forced to close due to the novel coronavirus. This sudden shift has presented a unique set of challenges, particularly for students enrolled in academic writing courses. These courses, which are often centered around hands-on, collaborative, and interactive learning experiences, have had to adapt to the constraints of the virtual classroom, leading to a range of difficulties for students (Hewett & Bourelle, 2017; Staples & Stein, 2022). Students had to grapple with a double whammy of the existing challenges of academic writing and entering new and unfamiliar territory of the remote learning environment. One of the primary challenges students face in remote academic writing courses has been the lack of in-person interaction and feedback. The absence of face-to-face discussions, peer reviews, and one-on-one consultations with instructors has made it significantly more challenging for students to receive the personalized guidance and support that is crucial for developing strong writing skills (Anson, 2015; Mackiewicz & Thompson, 2018). Additionally, the emotional and psychological toll of the pandemic, including increased stress, anxiety, and social isolation, has had a significant impact on students' overall well-being and their ability to focus on their academic pursuits (Besser et al., 2020; Gonzalez et al., 2020).

This study aimed to examine the specific challenges students faced in remote academic writing classrooms. This paper is drawn from two wider research studies and utilized two surveys that were fielded to students during the pandemic at the University of Technology, Jamaica (UTech, Ja.). The significance of this study is to inform the development of more holistic and effective remote and hybrid learning models for academic writing education, ultimately enhancing student learning outcomes and fostering a more inclusive and accessible educational landscape.

Literature Review

Emergency Remote Learning

Online learning refers to instruction provided through a digital device designed to facilitate learning (Clark & Mayer, 2023). However, online learning is categorized into various other formats, including synchronous and asynchronous, hybrid, blended, and emergency remote learning (Garrison & Vaughan et al., 2018; Hodges et al., 2020; Simonson et al., 2019). At the beginning of the pandemic, the university integrated emergency online remote learning to meet students' needs. Emergency remote learning denotes a swift transition from traditional in-person instruction to online delivery in response to unforeseen events like natural disasters or global health crises (Hodges et al., 2020). It is distinguished from planned online education by underscoring its impromptu and temporary nature (Hodges et al., 2020). This mode of learning necessitates educators to swiftly adapt their pedagogical approaches and leverage available digital tools to ensure educational continuity amidst challenging circumstances. Students, teachers, and educational institutions encounter various hurdles during emergency remote learning, including technological constraints, limited familiarity with online platforms, and the rapid adoption of new instructional strategies. Despite these obstacles, emergency remote teaching and learning at UTech, Ja. served as a crucial mechanism to sustain educational activities during the pandemic, and as such, the terms emergency remo*te* *t*eaching and online remo*te* *t*eaching/learning will be used interchangeably in this paper

Teaching and Learning During the Pandemic

Research on online remote teaching and learning during the COVID-19 pandemic, especially in the Global South, agreed on the challenges faced by students and teachers/lecturers. The pandemic immediately pushed educators, students, administrators, institutions, and families into a technology-led teaching mode that most were not prepared for. Financial and mental obstacles further compounded the challenge as many struggled to balance lives and livelihoods during uncertain times.

The pandemic magnified socio-economic problems that heavily impacted education at all levels. Universities reported that enrollment numbers had dropped. For instance, although, UTech, Ja. reported that the enrollment reduction was not significant (Murphy, 2021), the University of the West Indies, Mona campus,

disclosed that before COVID-19, the institution had approximately 19,000 students, but the student population has decreased to 15,500 over a four-year period (2023). This reduction could be attributed to the loss of income among households and university tuition not being a priority expense in a pandemic (Korotchenko & Dobbs, 2023). The pandemic's significant impact on enrollment numbers highlighted the disruption of students' educational goals. Therefore, an investigation into other effects is warranted.

One of the significant problems experienced by all levels of education is the magnification of the digital divide. This divide brings to light socio-economic factors that reduce access to technology and connectivity and the development of technological skills by students and lecturers. Effective participation in the online remote learning experience requires a computer, a smartphone, and internet connection, which was a cost that many could not afford before and during the pandemic. The literature indicated that the divide resulted in students not being proficient in the technical skills needed for online remote learning (Farrah & al-Bakry, 2020).

The lack of access to devices and the internet widened the digital divide between the high- and low-income groups. Those from lower-income families felt the difficulties associated with online remote learning and the digital divide. In this sense, Ferri et al. (2020) predicted that school closures could negatively affect learners from lower socioeconomic backgrounds, increasing the disparity between them and their more advantaged peers. Poor connectivity hindered students in developed and developing countries. Like Jamaica, in Indonesia, university students in some areas had a slow internet connection that affected their participation in online classes (Famularsih, 2020). Indonesian lecturers observed that some students could not afford data to access classes, which had to be supplemented by the university with a data quota provided to each student (Simamora et al., 2020). Similarly, studies show that of the students enrolled in the College of Engineering at California State University, 3% specified they did not have access to the internet, and 26% indicated they did not have access to reliable internet (Ayu & Pratiwi, 2021). Without the internet, students were also limited in their participation and could not follow the lessons or engage in activities that required them to access material online.

Both high-income and low-income countries faced these obstacles. Ferri et al. (2020) observed that the problem extended to European countries where connectivity and unreliable electricity supply in rural areas affected students' access to online classes. The electricity problem was also seen in rural Indonesian areas, so students were unable to complete assessments (Simamora et al., 2020). Similar

technological challenges among university students have also been recognized in developing countries such as Ghana and Malaysia (Ferri et al., 2020). Likewise, United Nations Children's Fund (UNICEF, 2020) identified the main reason for the lack of engagement in online remote learning among Jamaican students at pre/basic school or primary/preparatory level was the absence of and access to resources. At the secondary school level, students did not have a suitable device (62%) and could not access the Internet (18%) (para. 12). These problems may have extended to university students as well.

In addition to the technological challenges that students faced, they also struggled with their mental health. For instance, Asgari et al. (2021) mentioned Zoom fatigue experienced by engineering students and social disconnect from their classmates. They also spoke about the volume of work related to moving to the virtual classroom as lecturers attempted to replicate the face-to-face classroom. The move to the virtual classroom was time-consuming and made worse when lecturers were unfamiliar with the technological tools. The World Health Organization (WHO, 2022) announced a 25% increase in depression and anxiety worldwide during the pandemic. WHO identified several stress factors linked to the increase. Firstly, they named social isolation stemming from being unable to work or receive support from family or communities. Furthermore, loneliness, fear of infection, experiencing the death of loved ones, and economic uncertainty were stressors that increased levels of anxiety and depression. Similarly, assertions were made about Jamaica. A study on the prevalence and socio-demographic correlation of depressive and anxiety symptoms among Jamaicans during the pandemic found that the prevalence of notable depressive symptoms and anxiety symptoms was 54.7% and 49.2%, respectively (Whitehorne-Smith et al., 2021).

Furthermore, university students have reported an increase in anxiety and depressive symptoms because of the pandemic. The seven-item Generalized Anxiety Disorder Scale (GAD-7) among a sample of students in China indicated that 0.9% of the respondents were experiencing severe anxiety, 2.7% moderate anxiety, and 21.3% mild anxiety (Cao et al., 2020). For these students, the results of correlation analysis showed that economic effects and effects on daily life, as well as delays in academic activities, were positively associated with anxiety symptoms. In the United States, specifically among 2031 participants from Texas A&M University, 48.14% showed a moderate-to-severe level of depression, 38.48% showed a mild-to-severe level of anxiety, and 18.04% had suicidal thoughts (Wang et al., 2020). Most participants disclosed that their stress and anxiety levels had increased during the pandemic. These figures are in keeping with WHO's figures on mental distress during the pandemic. Wang et al. (2020) further mentioned

adjusting to remote and online learning along with having trouble focusing and worrying about academic performance as possible reasons for their results. However, the students indicated that technology helped them to cope through meditation and other mindfulness practices, leaving the researchers to suggest technology-based mental support for students.

Therefore, improving technological infrastructure is necessary to improve students' and lecturers' participation in the virtual classroom and their coping skills to reduce mental distress. Devices and internet connectivity should be accessible and affordable to all. Digital literacy for both students and lecturers will further benefit the advancement of online education, whether in a hybrid or distance modality. It will also ensure that students and lecturers are ready for future changes that may affect teaching and learning. At the same time, universities and lecturers must adopt new pedagogies in teaching and assessments to suit the online environment without compromising the quality of the university experience. Improvements in access to technology and changes in pedagogies will help students also manage stressors that affect their mental health.

Academic Writing at UTech, Ja.

Academic Writing 1 (AW1) and Academic Writing 2 (AW2) were compulsory general university modules for all University of Technology, Jamaica (UTech, Ja.) students. However, several UTech, Ja. studies have confirmed that students find academic writing to be challenging and, as a result, perform poorly in the writing modules (Burris & Burris-Melville, 2020; Smith & Stewart-McKoy, 2019; Smith et al., 2015). At the time of writing, students would complete Academic Writing 1 in their first year, while AW2 is expected to be completed upon the successful completion of AW1, its prerequisite. Each module is completed in a semester or thirteen weeks. The academic writing modules were offered remotely from March, given the suspension of face-to-face teaching. As explained by Ariffin et al. (2021), the COVID-19 pandemic disrupted the conventional learning process, and although remote learning has been adopted in various forms since the turn of the 21st century, the pandemic was the catalyst that hastened and streamlined the adoption of this learning method.

Prior to students going fully remote at the UTech, Ja., the Moodle platform operated as an online supplement to the in-person classes. It mostly featured additional lecture notes and other resources, including past test papers and sample assignments. There was no engagement between lecturers and students on the platform then. Campbell-Dawes et al. (2021) found that Academic Writing 1 students mostly used Moodle infrequently, and when they did, it was generally

used to access lecture notes. They also noted that some of the hindrances for students included a lack of ease of access and unclear applicability to the overall course objectives. Furthermore, Telfer et al. (2022) in their study posited that the typical UTech, Ja. students rarely use the internet for learning and do not consider themselves experts when navigating Moodle. Difficulties experienced in academic writing are not unique. This is underscored by numerous studies which found that students experienced both internal and external factors that interfere with their college writing in English as a second language classrooms (Basar et al., 2021; Jones-McKenzie, 2018; Negari, 2012; Ramsay, 2011; Souriyavongsa et al., 2013). The researchers also found that internal factors include self-motivation, self-confidence, lack of knowledge, and work-related anxiety. On the other hand, the external factors were the teacher's teaching style, classroom atmosphere, materials, and writing aspects (Basar et al., 2021; Negari, 2012; Ramsay, 2011; Souriyavongsa et al., 2013).

The challenges of academic writing were exacerbated by challenges that emerged in the online space. Ariffin et al. (2021) noted that in the college writing classroom, students face more obstacles when they are additionally expected to engage with online exercises and other typical features of the online learning environment. Closer to home, among first-year university students, Beckford (2021) found that technological barriers, such as unreliable internet access, hindered students' ability to fully participate in online composition writing courses. Additionally, many students struggled with limited access to quiet and conducive learning environments, further impacting their engagement and performance.

At UTech, Ja., March 2020 signified a move from traditional online learning to emergency remote teaching. Academic Writing modules, like much of the university, went into emergency remote mode. At the time, the Blackboard Collaborate (BBC) web conferencing platform was utilized for lectures and tutorials, while the Moodle learning management system (LMS) was utilized for supplemental resources and assessments. BBC was eventually replaced by the university with Zoom Learning. Between 2020–2022, 30% or more of the students in Academic Writing I failed the two modules. However, many Academic Writing II classes saw improvement in grades, although some classes had a high failure rate too. Consequently, this propelled the researchers to evaluate the Academic Writing 1 and 2 modules offered at UTech, Ja., which also underscored the need to explore the factors that possibly impacted students' performance. Accordingly, this research project's objective was to identify the academic writing challenges students face in an emergency remote teaching environment.

Methodology

Study 1

This descriptive quantitative research aimed to describe the challenges students face with the AW1 online delivery. This type of quantitative approach was most suitable for this research design since these types of research projects are intended to provide systematic information about a phenomenon. Descriptive research avoids introducing any interventions or treatments. It aims to paint a clear picture of a particular topic by gathering data on relevant factors. While not designed to test specific cause-and-effect relationships, strong descriptive studies can provide valuable insights into why things are the way they are, laying the groundwork for future research exploring cause and effect (Baker, 2017). In this quantitative study, a survey instrument was used for data collection.

Sample

The sample consisted of 372 students who did AW1 during semesters one, two, and three during the academic year 2021/2. These individuals were able to provide the information needed to analyze the risk factors that students experienced in doing AW1 at UTech, Ja. A convenience sampling method was used to select the participants for this investigation. Convenience sampling works for studies that target hard-to-reach populations (Bryman, 2016). It is a type of non-probability sample and is representative: "A representative sample is like the population, but it is smaller" (Johnson & Christensen, 2013, p. 217). In this case, the representative sample of 372 students was smaller but represents all the students (2276) who completed AW1 during the period under study.

Data Collection Methods and Procedures

In the quantitative research process, data collection is a very significant step as quality data collection methods improve the accuracy or validity of study outcomes or findings (Sadan, 2017). In this research, the data collection was carried out rigorously to ensure that the same results would be achieved if carried out by different researchers. As guided by Sadan (2017), the data collected in quantitative studies are based on a structured plan that guides the researcher on what data is to be collected, how long, and how to collect them. In this research, the information sought was derived from primary data collection, which means the participants were solely students who did AW1. They were asked questions concerning their demographic information, English Language competence, class participation,

online teaching, learning, and wellness issues. The data was collected via a cross-sectional survey instrument. Cross-sectional surveys are attractive because of "their appeal to generalizability or universality within given parameters, their ability to make statements which are supported by large data, and their ability to establish the degree of confidence which can be placed in a set of findings" (Cohen et al., 2018, p. 335).

The participants filled in their responses on a questionnaire instrument. It was a structured questionnaire where the questions and responses were provided, and the study participants selected the responses that applied to them. The questionnaire consisted of 57 closed-ended questions. The information gathered was then quantified by doing relevant statistical analysis. The quantitative data was entered into an Excel worksheet to be imported into Statistical Package for Social Science (SPSS) for analysis.

The data were collected between July 2022 and April 2023. The participants for the project were recruited using email, letters, and posters, which were distributed via their writing course facilitators, administrative support, Student Union representatives, and the UTech broadcaster. The survey questionnaire was administered online. There are various advantages of using an Internet survey. These include cost-effectiveness, speed, easy access to a wider and larger sample, and the ability to collect a large volume of data. Furthermore, it is convenient for respondents, achieves higher response rates and quality data, as well as facilitates ease with entering responses. Its design is flexible; it allows response checking, promotes accuracy in entries, exportability of data into software, and supports anonymity, honesty, and authenticity (Cohen et al., 2018). Students answered the questions and submitted their answers by clicking a link that was provided. In the larger study, the information obtained from the survey was analysed to identify the risk factors faced by the academic year 2021/22 semester 1, 2, and 3 cohorts of AW1 students.

Ethical Considerations

The proposal was submitted to the UTech, Ja. Ethics Committee for approval. The research commenced after approval was granted. The research was conducted in accordance with the ethical guidelines of the University of Technology, Jamaica.

Study 2

Research design

The study largely utilized a descriptive quantitative research design. Qualitative

questions were included to probe a few of the participants' quantitative responses. A survey was fielded to undergraduate students in a second-level general education writing module during the summer of 2020. The module is mandatory for all undergraduates at the university. This module employed a remote teaching mode after the university was closed to face-to-face classes due to the pandemic. The module was delivered via a learning management system, Moodle. Students can access all module documents, tests, and other information via this LMS. Classes were held live via the videoconferencing tool Blackboard Collaborate. Classes met for 4 hours each week, and the semester lasted for 10 weeks (about two and a half months). The summer session began in May 2020 and ended in July 2020.

Sample

In total, 525 students were registered in the module. Of that number, 335 students completed the survey. Most of the sample were female, 69%, and most of the participants indicated being in the age group of 20 to 25. Additionally, most participants indicated that they accessed classes from either Kingston, 39%, or St. Catherine, 27%.

Procedures

All study protocols were created, and the proposal and relevant materials were submitted to the ethics committee for approval. The data was collected using Google Forms. Emails were sent to the students in the module, asking for their participation. The email contained a link that students could use to access the questions if they agreed to participate in the study. The first page of the questionnaire required students to give informed consent. Those who gave consent were then directed to the questions.

Like the first study, a cross-sectional survey was used as it allows generalizability or universality within given parameters (Cohen et al., 2018, p. 335). Participants completed a structured questionnaire where the questions and response options were present.

Data Analysis

Quantitative data analysis. The data were analysed using descriptive statistics – including percentages and means – in Microsoft Excel and SPSS version 25.

Qualitative data analysis. Some questions on this instrument required a qualitative response. The thematic analysis method was used to analyse these

questions. In this paper, the questions drawn for thematic analysis were questions asking participants to explain their mental health challenges. The data were coded according to Braun and Clarke's (2022) methods.

Results

Participants reported various challenges they faced as they traversed university life during the Covid-19 pandemic. These challenges include technical challenges, mental health challenges, and disruption of social relationships, among others. The following results detail how participants reported the challenges they faced in studies 1 and 2. Descriptive statistics were used throughout the study.

Study 1: Academic Writing I.

Demographics

In study 1, of the number of students who participated, approximately 75% were female. In addition, the mean age was 21 years old. Results also indicated that students mostly access classes from the larger Kingston Metropolitan area. Twenty-three percent of students accessed classes mostly from Kingston and St. Andrew, and 24% reported accessing classes from St. Catherine. Participants reported that over 27% of them contracted the COVID-19 virus (n=69), and over 44% had someone in their immediate family contracting the virus, with close to 10% of them having gone through the experience of an immediate family member dying from the virus.

Online Challenges

Participants reported that technical challenges plagued them during their time in AW1. Forty-three percent (43%) of participants reported that the major technical problem that they experienced was frequent disconnections while completing an activity or an assessment. Next, approximately 38% of participants reported that they had problems navigating the Moodle course page layout. In addition, 33% reported that they did not get timely assistance from the university technical team. Other major problems include accessing the videoconferencing platform (24%), Blackboard Collaborate, communication with their lecturer (23%), and accessing the video recordings of classes (8.5%). These and other results can be seen in Table 1.

Table 1: Table showing online challenges faced by students in Academic Writing I

Challenges	%	N
Layout of Course Page	37.87%	103
Accessing the BBC class links	23.90%	65
Communicating with the Lecturer via Moodle Messaging	23.16%	63
Getting disconnected while completing an activity/assessment	43.38%	118
Viewing course content	12.87%	35
Not being able to connect to BBC via link	23.16%	63
Accessing the BBC class recordings	8.46%	23
Getting timely assistance from Tier1 Support	32.72%	89
Other (please specify)	7.35%	20

Mental Health

Mental health challenges were numerous and emerged as some of the most significant challenges that students faced. Over 31% of participants reported that their mental health got 'a little worse' since the pandemic, and close to 14% reported that 'my mental health is significantly worse.' Significantly, however, 40% of students reported that their mental health did not change during the pandemic. Additionally, only 5% reported that their mental health 'got better.' See Table 2 below for details.

Table 2: Table showing students rating of the state of their mental health

State of Mental Health	%	N
My mental health is significantly worse	13.90	36
My mental health is a little worse	31.27	81
My mental health is the same	40.15	104
My mental health is a little better	8.88	23
My mental health is much better	5.79	15

Specific mental health challenges that students reported are depression, anxiety, stress, loneliness, self-harm, and suicidal thoughts. Stress was the most frequently identified, followed by anxiety, depression, and loneliness. Although less significant, self-harm and suicidal thoughts were also experienced by participants. See Figure 1 for details.

As the most frequent mental health challenge, students rated the level of stress that they experienced. Results showed that 20% (n=52) of students found studying at the university 'very stressful,' over 25% (n=66) reported that they found studying

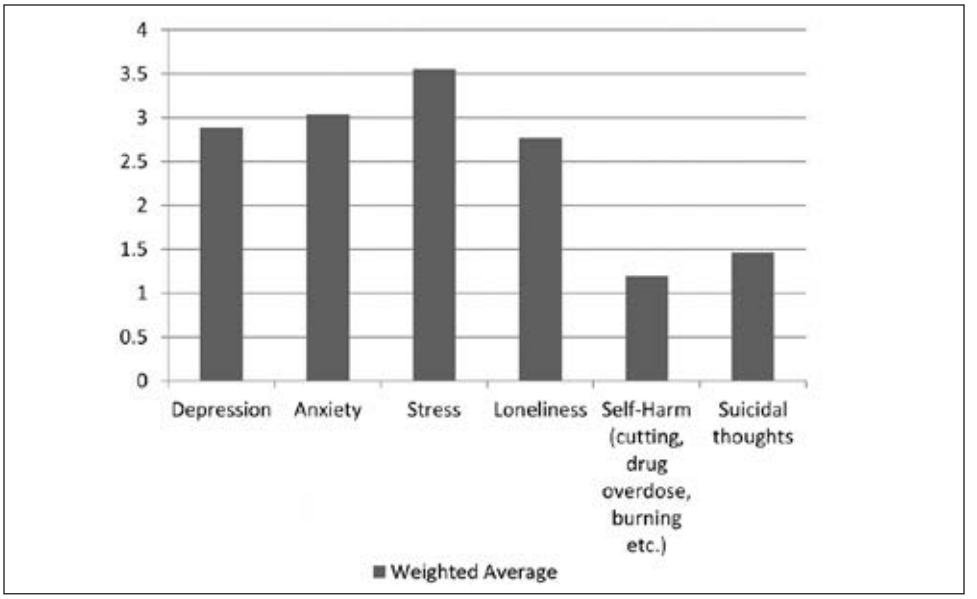

Figure 1. Figure showing mental health challenges reported by students

'stressful', and 23% (n=60) reported that they found studying during the pandemic "somewhat stressful."

As indicated in Figure 2, weighted means show the areas where students reported the greatest effects on them during the pandemic were social relations (3.72, SD=.08), finances (M=3.38, SD= .07), disruption in sleep patterns (M= 3. 22, SD = .08)) and disruptions in eating habits (M= 3.16, SD=.07).

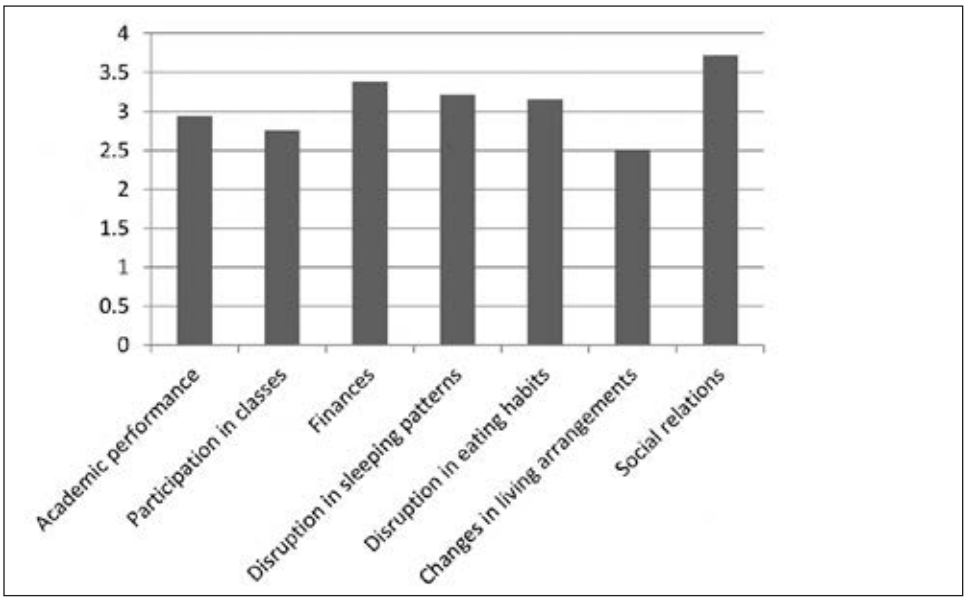

Figure 2: Figure showing the means of areas of students' lives affected by the pandemic

Coping Strategies

Coping strategies are crucial to mental health and wellness. Figure 3 shows that participants reported that their most frequent coping strategies include exercise (36%, n =94). reaching out to others (34%, n=88), and religious practices and beliefs (31%, n=80

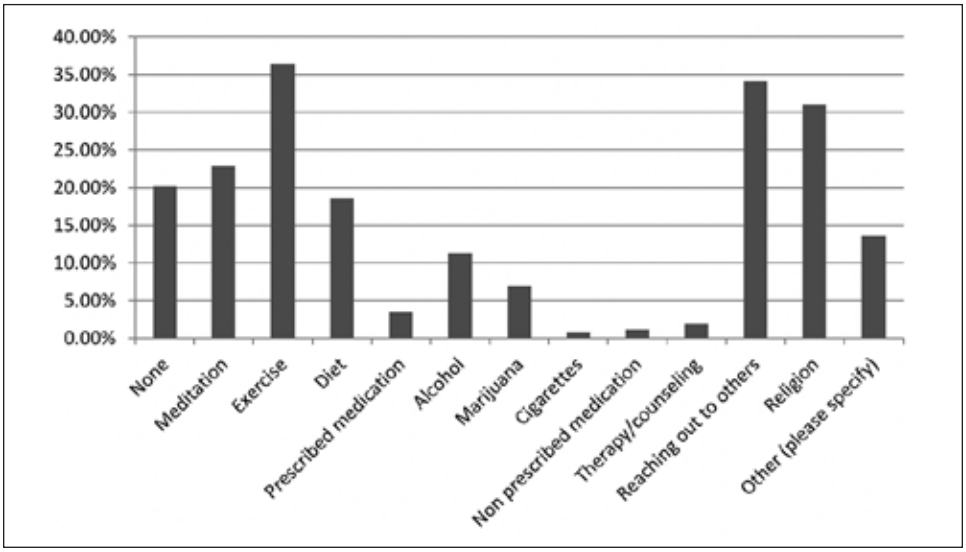

Figure 3: Figure showing *student*s coping strategies during the COVID-19 pandemic

Study 2: Academic Writing 2

The results for this report were obtained from a larger study that investigated the students' experiences with remote learning during the pandemic. These results focused on the challenges that students faced during their first semester of remote learning after COVID-19. The WHO declared the virus a pandemic.

Demographics

In study 2, of the number of students who participated, approximately 69% were female. In addition, the mean age was also 21 years old. Results also indicated that students were mostly accessing classes from the larger Kingston Metropolitan areas. Thirty-nine percent of students accessed classes mostly from Kingston and St. Andrew, and 27% reported accessing classes from St. Catherine.

Student satisfaction

Results that help to contextualize the challenges reported by students include students' overall satisfaction with the module. Generally, students reported on

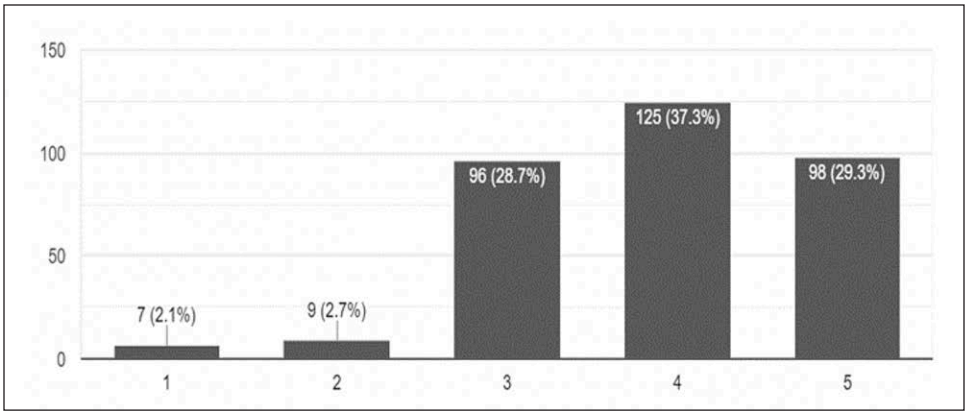

Figure 4: Figure Showing Students' Satisfaction With Remote Learning

a 5-point scale the level of satisfaction (1- not satisfied to 5- very satisfied) with the delivery of the module (M= 3.88, SD=.93) by remote means. Of the total 335 participants, 29% (n=98) reported being extremely satisfied with the online class, and 37% reported being sufficiently satisfied. Only 5% reported any form of dissatisfaction with the module. See Figure 4 for more details.

Tools used to access the online class

Participants reported that they used a combination of technologies and applications to access the module. 87.5% (n=293) reported using laptops, 72.2% (n=242) reported using mobile phones, and 43% (n =144) reported accessing broadband internet for classes.

As indicated in Table 3, of the total number of participants, 67% reported accessing classes via videoconferencing, and only 60% reported having access to the Learning Management System that was used to deliver the class.

Table 3: Table showing the technological tools students have access to for remote learning

Tools	**%**	**N**
Laptops	87.5	293
Mobile phones	72.2	242
Broadband internet	43	144
Access to video conferencing	67.2	225
Access to teleconferencing tools	12.8	43
Access to LMS	60.3	202
Totals	**100**	**335**

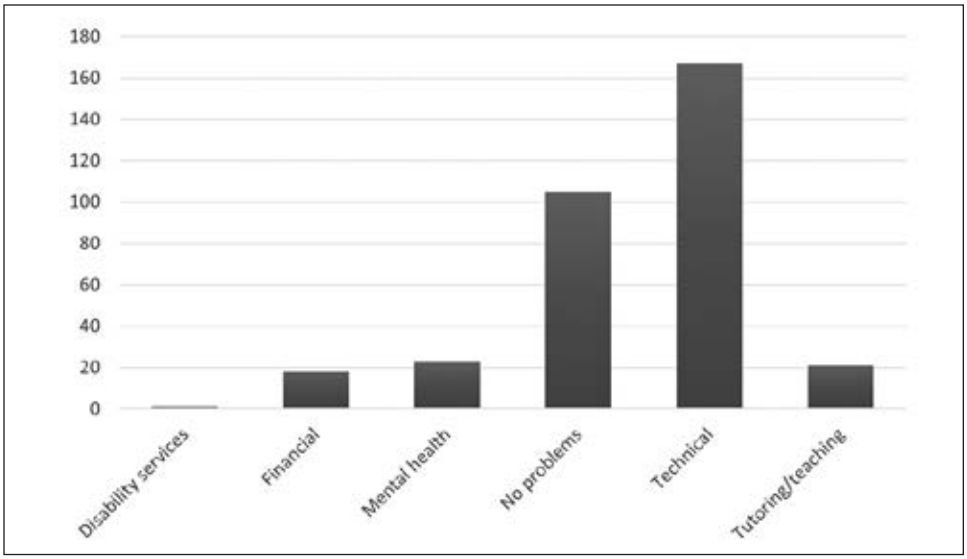

Figure 5: Figure showing the challenges faced by students studying online during the pandemic (n- 335)

For the Academic Writing 2 study, the results indicated that the challenges were similar. Participants also reported various challenges they faced during the semester. Technical challenges dominated the list. Of the 335 students who participated in the study, approximately 50% reported experiencing technical challenges. This was followed by mental health challenges, problems with the delivery of the module, and financial challenges. Of note, however, as shown in Figure 5, a significant number of students reported not experiencing any challenges at all. See Figure 5 for details.

Qualitative Results

Thematic analysis using the 6-step method outlined by Braun and Clarke (2022) was used to analyse the qualitative responses from the survey. The results showed that the technical problems that students reported were dominated by reports of poor internet connectivity. This resulted in loss of connection during classes, not being able to join classes, and not being able to complete and submit online assessments on time. As one student put it:

> "[I had] issues with connectivity during class and when needed to submit work, there would always be issues with submission."

Students also noted that the Learning Management System (LMS) that they used, Blackboard Collaborate, had multiple glitches that affected them negatively. One reported:

> "The blackboard collaboration platform was very unstable in kicking students out of class and having audio problems."

Poor internet service and unstable connections to the LMS emerged as the major technical problems that students experienced.

Mental Health Challenges

In addition to technical problems, some students reported experiencing mental health challenges. Qualitative responses indicated the specific mental health challenges that students reported. They included anxiety, depression, and stress. They reported that these stemmed from increased workload, inability to multitask effectively, and worries over financial troubles. The technical challenges they experienced also resulted in mental health deterioration, as these were often out of their control. Two students articulated these problems as follows:

> "I had a hard time balancing this course along with the others I had as well which carried a heavy workload, at times it can be frustrating . . ."

> "Not physically attending school, but constantly having to do schoolwork in the comfort of my home feels frustrating. It's a progressive transition into online learning."

These students noted that these challenges were caused by being unable to manage multiple activities like work and study. They also reported feeling isolated from peers which had a huge impact on their mental health. Participants also noted that their workload resulted in much anxiety.

Tutoring

The results also show that students who reported challenges with tutoring noted that these challenges stemmed from feeling lost in class due to a late start of the semester and not hearing from lecturers at times. One student said:

> I have been tossed around from class to class and with little or no guidance as to what is expected of me. The recording alone is not sufficient for me as a lot of persons learn differently. Furthermore, emailing my lecturer and I have not been getting any response from her.

Financial Challenges

The financial challenges that they faced were mostly due to the inability to afford tuition and critical internet service for class. Results of the qualitative data indicate that those who depended on buying phone data to connect to online classes often found it difficult to purchase data.

> COVID-19 has affected my salary drastically and has made payments harder. With this issue, I became less focused in class as my focus became mainly to have my fees paid and enough to pay for the internet.

Conclusion

The results of both surveys highlighted the numerous challenges that students faced navigating remote learning. Technical challenges outpaced the other challenges. However, especially for students in AW1, mental health challenges were also significant. Fortunately, students found mostly healthy coping strategies throughout their experience. For Academic Writing II, many students reported high satisfaction with the module and no problems at all, which speaks to their resilience and the possible efficient adoption of the learning technologies by the lecturers.

Discussion

The main objective of both studies was to identify the academic writing challenges that students at the University of Technology, Jamaica, faced during remote teaching and learning, which was mandated because of the COVID-19 pandemic in 2020. The results showed that students experienced several challenges. These can be categorized into academic writing, pandemic, and remote teaching.

Academic Writing Challenges

The students had various writing issues, which included grammatical, language, and documentation difficulties. These are not unusual challenges for students; however, they were amplified by the onset of remote teaching.

Pandemic Challenges

The COVID-19 pandemic ushered in a multitude of problems for students in developed and developing countries. The Academic Writing students at UTech,

Ja. were not spared some of these dreadful impacts. Firstly, students suffered from various mental health issues. Almost half of the students in AW1 reported having mental health issues, which negatively impacted their emotional and general health. However, they utilized various healthy coping strategies to address their issues. The online classroom required more creative approaches to help students navigate learning during a pandemic. Lessons had to be interactive and engaging (Ferri et al., 2020). If not, students would have been less motivated. For example, Garcia-Morales et al. (2021) revealed that students needed to pay attention more in the virtual classroom due to barriers such as boredom, isolation, and lack of time to keep up with the volume of work. Farrah and Al-Bakry (2020) stressed the importance of community and self-reliance in this respect, as the online environment required more student-centered research, leaving the lecturer to operate in a supervisor/facilitator role.

Another significant obstacle that students faced was financial problems. This was triggered by the need to acquire new tools for learning as well as for internet connection, which presented additional financial constraints overall. During the pandemic, universities in the Global South needed more financial resources for technology and implementing new infrastructure to support online teaching and learning. Decreased budgets and government support compounded these financial constraints (Garcia-Morales et al., 2021). To address the socioeconomic gaps, Asgari et al. (2021) suggested that universities provide students with comfortable and private spaces to access the Internet. Additionally, short remedial classes may help students close learning gaps due to a lack of face-to-face interaction. They further proposed loan programs for devices and financial programs to help students with their tuition. The pandemic has shown that online programs, as seen pre-pandemic, can be beneficial to university students once the technical requirements are fulfilled:

Remote Teaching Challenges

The third category of challenges that students experienced was those related to remote teaching. Internet connectivity and technological failings were major causes of distress for the students. This was a multi-layered issue. Firstly, there was the external issue where students had to contend with frequent internet disconnections caused by flaws of the two major internet provider companies in Jamaica. Also, some students were financially incapable of purchasing internet services. Secondly, students grappled with the university's inability to provide them with technical support to navigate remote learning. The university also had bandwidth limitations which exacerbated the issue. This led to their LMS

having many glitches when students engaged with it. Furthermore, students had problems acquiring the digital devices needed to facilitate online remote learning. Another challenge was the students' low proficiency in technical skills. This hindered or slowed them down in maneuvering the Moodle platform, accessing video conferences, class recordings, and communicating with lecturers. This was amplified by the tutor's discomfort in engaging with the technological tools to accommodate remote teaching. In developing countries, students are further demotivated because of the unavailability of devices and the Internet. Farrah and al-Bakry (2020) suggested that before universities switch to online delivery modes, they should lessen technological obstacles that prevent an effective online remote learning environment for students and lecturers. Furthermore, lecturers should not recreate face-to-face teaching models in the virtual classroom but develop strategies that promote collaboration and independent learning. To address student learning challenges, Asgari et al. (2021) recommended shorter lecture sessions, more group discussions, and providing clear roadmaps and other tools to help students learn at their own pace.

Intuitively, many may believe that the pandemic created a double whammy for the students because they already had an aversion to Academic Writing and were thus having challenges with the demands of such a course. It was then assumed that the pandemic would multiply these writing issues. Interestingly, not only were these issues intensified, but a third major issue emerged. This was remote teaching, and students experienced many difficulties, thus, making the scenario more of a trifecta of challenges for Academic Writing students at the University of Technology, Jamaica, during the COVID-19 pandemic.

Recommendations

The following recommendations are being proposed as ways the university can help to alleviate the challenges faced by students doing academic literacies modules:

- Implement and maintain expeditious and efficient systems in addressing technical issues faced by students. Challenges resulting from nationwide problems may be outside our scope, but the university needs to do more for its students in the online space.
- Provide students with more and improved mental health access. This could include online and 24-hour hotlines to help students cope. Additionally, the university could include mental health days in its calendar to specifically highlight and address these challenges.

- Continue with various versions of online models for all students to optimize future transition to online operation.
- Improve the internet strength and spread on campus.
- Offer more financial assistance to students. Financial challenges not only manifest but contribute to mental health challenges. The university needs to create more programs to address this serious challenge that students face.
- Academic staff and students need to engage in upskilling to better manage online teaching and learning demands.

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The Impact of Family Income and Education on University Students' Academic Performance

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Abstract

For many years it has been asserted that students residing in an educated and financially stable family perform better academically than those from families of low socioeconomic status. While this may be true from a practical sense, it does not necessarily dictate students' natural capability to perform optimally academically. Therefore, the aim of this study was to investigate the impact of family income and education on students' academic performance at a tertiary institution in Jamaica. A descriptive cross-sectional survey was used. The results showed that a significant proportion of the students were from low socioeconomic families, 33.3% earned monthly income of $30,000–$60,000. Of these students, the tuition of 57.4% of them was funded by student loans, 33.3% by parents and spouses, 3.7% were self-financed, and 1.9% relied on scholarships. Most of the students (70.4%) earned a GPA between 2.01–3.00 of which 51.9% failed one or more modules during the period of their study. The majority (63%) of students were unable to purchase all required school supplies, and 39% were the first in their family to attend a tertiary institution. Family income had a moderate impact on students' academic performance when compared with family education. Students whose tuitions were paid by their parents were better able to afford all school supplies than those whose tuition was funded by student loans. Whether or not these students are from families of high or low socioeconomic class, their parents placed a high value on education and were very involved in the process.

Keywords: Family Income, Students, Socioeconomic, Academic Performance, Impact

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Introduction

According to Muffels (2014) and Web Finance (2017), family income is the total revenue of all family members aged 15 years or older living in the same household. The sources of income include wages, social security, child support, pensions, capital gains, and dividends. The family is the foundation for the upbringing and education of a child. As such, family plays an essential role in the academic achievement of children. The type of occupation in which a parent is engaged could determine one's income and ability to provide enough funds and optional facilities which a school-aged child requires for high performance at school, (Ololubei, 2016).

Baoyan and Minggang (2015) in a journal review entitled "How Father's Education and Economic Capital Impact Academic Performance, found that family income has an "opposite effect" on students' academic performance, that is, a student's academic performance may not necessarily be favorable because he or she is from a high-income family. They highlighted that limited resources and limited psychological expectations, perceptions, and reactions of parents negatively affect how students perform. They found, however, that having a low family income has a direct influence on academic performance while having a high family income does not necessarily help performance. Arshad et. al. (2015) and Bangchang (2015), posit that though family income may be important, there are many other factors such as the family's education that may affect one's academic performance.

According to Okioga (2013), parents from a higher-income class play an active role in their children's education and development while families from a lower-income class do not, which causes their children to feel abandoned.

As a result, of the difference in the upbringing of these children, students of the middle class may be seen performing at a higher level than those from a lower class, (Okioga 2013).

Family education is important to students' academic performance. While the possibility exists that children occasionally stray from the beliefs or values of their parents, the same values, and attitudes of the family help to shape the values and attitudes of students. If parents regard education with high esteem their children will tend to develop that same sort of belief.

Income is integral to a student's ability to perform well in school. While income on its own does not determine a student's ability, it influences how far a student can go. Income according to Dictionary.com (2017) and Scott (2024), is the payment via cash or cheques received for goods, services, or investments.

In this regard, education requires tremendous monetary investments and so without income, a person's access to education may be thwarted. Income can mean grants, scholarships, or investments from family members, friends, and parents. Although students generally rely on the assistance of their families, namely parents to support their educational pursuits, other avenues provide reprieve if parents are unable to invest in their children's education.

Academic performance is affected by, but not limited to family income and education. However, as a motivator, most students aspire to learn and excel through good academic performance. Family educational background and income are important and form the platform for academic buoyance. Often through sheer willpower, self-motivation, determination, and encouragement from others inside and outside their homes and family relations students burden themselves to achieve and excel in academic pursuits as any other member of society (Yurk, 2013).

Purpose of the study

The purpose of this study was to investigate the impact of family income and education on students' academic performance at a tertiary institution in Kingston, Jamaica.

Research Objectives

1. To determine the relationship between family education and students' academic performance
2. To determine the relationship between family income and students' academic performance
3. To determine the effects of family education and income on students' academic performance

Research Questions

1. Is there a relationship between family income and students' academic performance?
2. Is there a relationship between family education and students' academic performance?
3. What are the effects of family education and income on students' academic performance?

Literature Review

Over the years research has shown that parental educational level plays a crucial role in the quality and type of educational achievement children acquire, (Heckman & Masterov, 2007). It is alleged that educated parents nurture their children to have a healthy self-perception towards their academic capabilities, thus they are usually engaged from an early age in intellectual stimulations to help them develop a healthy attitude towards learning. According to Erdem and Kaya (2020) educated parents with a high income have high expectations of their children and as such, they are expected to attain good grades. To acquire these grades, they expose their children to diverse learning environments and are readily involved in their education.

Tertiary education in Jamaica is a privilege that is not readily available to all Jamaicans due to several reasons. Often the reasons are heavily influenced by economics which plays a vital role in establishing who has access to this level of education. Today we have seen where there is a gradual increase in the number of youths who have enrolled in colleges and universities to attain a higher education. However, for many students, specifically those of low socioeconomic backgrounds, the journey through university has proven difficult. This review sought to gain an understanding of the relationship between family income, education, and academic performance, as well as the effects of both family education and income on students' academic performances.

The relationship between family education and academic performance

According to Lui and Lu (2008) and Veiga (2016), the first education the child obtains is family education. It further states that parental educational background plays an important role in their child's academic performance, and the higher the parent's educational background the better the academic performance of the child.

Flecha (2012), states that the correlation between parents' education and their children's academic performance has been studied for years. There has been a great deal of confusion about the consequences of this relation due to the high failure rate among students with families from a low-educational background (Gooding, 2001). In recent studies, schools have discovered that the promotion of educational interactions among students and their families contributes significantly to increasing academic performance. Researchers from a study carried out by Harvard Research team in 1993, also expressed the view that students' academic performance improves when parental participation increases (Flecha, 2012).

According to Flecha (2012), students whose families have low educational backgrounds experience higher rates of early school leaving, low academic expectations, and refusal from higher educational levels. Scholars Buchman and DiPrete (2008), in a research paper entitled "The Growing Female Advantage in College Completion: The Role of Family Background and Academic Achievement (as cited in Rudel, 2015), stated that parental education plays an essential role in determining the kind and quality of education their children receive. They claimed that parental education directly influences children's educational aspirations, to the extent that parents expect their children to equal or surpass their educational level.

Dornbusch, Ritter, et al., (1987) cited in Gooding (2001), asserts that the purpose that parental education plays is that its levels affects the way parents groom their children and hence affects students' academic performances. It was also mentioned that children from families with higher educational levels academic performance increases because they are more permissive and less strict with the children. According to Gooding (2001), researchers have argued that there's a relationship between parental educational attainment and students' academic achievement. DeBaryshe, Patterson, and Capaldi (1993) as cited in Gooding (2001) debated that parental education is precisely related to parenting and not students' academic performance. Their research states that parents from low educational backgrounds use forceful or violent strategies for discipline, which results in the child having antisocial and abnormal behaviors, which in turn, results in a decrease in the child's academic performance.

Buchman and DiPrete (2008) found a "same-sex effect" in the probability of males completing university. They pointed out that the father's educational accomplishments and household presence have a greater influence on whether male children will drop out of school. In contrast, Rosen and Aneshensel (1979) and Wells et al. (2011) found that a mother's education has a greater effect on female children's educational expectations as cited in Rudel, (2015).

Bangchang (2015) after carrying out research with a total of 599 students from the faculty of science and technology of Thammasat University in his research published in a journal article entitled "Factors Affecting Academic Performance of Undergraduate Students" argued that students with educated fathers are more likely to perform better academically. He concluded that educated fathers are supportive and influential models in their children's education.

When children of educated parents enter school, the parents are more likely to pay attention to the quality of education their children receive by participating in parent-teacher conferences and volunteering at school. Additionally, parents

who are highly educated are more likely to read to their children than those who are less educated. In conclusion, children who have parents who are highly educated, tend to have a higher performance rate than those of less educated parents (Egalite, 2016).

The relationship between family income and academic performance

Jamaica is an upper-middle-income country. Although Jamaica is so classified, the country has challenges with low growth and high public debt, which weakens the economy, making Jamaica one of the slowest-growing developing countries in the world (World Bank Group, 2017). This state of affairs may be considered as a vital aspect in evaluating family income and its effect on education. The impact of family income on academic performance may be viewed from the three visible income groups; the upper, the middle, and the lower class.

In Jamaica, upper-class and middle-class people are seen at the top of the social chain of command dominating business, banking, and commerce improving their aspects of accessing and accepting better opportunities in education. The middle class, on the other hand, can be seen taking command of government and politics and are well-educated working-class persons who have considerably less riches than the upper class but place exorbitant value on education as a mandatory means for success and social mobility. The Jamaican middle and upper class believe in the importance of education and educating their children as a necessary part of their existence (Smith, 2013), inadvertently propelling persons in these classes to perform at a higher level than those of their colleagues of a lower class.

Family income and how it is earned by the heads of households directly affects countries worldwide, including Jamaica. In some instances, many countries have implemented cash transfer programs to support the income of poor households. The cash transfer programs are usually of two types – conditional and unconditional. In other countries, governments with the aid of international institutions provide unconditional monthly financial resources while under specified conditions some transfers take place based on unemployment or to keep children in school.

Living in poverty can distract from academics because survival becomes a more immediate and pressing priority. Tertiary students from low-income families generally have to take into consideration; transportation, food, books, boarding if the individual lives at a remote distance, and above all tuition. This sometimes may place students under undue pressure which may cause the individual to become less focused during classes. Which may result in a continuous drop in academic performance than that of the upper and middle counterparts. Which

impacts the access and quality of their education creating limitations for tertiary students from low-income families.

Ever so often the situation is such that with the regularization of the Jamaican education system, lack of revenues, financing for teacher training, and high-quality educational arrangements, it results from persons at the bottom of the social pyramid, that is, the poor exhibiting a lack of accomplishment and groundwork for the organization or institution. This, in turn, may perpetuate poverty and despair among this group, which may foster beliefs in countercultural means to succeeding and driving the belief that educational pursuits may not be for them. Consequently, the dropout rate is increased (Sanderson, 2021; Doll et al.2013).

On the other hand, Bangchang, (2015) found that students who pay their tuition fees by student loans are more likely to have better academic performance than students whose parents pay for it. Students who acquire a student loan to pay their tuition are usually pressured to succeed to find a quality job to repay these high loans. This excess pressure motivates these students to study hard over time with the hope of acquiring a quality job.

Empirical evidence suggests that students' academic ability and performance are impacted by parental influences, in such a way that students' achievement test scores increase with parental socioeconomic status. A family's socioeconomic status (SES) may provide the financial resources to pay for college as well as numerous aspects of college preparation. The ready availability of financial resources as well as the social pressures associated with one's SES may also shape children's educational expectations and performance, with substantial implications for ultimate attainment, (Rudel, 2015).

Effects of Family Income and Education

Family plays a fundamental role in the education of children. The qualities, behaviors, and resources of parents are said to have a considerable impact on student's academic performance and are also believed to account for the gaps that exist in student achievement. It is traditionally believed that the more affluent and educated parents can provide a better environment for their children and as such these children perform better in school when compared to their counterparts from families of lower income and educational levels. According to Egalite, (2016), various studies have highlighted that parental education has a strong association with children's success in school, the number of years they attend school, and their success later in life.

Von Otter (2014), assumed that parents with greater experience in education and school-based learning can offer more practical help with schoolwork to their

children. Families with more educational and financial resources are better able to provide a suitable work environment for the child, such as assigning a time and a place for study and providing tools for learning for example books and computers.

Drajea and O'Sullivan (2014) in their study recognized that there was a relationship between parents' education, literacy levels, and poverty in terms of household income and that it has a significant impact on the educational achievement of children in primary school. They suggested that when parents are educated particularly about the value of devoting time to their children and showing an active interest in their schoolwork, it may greatly improve their children's chances of achieving the best of their abilities in school.

West et al., 1997 as cited in Renth, Buckley, and Puchner, (2015) and Zhao and Wang (2014) proposed that mothers with high educational qualifications take greater responsibility for themselves to get their children educated. They tend to be involved in informal schooling for instance through the use of extracurricular textbooks and the hiring of private tutors. According to West cited in Renth, Buckley, and Puchner, (2015) less educated parents could influence lower achievement levels of their children by way of their past education or experiences. In agreement with this notion, Eccles and Harold, (1996), Hoover-Dempsey and Sandler, (1997); Lareau, (2000), and Weiss et al., (2003), as cited in Von Otter, (2014) showed that parents with a low level of education often see themselves as incapable of helping their children and therefore reduce their involvement.

As cited in Renth, Buckley, and Puchner, (2015) Fry (2007 and West (2007) in their research reported that there are specific characteristics of low-income families that contribute to the low performance of children. They believed that the education levels of parents are linked to whether youths remain in school. According to the Organization of Economic Co-operation and Development (2021), at-risk students, that's students from families of low income and education, are not able to withstand academic challenges, which is the main cause of the difficulties in school. Whilst children from higher socioeconomic groups are better prepared to endure these difficulties because they can confront these challenging tasks with a better self-concept and positive attitude. Thus, the child from a family of low income and education is not capable of facing the difficult academic tasks and will continue to fall behind, causing further widening of the achievement gap as cited in Renth, Buckley, and Puchner, (2015). The study revealed that many parents spoke of their limited access to resources as an obstacle to their children obtaining certain important academic tools. For example, these parents noted that they have limited access to technology. In addition, Drajea and O'Sullivan, (2014) posited that low family income affects children in several ways including

the absence of learning and experiences at home, lack of access to computers, and lack of a sense of esteem. It is believed that these factors make it difficult for children to see themselves as positive learners. As a result, children's attitudes towards school and aspirations for academic achievement are affected.

Summary

To reiterate, family education is important to students' academic performance. While the possibility exists that children occasionally stray from the beliefs or values of their parents, the same values and attitudes of the family help to shape the values and attitudes of students. If parents regard education with high esteem their children will tend to develop that same sort of belief. Income is integral to a student's ability to perform well in school. While income on its own does not determine a student's ability, it influences how far a student can go. Income according to Dictionary.com, (2017) and Scott (2024) is the payment via cash or cheques received for goods, services, or investments. In this regard, education requires tremendous monetary investments and so without income, a person's access to education may be thwarted. Income can mean grants, scholarships, or investments from family members, friends, and parents. Although students generally rely on the assistance of their families, namely parents to support their educational pursuits, other avenues provide reprieve if parents are unable to invest in their children's education.

Academic performance is affected by, but not limited to family income and education. However, the most important motivator of good academic performance is the student's will to learn and excel. Family educational background and income are important and form the platform for academic buoyance. Often through sheer willpower, self-motivation, determination, and encouragement from others inside and outside their homes and family relations, students burden themselves to achieve and or excel in academic pursuits as any other member of society.

Methodology

Research Design

A descriptive cross-sectional research survey was used for this study. A quantitative perspective was utilized due to its suitability to gather numerically relevant data and enable the analysis of large amounts of data over a short period.

Study Setting

According to the UTech, Ja website, the institution was established in 1958, formerly named the Jamaica Institute of Technology; the university offers more than 50 programmes across five faculties and three colleges. The Caribbean School of Nursing (CSON) provides training for nursing and midwifery.

Population

Information from the Student Records Office (2017) indicated that the ccombined population of nursing students from all year groups enrolled at the SON, Kingston campus was approximately three hundred and thirty (330). This sum included eighty-four (84) 1st-year students, Eighty-one (81) 2nd-year students, Eighty-eight (88) 3rd-year students (N=88), and seventy-seven (77) 4th-year students.

Inclusion Criteria

- 3rd year BSN students from the School of Nursing, Kingston campus who were eighteen (18) years or older.

Exclusion Criteria

- 3rd year BSN students from the School of Nursing, Kingston campus below age eighteen (18) years; and those absent at data collection.
- Students of the SON who, are currently First-year nursing students, Second year nursing students, Fourth year nursing students, and All Midwifery students.
- Students on leave of absence or who have discontinued or deferred the nursing programme

Sample Size

The researchers' target population of 3rd year BSN students consists of Eighty-eight students (N=88). The sample size was calculated using a computer software known as Raosoft. The population size 88 was inputted in the Raosoft (2017) calculator, with a 90% confidence level, a 5% margin of error, and a response distribution estimated at 85% which generated a sample size of Fifty-four (n = 54). Therefore, the sample size was 54 3rd year BSN students.

Sampling Technique

For this study, the researchers used the simple random sampling technique. It is a form of probability sampling in which a distinct number of units are selected from

the number of units in the population in a way that every unit of the population has an equal chance of being selected in the sample (Thompson, 2012).

The population of nursing students (BSN) in the third year was a total of Eighty-eight (N=88) with the calculated sample size consisting of fifty-four (n=54) third-year nursing students. A list of all the students in the BSN year 3 group was obtained from the class tutor. The researchers went through assigning consecutive numbers from one (1) to eighty-eight (88) to each student. The researchers then used a table of random numbers online software to select the members of the sample. The table of random numbers was generated through the use of a computer software known as Research Randomizer (Urbaniak, & Plous, 2017). The research randomizer generated sets of eight (8) numbers randomly in a column. This process was repeated until 54 numbers were selected. The first fifty-four numbers on the table of random numbers were used to represent the selected sample frame (n=54).

Data Collection Instrument

The data collection instrument used in this research was that of a structured questionnaire consisting of twenty-one (21) questions. The questionnaire required participants to select one or more responses as applicable to the questions and they were instructed to answer all questions. Each participant was asked to tick the best option that applied to him/her. The questionnaire took approximately ten to fifteen (10–15) minutes to complete. A questionnaire was selected because it was uniformed and structured with instructions and answer options making it suitable for the respondents to answer the research questions and objectives. It allowed ease in administering to large groups and data collection was obtained within a short period. It was also relatively inexpensive (Mcleod, 2014).

The questions addressed each research question and objectives as well as obtained demographic information from the respondents. Eighteen (18) of the items on the questionnaire were closed-ended questions which can be characterized as nominal, ordinal, and interval data while three (3) questions were open-ended. Questions one to four (1–4) related to demographic information, while questions five to eighteen (5–18) addressed the research questions.

Procedure for Data Collection

A letter was sent to the College Ethics Committee seeking approval to conduct the study, and thereafter, permission was also requested from the Head of the School of Nursing to utilize the BSN year 3 students as the target population. After approval was granted by the Research and Ethics Committee, and SON, the researchers visited the BSN year 3 students at a mutually agreed time. The students

were informed of the purpose of the study and that information shared during participation will be kept confidential. Privacy and anonymity were maintained as no identifying markers such as name were needed on the questionnaires as a number was assigned to each participant.

Students interested in participating in the study were asked to remain in the classroom for data collection. Those who volunteered were given a consent form and questionnaire with instructions for completion from the researcher. The fact that the study had little or no risk to participants was emphasized. They were given ten to fifteen minutes to consider if they wanted to participate.

The questionnaires were distributed separately from the consent form to maintain privacy during data collection. The self-administered questionnaires were randomly pre-numbered from one to eighty-eight. This facilitated data entry and further preservation of anonymity and confidentiality. The questionnaires were administered by the researcher to the fifty-four participants.

The participants were instructed to leave the completed questionnaires in a box on the desk. The participants were allowed approximately ten to fifteen minutes (15 mins.) to complete the questionnaire. Researchers left the room for approximately 15 minutes and returned to collect the box with the completed questionnaire. Completed questionnaires were collected on the same day of distribution. This was done to maintain anonymity during the data collection process. The consent forms with signatures affixed were stored in a locked cupboard that was only accessible to the researchers

A review of the study was done weekly by all five (5) researchers along with the supervisor until the entire project was completed to ensure accuracy and to eliminate any errors.

Data Analysis

Data gathered from the questionnaires were grouped and coded according to participants' responses and analysed through the Statistical Package for Social Sciences software version 16 (SPSS). The data was first entered into Microsoft Excel software and then imported into the SPSS software. Nominal variables data were summarized in frequency tables and graphical figures. This helped the researchers to organize data in a logical and concise manner. After analyzing the data gathered the researchers provided a discussion of the analysis.

Ethical Consideration

While conducting this research, ethical consideration was very important. Therefore, the researchers collected and processed data in an honest and ethical

manner. Both response & nonresponse bias were avoided through the use of close-ended questions on the questionnaire. The participants were informed and assured that the information obtained would be kept confidential and anonymity was maintained as the questionnaire did not require any identifying markers such as name. The purpose of the study was explained to the participants, and they were allowed to choose whether they wanted to participate in the research without being forced to do so. Individuals' choice to refuse to participate in the research were respected. Pseudonyms were also used to maintain anonymity and confidentiality.

The research proposal along with a letter was sent to the College Ethics Committee seeking approval to carry out the research at its institution. Upon receiving formal approval from the Ethics Committee, the data collection phase of the research commenced. The ethical premise upon which the research was conducted was maintained as outlined above. A box was provided for the participants to place the completed questionnaires in. The researchers left the room while the participants completed the questionnaire and only re-entered after the estimated 15 minutes for questionnaire completion, to collect the box. This assisted with confidentiality, privacy, and anonymity. The hard copy of the data collected was kept for three months upon completion of the research and stored in a cupboard by the researchers that was kept locked, at all times. The soft copy was password protected, and accessible only by the researchers. The main intent of the researchers was to identify the Impact of Family Income and Education on Students' Academic Performance by analyzing the findings. At the end of the research, the responses received from participants were destroyed.

Results

Table 1. Gender of Respondents

Gender	N	%
Female	51	94.4
Male	3	5.6
Total	**54**	**100.0**

Of the 54 respondents who took part in the study, 94.4% (51) were female while the remaining 5.6% (3) were males.

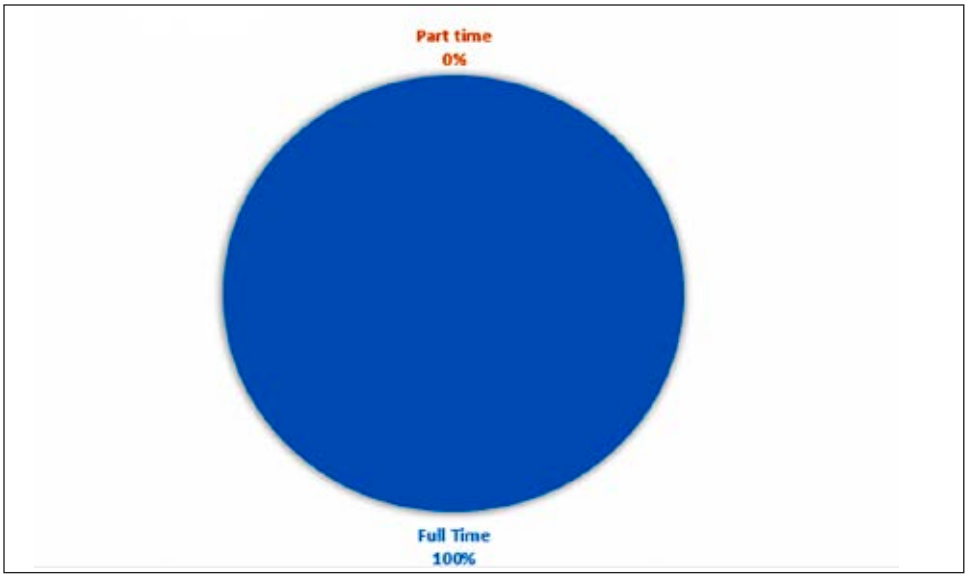

Figure 1. Respondents' mode of attendance

100% of respondents attended university on a full-time basis.

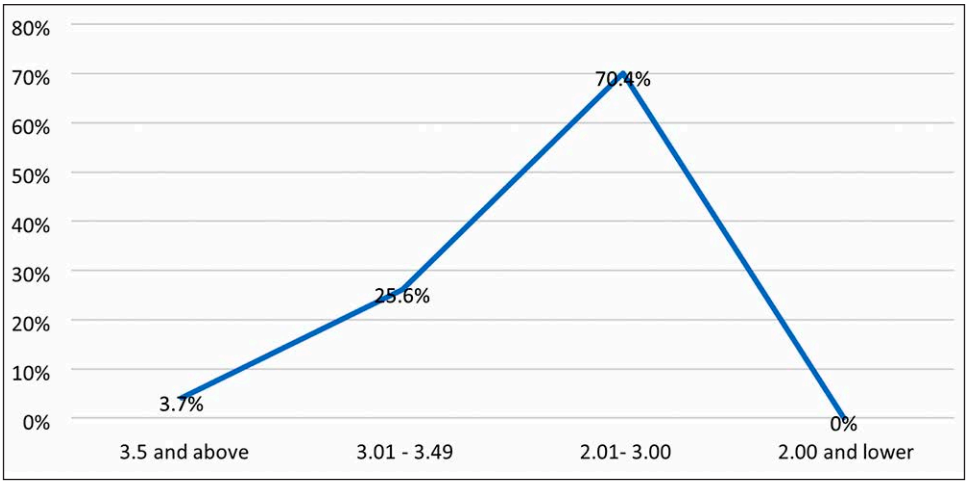

Figure 2. Respondents Grade Point Average (GPA)

70.4% (38) of the respondent's grade point average fell in the category of 2.01-3.00, 25.6% (14) of the respondent's GPA fell into the category of 3.01–3.49 while the remaining 3.7% (2) of the respondents earned a GPA of 3.5 and above.

Table 2. Sources of Funding for Respondents' Tuition and Type of living accommodations

Source of Tuition Funds	**N**	**%**
Parent	18	33.3
Scholarship	1	1.9
Self	2	3.7
Spouse	2	3.7
Students' Loan	31	57.4
Total	**54**	**100.0**
Living Accommodations	**N**	**%**
Rented	30	55.6
Home	24	44.4
Boarded on Campus	0	0
Total	**54**	**100**

Of the 54 respondents 57.4% (31) stated that their tuition was paid by student loan, 33.3% (18) stated that their tuition was paid by their parents, 1.9% (1) selected scholarship, while spouse and self-accounted for 3.7% (2) each.

Respondents were also asked the question "What are their current living accommodations?" Of the 54 respondents, 55.6% (30) stated that they live at a rented facility while 44.4% (24) are living at home. None of the respondents stated that they board on campus.

Table 3. Respondents' ability to purchase school supplies

Response	**N**	**%**
No	34	63.0
Yes	20	37.0
Total	**54**	**100.0**

Of the 54 respondents, 63% (34) stated that they weren't able to purchase school supplies while the remaining 37% (20) stated that they were able to purchase school supplies.

A majority of 15 (27.8%) of the respondents said they consumed food from home, consumption of patty was the second highest with 13 (24.1%), and food from Burger King/KFC is the third highest at 12 (22.2%). 4(7.4%) respondents stated that they typically consume snacks while 3 (5.6%) stated they consume nothing for lunch and 7 (13%) respondents gave multiple responses.

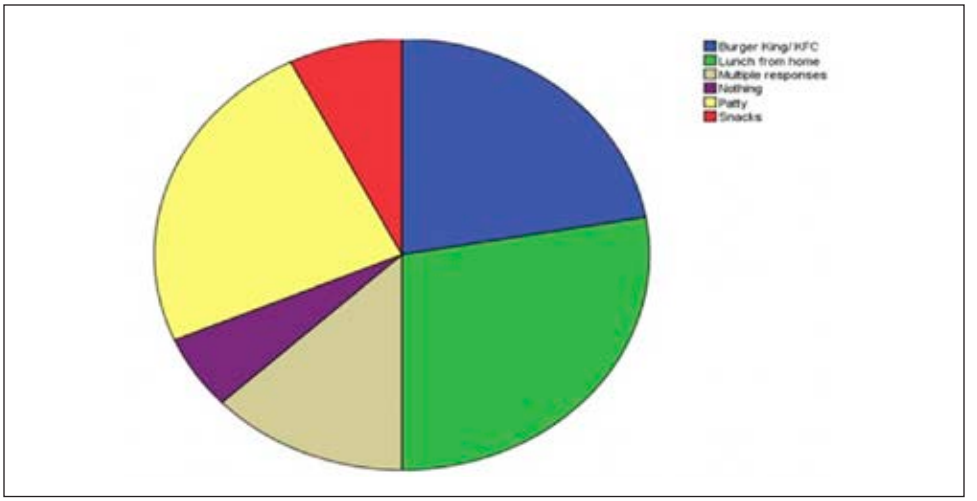

Figure 3. Types of lunch consumed by Respondents

Table 4. Failure of modules during their 3 years of study

Response	N	%
No	26	48.1
Yes	28	51.9
Total	54	100.0

Of the 54 respondents, 51.9% (28) stated that they have failed one (1) or more modules over the last three (3) years of their study while the remaining 48.1% (26) have not failed any module.

Of the 51.9% (28) respondents who admitted to failing modules over the last 3 years, 35.2% (19) of those respondents stated that they have failed one (1) module, 11.1% (6) said they have failed two (2) modules, 3.7% (2) failed three (3) modules and 1.9% (1) stated that they failed four (4) or more modules.

Table 5. How Often Respondents Attended Class

Frequency	N	%
50% of the time	2	3.7
All the time	23	42.6
Most (75%) of the time	29	53.7
Total	**54**	**100.0**

Of the 54 respondents, 53.7% (29) admitted they attended classes most of the time, 42.6% (23) attended classes all the time while the remaining 3.7% (2) said they attended classes 50% of the time.

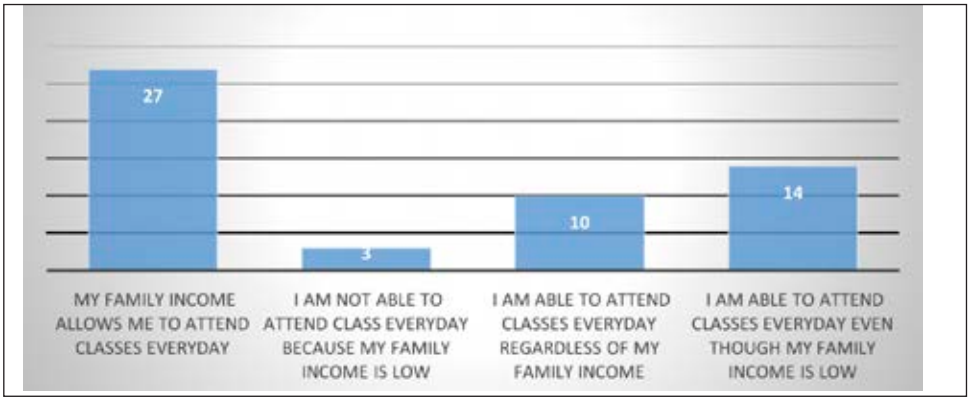

Figure 4. Family income relation to School Attendance

27 (50%) of the respondents stated that their family income allowed them to attend classes every day, 3 (5.6%) admitted that they weren't able to attend classes every day because their family income is low, 14 (25.9%) stated that they were able to attend classes every day despite family income being low, and the remaining 10 (18.5%) stated that they were able to attend classes every day regardless of their family income.

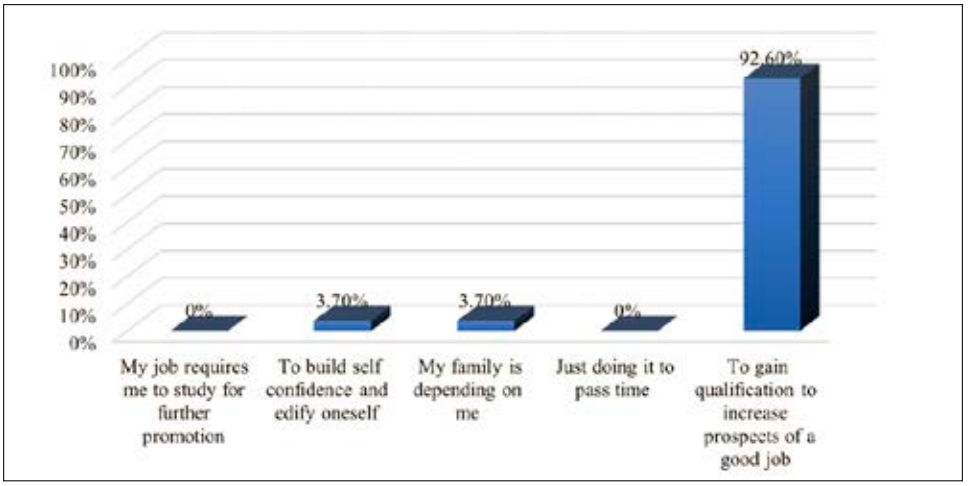

Figure 5. Motivators to Respondents' Academic Pursuits

92.6% (50) of the respondents stated that the main reason for their academic pursuit is to gain qualification to increase the prospect of gaining a good job,

and another 3.7% (2) stated they are in pursuit because their family depend on them to earn a good wage to assist in family goals, and the remaining 3.7% (2) stated that their main influence to academic pursuit is to build self-confidence and edify self.'

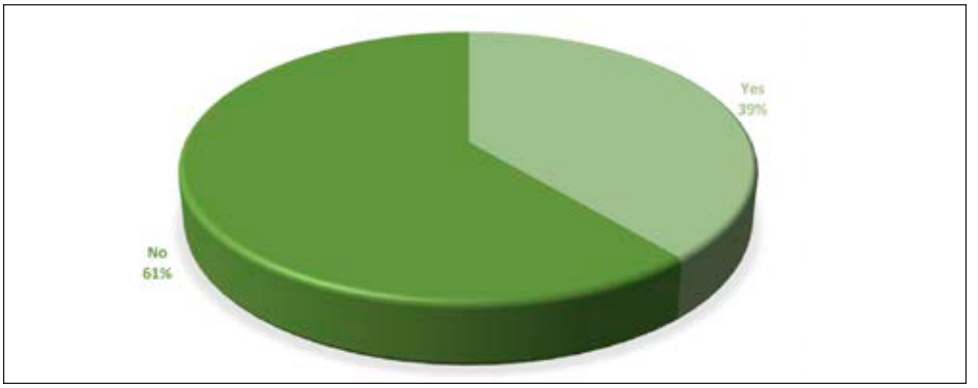

Figure 6. Were respondents the first in their immediate family to attend University

39% (21) of the respondents said they are the first in their immediate family to attend university while the remaining 61% (33) admitted that they aren't the first to attend university.

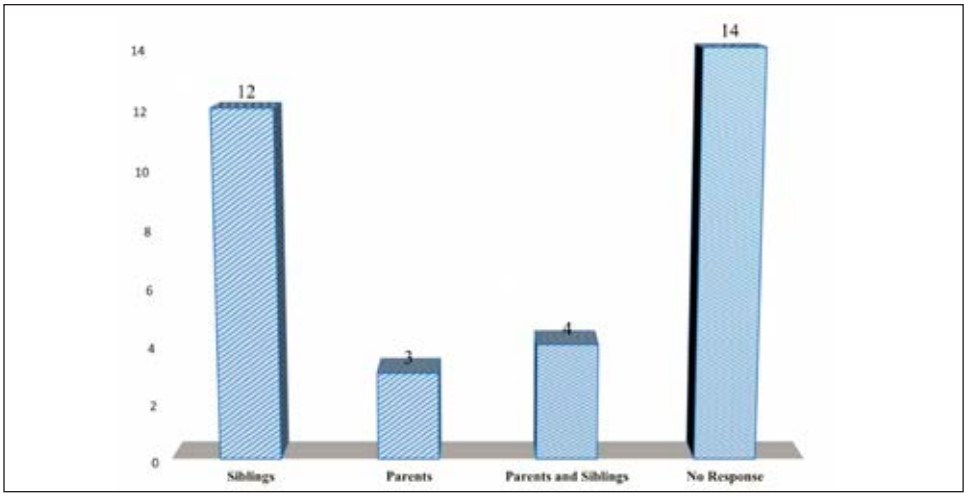

Figure 7. Family members who attended University before Respondent

22% (12) of the respondents stated that their siblings attended university before them. 5.6% (3) respondents stated that their parents attended university before them. 7.4% (4) respondents admitted that both their parents and siblings attended university before them. The remaining 25.9% (14) of respondents did not respond to the question.

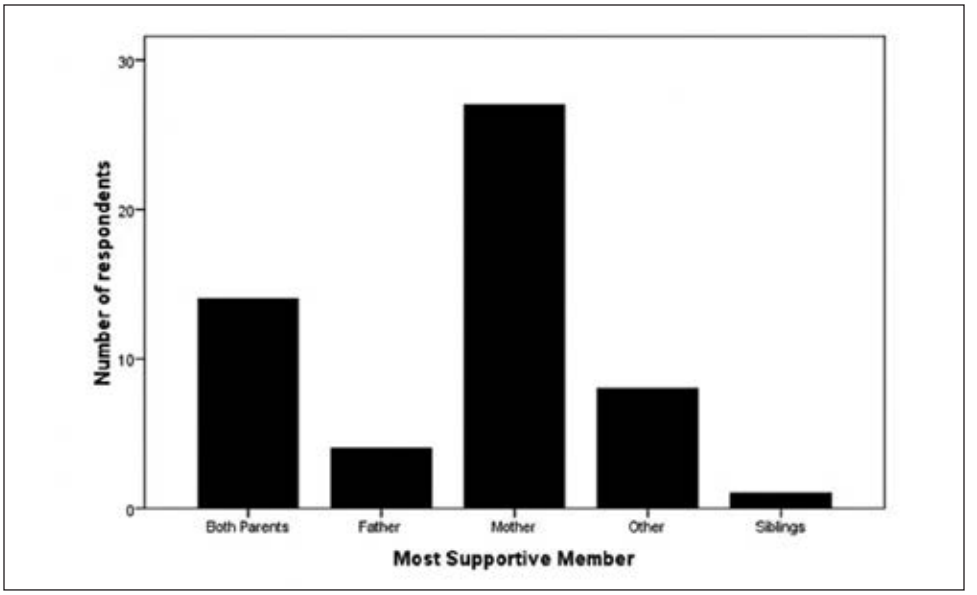

Figure 8. Persons who were very supportive of Respondent University Education

50% (27) of the respondents believe that their mothers are the most supportive of their schooling. 7.4% (7) believe that their fathers are most supportive while the remaining 14.8% (8) and 1.9% (1) believe that their siblings and other relatives/ friends are most supportive.

98.1% (53) of the respondents declared their families believe that getting an education is of utmost importance, whereas 1.9% (1) respondents insisted that the family's view of getting an education was slightly important.

Table 6. Level of Parental Involvement in Respondents Schooling

Parental Involvement	N	%
Great involvement	35	64.8
Minimal involvement	16	29.6
No involvement	3	5.6
Total	**54**	**100.0**

64.8% (35) of the respondents' parents are greatly involved in their schooling, 29.6% (16) of the respondents' parents are minimally involved in their schooling, while the remaining 5.6% (3) of the respondents' parents are not involved in their schooling.

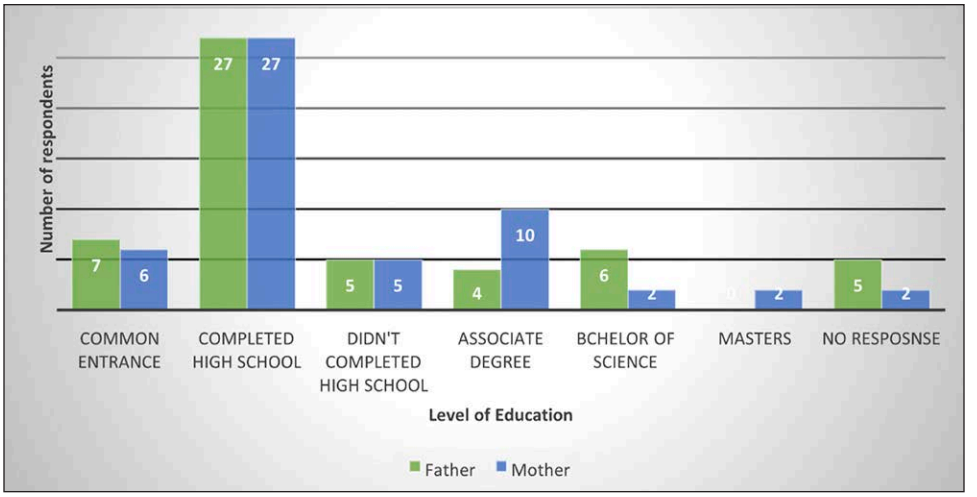

Figure 9. Comparison between mother and father's highest level of education

The majority 50% (27) of the respondents' mothers and fathers completed high school. 18.5% (10) stated that their mothers' highest level was an associate degree, while 7.4% (4) agreed to the same for fathers. Both parents each had 9.3% (5) for having not completed high school, 11.1% (6) stated that common entrance was the highest level of education of their mothers, while 13% (7) agreed to the same for fathers. Bachelor of Science accounted for 11.1% (6) and 3.7% (2) for father and mother respectively. 3.7 % (2) stated that their mother had a masters. 12.9% (7) of the respondents did not respond to the question.

Table 8. Respondents' Family's Monthly Income

Monthly Income	N	%
Below $30,000	6	11.1
$30,000-$60,000	18	33.3
$70,000-$100,000	14	25.9
$110,000-$400,000	9	16.7
$500,000 and above	4	7.4
No response	3	5.6
Total	**54**	**100.0**

Of the 54 respondents, 16.7% (9) of the respondents stated that their family income ranges between $110,000–$400,000, 33.3 % (18) chose income ranging between $30,000–$60,000, 7.4% (4) chose income ranging from $500,000 and above, 25.9% (14) chose $70,000–$100,000, 11.1% (6) selected income below $30,000 and 5.6% (3) of the respondents did not respond.

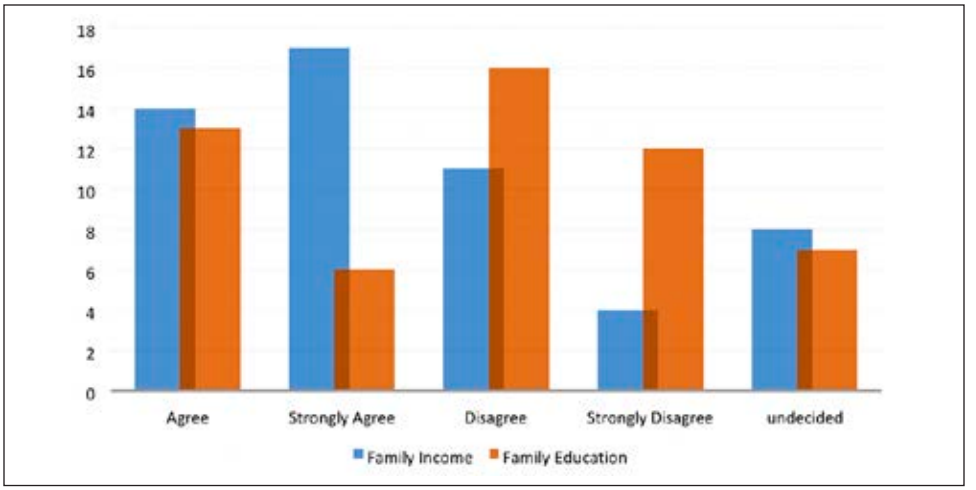

Figure 10. Respondents view on family income and education impact on academic performance

27.7% (15) of the respondents strongly agree that family income or the lack thereof affects their academic performance, 25.9% (14) of the respondents agree to same, and 20.3% (11) of the respondents disagree to same. 7.4% (4) respondents strongly disagree that family income or the lack thereof affects their academic performance while the remaining 14.8% (8) were undecided. 11.1% (6) of the respondents strongly agree that family education or the lack thereof affects their academic performance, 20.3% (11) of the respondents agree to same, and 29.6% (16) of the respondents disagree to same. 22.2 % (12) respondents strongly disagree that family education or the lack thereof affects their academic performance while the remaining 12.9% (7) were undecided.

Discussion

The correlation between parents' education and their children's academic performance has been studied for years. There has been a great deal of confusion about the consequences of this relation due to the high failure rate among students with families from low-educational backgrounds (Gooding, 2001; Flecha, 2012). In this study, results have shown that more than half of the respondents have failed one or more modules whereas less than half did not fail a module in the last three years.

It is believed that tertiary students from low-income families generally have to take into consideration transportation, food, books, boarding if the individual doesn't live close to school, and above all, tuition. These place students under undue pressure which may in turn affect their concentration in class and ultimately their academic performance. When asked "what their family's total monthly income

was?" the majority of the respondents selected the range $30,000–$60,000 while a minority of the respondents selected the range $500,000 and above; however, a few of the respondents, which accounted for 5.6% did not respond to the stated question.

It is evident from these results that more students had to acquire a student loan to cover tuition fees than those' whose tuition fees are paid by their parents. More than half of the respondents were not able to purchase school supplies while less than half of the respondents reported that they were able to purchase school supplies. This suggests that most students from this study had difficulties obtaining resources needed for school. This is supported by Renth, Buckley, & Puchner (2015) and Egalite, (2016), whose study revealed that parents' limited access to resources does pose an obstacle to their children in obtaining certain important academic tools.

While analysing this result, it was noted that the 29.6% of students who earned a GPA of 3.01 and above are the same sets of students who made up the percentage of those living at home and are able to purchase all their school supplies and tuition being paid by their parents. This finding was supported by research carried out by Von Otter (2014), who suggested that families with more financial resources are better able to provide tools for learning, hence it is believed that students from higher socioeconomic classes perform better academically. He went on to say that students from low socioeconomic backgrounds at times are faced with difficulties in acquiring funds to cover college-related expenses due to low family income, the stress of which affects their focus and concentration in class and ultimately their academic performance.

After collating all the information received, it was seen that a minority (5.5%) of respondents stated that they were unable to attend classes due to low family income. However, a majority (40.7%) of respondents stated that their family income allowed them to attend classes every day. These results further support the claim that family income has an impact on students' academics and specifically on their class attendance (Chen, & DesJardins, 2008).

During the analysis of the data, it was also found that a part of the 3.7% of respondents who failed a module, also stated that they were not able to attend class every day due to their family's low income. The Organization of Economic Co-operation and Development (2011) as cited in Renth, Buckley, and Puchner (2015), in their research explains that students of low-income families and education are not able to withstand academic challenges. Whereas children from higher socioeconomic groups are better prepared to endure the difficulties because they are able to confront challenging tasks with a better self -concept and positive

attitude. Hence, it is assumed that students of higher socioeconomic status are more likely to perform better academically than those of low socioeconomic status.

In attaining a tertiary level education, one tends to always have a set of goals or reasons as to why this level of education is necessary. After carrying out this research, it showed that 92.6% of the class chose to further their education to gain qualifications to increase prospects of a good job, which according to Latour (2018), "Is one of the most acknowledged reasons for people to seek a higher education". However, a minority of respondents are pursuing this level of education because their family is of high dependence and to gain self-confidence and edify oneself.

Persons with parents attaining a tertiary education are five times more likely to attend university (Egalite, 2016; Huffpost 2018). In this research the majority, 39% of respondents stated that they were first in their family to attend university. A majority of the respondents also reported that their parent's highest level of education completed was high school. These results indicate that though most parents have only completed up to secondary level of education, they encourage and support their children to pursue higher education. This is supported by Buchman and DiPrete (2008) as cited in Rudel (2015) and Chemagosi, (2020)., who in their research suggested that parental education plays an essential role in determining the kind and quality of education their children receive and that it directly influences children's educational aspirations, to the extent where parents expect their children to equal or surpass their educational level.

The findings suggested that participants' families viewed education to be vital and they were very much involved in the process. When asked about their 'family views on education' a majority, 98.1% of the respondents stated that education is of utmost importance. Once attending university, it is important for students to have a strong support system to help encourage and push one through school. The majority of respondents, 64.8% stated that their parents were greatly involved in their education and a minority of respondents 35.2% reported minimal or no involvement by parents. It was also evident that for 50% of respondents, their mothers were the most supportive of their schooling when compared to support from fathers 7.4% (Mueller, 2007; Lui & Lu 2008).

Limitations

1. The finding for this research could not be generalized to other undergraduate students as the study was conducted using just year 3 BSN students at one tertiary institution at the Kingston campus, Jamaica,
2. Even though persons agreed to participate in the research they did not answer all the questions on the data collection instrument.

Conclusion

Family income and education play a significant role in university students' academic performance. This study aimed to investigate the impact of family income and education on students' academic performance at a tertiary institution. This study supports the claim that there is a relationship between family income and education and students' academic performance. This study concluded that the main reason for students to complete tertiary education is to increase their job prospects, however, students' ability to do so is impacted by their family income and education level.

This study found that the majority of the respondent's total family income ranged from $30,000–$60,000 per month which is equivalent to $360,000–$720,000 a year. The majority of the respondent's tuitions were funded by student loan. The total cost of an undergraduate nursing degree at the University for the Academic Year was $420,550. Most of the students who used student loans are from families whose income ranges from $30,000-$60,000 per month. Therefore, this could be the main reason for the majority opting to pay their tuition through the use of a student loan as their family income is not sufficient to pay for tuition fees along with other school expenses.

Students who live at home, whose tuitions are being funded by their parents are better able to afford all their school supplies. They attend classes most of the time and they possess the higher range GPAs (Drajea, & O'Sullivan, 2014).

The study also showed that most students' whether they are from families of high or low socioeconomic class, their parents place a high value on education, and are very much involved and supportive in the process. Also, once the parent/s or sibling/s have attended and completed university it gives the respondents more drive to follow in their parents'/siblings' footsteps. However, it is important to note that even though some students' parents and or siblings have not attended university, they still have the determination to complete tertiary-level education to gain qualifications and increase prospects of a good job.

Recommendations

The following recommendations are posited:

1. The government could form a partnership with private sectors to create more scholarship opportunities for students of low-income families who have the desire and drive to further their education.
2. At the University, students who maintain a 3.47 and above GPA are usually

placed on the dean's list for recognition of their hard work. The researchers therefore recommend that students whose tuition is being funded by student loans and are maintaining a GPA of 3.47 and above be recommended for scholarships or grants offered to the University each academic year.

3. The institution could seek sponsorship to put in a permanent shuttle bus system that will transport students to a central location to promote safe traveling as well as reduce transportation cost.
4. Low-income families try to engage in activities that help them to better fund their children's tertiary educations. Such activities may include saving monetarily what they can afford in advance through partners or investment accounts with financial institutions such as credit unions, banks, etc., and making these funds available to their children when they are ready to start their tertiary education.

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Performance-Based Task Pedagogical Strategy for Assessment and its Effect on Mathematics Performance of Jamaican Grade Nine High School Students

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Abstract

This study aimed to address the problem of decreased performance in mathematics amongst rural Charm High School students. The researchers also wanted to determine how teachers and students perceive performance-based tasks (PBT) as an assessment strategy. A true experimental design was employed to measure the effectiveness of PBT as an assessment strategy in mathematics lessons at the school. Four research questions guided the study, querying the students' academic performance and the rated experiences of the participants as they implemented and utilized PBT in their mathematics lessons. Data were collected using pretest, post-test, Likert scale feedback questionnaires, and emotional happiness rated exit cards. The data collected were analysed using inferential and descriptive statistics. The participants were 20 teachers and 60 students who were randomly allocated. Results indicated a significant improvement in the performance of students who were exposed to PBT as an assessment strategy compared with those who were not. Teachers and students overall had a positive perception of the use of PBT in mathematics lessons at Charm High School. They agreed that PBT was an appropriate method of assessing students' understanding of mathematics concepts and ability to apply knowledge to solve real-world problems. The students indicated that PBTs increased self-assessment, motivation, and interest in learning mathematics. It is recommended that teachers of mathematics receive in-service training to effectively integrate performance-based assessment tasks into their student exercises.

Keywords: Performance-Based Tasks (PBT), STEM, 5-E Lesson Model, Formative Assessment, Rural School, NSC, Alternative Pathway to Secondary Education (APSE)

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Introduction

A major aspect of teaching and learning is assessment. According to Karakose et al. (2023), the improper use of assessment or an inaccurate assessment task can impede the learning process. To make mathematics meaningful to students, researchers have examined multiple ways of measuring students' knowledge, application, and competence in the field (Retnawati, 2016). Studies have shown that performance-based tasks (PBT) provide a means to assess students' higher-order thinking skills and assist teachers and administrators in supporting students in developing a deeper understanding of a concept (Chang et al., 2021; Retnawati, 2016). Statistics from previous research (Alkhateeb, 2018; Arhin, 2015) have also shown that performance-based assessment enables students to exhibit their abilities, embrace teacher input, accept peer evaluation, and enhance academic progress. Hence, this research focuses on examining the use of PBT as a pedagogical assessment strategy and its effect on academic performance in mathematics on a set of ninth-grade students who are perceived to be mathematically challenged. The PBT strategy was implemented as part of the elaboration and evaluation activity in a series of 5E lessons which was used as a formative assessment.

Background to the Study

Data compiled on the average mathematics pass rate from the Caribbean Examination Council (CXC) have revealed that there is a need for swift strategies to address poor performance in Mathematics. Only 38.2 percent of Caribbean students who sat the 2021 Caribbean Secondary Examination Certificate (CSEC) mathematics exam achieved a passing grade ranging from Grades 1 to 3. The statistic shows a 23 percent decline in the pass rate when compared to the year 2020, which reported a 61 percent pass rate. The grades for 2022 and 2023 were 37 percent and 43 percent respectively (MOE, 2021, 2022, 2023). The Honourable Karl Samuda, then Minister with Responsibilities for the Education Portfolio was cited in Thomas (2019) as stating that "Low academic performance in mathematics has been an issue affecting Jamaica for many years" (para. 1). Accordingly, the researchers decided to examine the issue of poor performance in mathematics

and how it can be addressed. The decision to ground the study in the subject of mathematics was influenced by the fundamental correlational nature of the subject to science and technology, STEM. The direct link that mathematics has to other subjects influences the crafting of educational policies that accentuate students' development of problem-solving and computational skills (Hansson, 2020).

By observing the positive reviews established by the literature on the effect of PBT on individuals' academic performance in other non-Caribbean territories, the researchers thought to investigate PBT more closely. Kelly (2019) explained that performance-based learning helps students acquire knowledge and skills that contribute to their overall independence and practical skills. Beyranevand (2016) supported this view and found that using performance tasks was an effective way to improve students' understanding of mathematics by applying what they know to the solution of real-world problems. The researchers chose PBT over other assessment strategies based on the claim made by Westbroek et al. (2020) that "a more fruitful approach to assessment would be to embrace PBT to improve students' understanding of mathematics" (para. 34). Performance tasks encourage self-efficacy, evaluation criteria participation, and responsibility for learning, feedback, and evaluation from peers and teachers (Alkhateeb, 2018).

Identifying the Problem at Charm School

Charm High School (pseudonym) faces a concerning decline in Grade 9 math performance. Average scores have plummeted from 56.4% in 2018 to a mere 28.5% in 2022 (Figure 1).

This translates to a significant drop in students eligible for the Caribbean Secondary Education Certificate (CSEC) math exam, with the number of potential

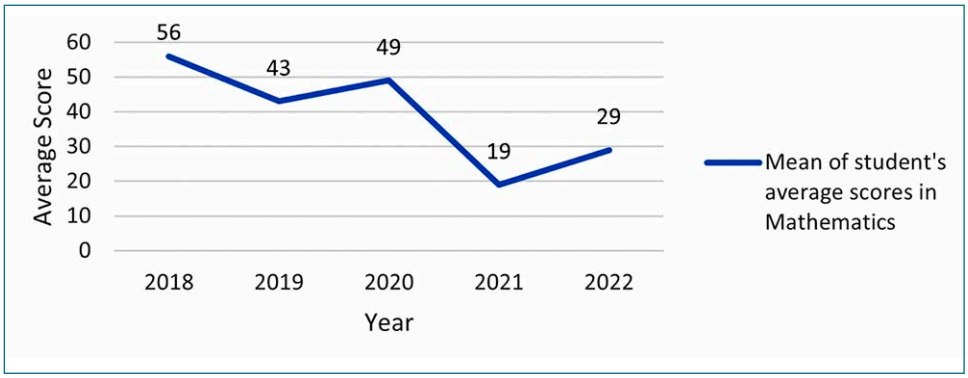


Figure 1: Grade 9 Charm students' Average Academic Performance, 2018–2022

(Source: Data from Charm High School's Students Management System, Fraser 2023)

candidates shrinking from 90 in 2017 to just 30 in 2022. December 2022 end-of-term results confirm this trend, falling below the school's 60% benchmark. Contributing factors include limited resources in Charm High's rural setting and the students' performance at the lowest level (Stage 1) on the APSE curriculum. These combined challenges suggest traditional assessment methods might not be optimal and deeper learning is needed from teaching approaches being employed. The school's situation necessitates exploration of alternative strategies, such as performance-based tasks, which may be better suited to these students' needs.

Investigating the Impact and Perceptions of Performance-Based Tasks in Grade 9 Math

In response, an intervention was assessed for PBT's effect on the Mathematics performance of Jamaican Grade 9 Charm High School students, using quantitative results to address two objectives which were guided by three research questions. Objective one: Evaluate the effect of performance-based tasks as a pedagogical assessment strategy on Charm students' performance in Mathematics - RQ1a and RQ1b null hypothesis "Ho: UEG1 = UEG2. There is no observable significant statistical difference between the mean scores received by Charm students in the experimental group before and after the intervention" and "Ho: UEG = UCG. There is no observable significant statistical difference between the mean scores received by Charm students who are exposed to PBT as a formative assessment strategy (EC) and the scores received by Charm students who are not exposed to the strategy (CG)". Objective two: Identify how students and teachers perceive the use of PBT as an assessment strategy – RQ2 "How do students rate their experience with the use of PBT as an assessment strategy at Charm high school in grade 9 mathematics lessons?" and RQ3 "How will teachers rate their experiences in trying to implement and utilize PBT in their mathematics lessons?"

When students can make sense of what they learn, it improves their understanding and enables them to transfer their knowledge across different disciplines. McTighe et al. (2020) supported this hypothesis and explained that although performance tasks can be content-specific, they can also be used as a vehicle for integrating two or more subjects and/or weaving in 21st-century skills and habits of mind. They are also able to make general conclusions, apply principles more effectively, and see mathematics in a more integrated light (Sorto & Heid, 2017). There is an emphasis on the need for meaningful learning which provides students with education through relevant, meaningful, and useful instructions (Ausubel, 1968, as cited in Sexton, 2020).

Definition of key terms in the study

Alternative Pathway to Secondary Education (APSE) curriculum. The Ministry of Education and Youth, in Jamaica has its own national curriculum for mathematics that aims to equip students with the necessary knowledge and skills to help them apply math concepts and solve real-world problems (Ministry of Education and Youth, 2016). The APSE curriculum has three levels, with three being the lowest. Each level is taken from the National Standards Curriculum (NSC), and the difficulty and complexity of each level are adjusted based on the literacy and numeracy levels of the learners.

Elaboration Activity. This is a component of the STEM 5E lesson model where during the lesson students are provided with learning activities, which help them make connections between their lives, and the concepts being covered (National Standards Curriculum – APSE III – Mathematics, 2019). It is at this point in the lesson that the teacher incorporates resources through effective strategies to allow students to develop a deeper understanding of concepts by helping students know how their knowledge can be applied and why the content is relevant. Thus PBT was the assessment strategy used to pull on students understanding, and application of the concepts covered.

Evaluation Activity. This is another component of the STEM 5E lesson model where teachers make use of formal and informal assessment strategies to observe their students to determine the progress being made or the extent to which learning has taken place (National Standards Curriculum – APSE III – Mathematics, 2019). Students are given a chance to demonstrate their understanding of key components of the lesson from this activity. Therefore, PBT was used as an assessment strategy to determine how well the students grasped the concepts covered.

Exit cards. Patka et al. (2016) defined an exit card as a short question or prompt written by a teacher that students respond to by providing feedback about what they learned, the challenges with the material, and their experiences, and requesting additional help. The teacher-researcher created colourful exit cards for each student to complete at the end of each lesson on exiting class. The exit cards contained two Likert-scale questions with smiley or sad face options (instead of numbers) to assess student attitudes and experiences with the day's PBTs. This approach ensured quick responses and avoided concerns about participant random answers. The researcher converted the smiley faces to numerical values (e.g., sad face = 1, smiley face = 5) for data analysis. These exit tickets provided immediate feedback and allowed comparison with the student questionnaire at the end of the intervention.

PBT Assessment versus Competency-based Assessment. Performance-based

assessments evaluate students' ability to apply concepts learned to produce a product or solve a problem using specific contexts while competency-based assessments evaluate skills, knowledge, and attitude across multiple contexts (Prince, 2020).

Pedagogical approach. A pedagogical approach includes all a teacher's actions taken to facilitate student learning, and the strategies and steps taken during the teaching of a lesson (Devonish, 2018; Killian, 2019).

P**erformance-based task (PBT).** "Any learning activity or assessment that asks students to construct a multifaceted response, create a product, or produce a demonstration – in other words, to perform with their learning to demonstrate their knowledge, understanding, and proficiency" (McTighe et al., 2020, p.12). In this research, PBT was used as a pedagogical assessment strategy, where students applied their knowledge, not just memorized facts. PBTs helped expose students to practical applications of math through real world simulated activities.

STEM education. "STEM education is an interdisciplinary approach to learning that removes the traditional barriers separating the four disciplines of science, technology, engineering, and mathematics and integrates them into real-world, rigorous, and relevant learning experiences for students" (Vasquez et al., 2013, p. 4).

The Use of Performance-Based Tasks in Mathematics Lessons

Conceptual Framework

Figure 2 visually depicts the expected positive impact of performance-based tasks (PBTs) on student achievement (Swaen & George, 2022). The teacher selected a sample of adequately literate Charm students who were assessed three times weekly. These in-class activities, where students solve real-world problems using math concepts, aim to boost engagement, problem-solving, collaboration, and higher-order thinking (Chang et al., 2021; Albay & Eisma, 2021; McTighe et al., 2020; Makmuri & Kharis, 2021).

Bridging the Gap: Exploring the Effectiveness of Performance-Based Tasks in Jamaica

Performance-based tasks (PBTs) are gaining traction in education, especially STEM academies and strand school formats (Ernst & Glennie, 2015). Research suggests they can be beneficial, promoting knowledge acquisition (Magsino, 2017) and skill development (Yildirim & Orsdemir, 2013). PBTs may also encourage higher-order thinking (Mahendra et al., 2019) and increase student motivation

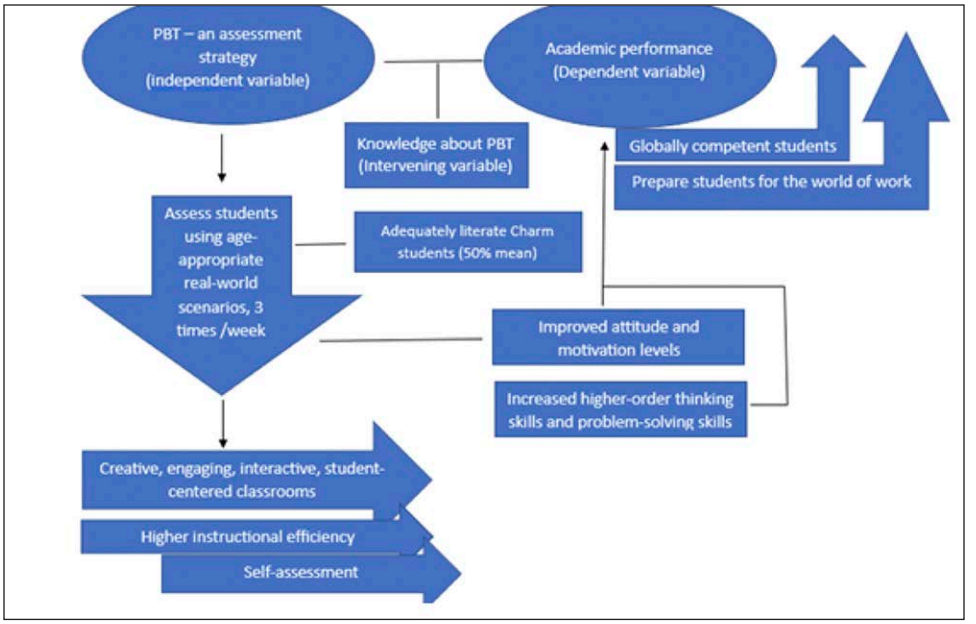


Figure 2: The PBT Assessment Strategy Conceptual Framework

compared to traditional assessments (Arhin, 2015; Hancock, 2007). However, some studies suggest potential drawbacks, such as increased teacher workload in creating and assessing PBTs. Additionally, some students might experience anxiety with open-ended tasks. Further research is needed to explore the long-term effects of PBTs across diverse contexts.

There is a difference between performance-based tasks (PBTs) and project-based learning (PBL), although they share some similarities. Performance-Based Tasks (PBTs) has a focus to assess a specific skill or set of skills, it is shorter in duration (can be completed in a class period), it is more teacher-directed, with clear instructions and expectations and the product can involve a variety of products like presentations, essays, models, or demonstrations. Both involve applying knowledge and skills to solve problems or create something. Both can promote critical thinking, communication, and collaboration skills and can be used as assessment tools. In essence, PBTs are a focused assessment tool within a broader learning approach like PBL. PBL can incorporate PBTs as smaller assessments throughout the project to gauge student understanding.

Reid-Brown (2017) found that PBL's practical activities increased student engagement and content retention in Jamaican eighth graders. This may suggest that similar benefits might be achievable with PBTs. However, though there may be limited research that has examined the effects of performance-based tasks (PBTs)

on student achievement in Jamaica compared to PBL. This gap in knowledge justified investigating the effectiveness of PBTs in enhancing student achievement in Jamaican classrooms, along with how teachers and students perceive their use.

Difficulties in Implementing Performance-Based Tasks in Mathematics Lessons

Performance tasks (PBTs) in math, like any assessment, have hurdles. Studies reveal teacher challenges: crowded classrooms, limited time for complex tasks, and lack of resources (Metin, 2013) and supported by Vasiliene-Vasiliauskiene et al. (2020) though speaking on project-based learning (PBL). Students might struggle with foundational skills, motivation, or confidence (Retnawati (2016). Teachers themselves may grapple with understanding higher-order thinking skills or lack resources to create effective tasks (Alibraheim & El-Sayed, 2021) and Wilson (2020). Though some studies reference project-based learning (a close relative of PBTs), they all point to similar hurdles for successful PBT implementation in math classrooms.

PBTs can be frustrating for young students due to the gap between their current knowledge and the problem-solving skills required (Goldstein, 2016; Demirel et al., 2013). This aligns with Vygotsky's learning theory, where learners need support (scaffolding) to bridge the gap between what they can do independently and what they can achieve with help (Vygotsky, 1978). However, Demirel et al. (2013) and Goldstein (2016) specifically focused on very young children who lacked literacy skills, which are crucial for PBT success and since PBTs rely on a certain level of numeracy and literacy for independent work, the teacher-researcher applicably chose older students (grade 9) to assess PBTs effectiveness in improving academic performance, since the Charm students had literacy challenges.

Performance-Based Task as an Assessment Strategy in the Jamaican Context

The Jamaican National Standards Curriculum (NSC) incorporates performance-based tasks (PBTs) within the Primary Exit Profile (PEP) assessment. This change has resulted in a shift from the traditional assessment methods where students would do a single sitting of the Grade Six Achievement Test (GSAT) to the Primary Exit Profile (PEP) examination, which is done as five separate assessments. There are three performance task assessments done in Grades 4, 5, and 6, an ability test and a curriculum-based test, done in Grade 6 (National Assessment Plan, 2020). The PEP assessment instruments are designed to ascertain students' performance through the demonstration of 21st-century skills aligned with the NSC (Ministry of Education & Youth, 2023). While the PEP demonstrates the national commitment

to PBTs, research and documented implementation specifically within Jamaican, STEM lessons transitioning through Secondary school student years appears limited.

The use of PBT for this Jamaican case study. This study leveraged Performance-Based Tasks (PBTs) tailored to Jamaican NSC standards. As seen in the intervention plan, these tasks went beyond basic application (Level 3 of Bloom's Taxonomy and Webb's DOK). For example, students-built models showcasing the connection between area and circumference of a circle in construction (Level 6 of Bloom's Taxonomy, DOK 4). PBTs like these, aligned with the national focus on real-world application, presented scenarios like calculating construction areas, garden fencing, production material volume, and water park pool areas. The researcher deliberately included discussions about professions that utilize these mathematical concepts, fostering integration of Science, Technology, Engineering, and Mathematics (STEM) fields. This approach aligned with the 5E model's emphasis on applying knowledge and the NSC's focus on critical thinking and problem-solving. Ultimately, these PBTs, as detailed in the intervention plan, fostered active learning, collaboration, and real-world application of mathematical concepts, while also preparing the nation's students for understanding Mathematics within the overall development of 21st-century competencies outlined by the NSC– communication, collaboration, critical thinking, and creativity (Kelly, 2019).

Methodology

This research on the effectiveness of performance-based tasks on Mathematics performance among Grade nine Jamaican high school students utilized a quantitative tradition with a true experimental design and a descriptive design.

Figure 3 was developed to show how the teacher-researcher observed and quantified teachers' and students' ratings of the use of PBT for presenting descriptive statistics. Figure 4 shows how the experimental design was used in this research.

Figure 4 shows that the researchers randomly assigned participants to a control group (CG) and an experimental group (EG) from the research sample. A test was administered to the EG and the CG before any treatment. The experimental group was assessed using age-appropriate PBTs. A posttest was administered to both groups again. The test scores before and after implementing the PBT strategy were used to determine if there was a statistically significant difference in the test scores between the EG and the CG. The effect of the treatment was measured by taking the difference between the pretest and posttest scores for the

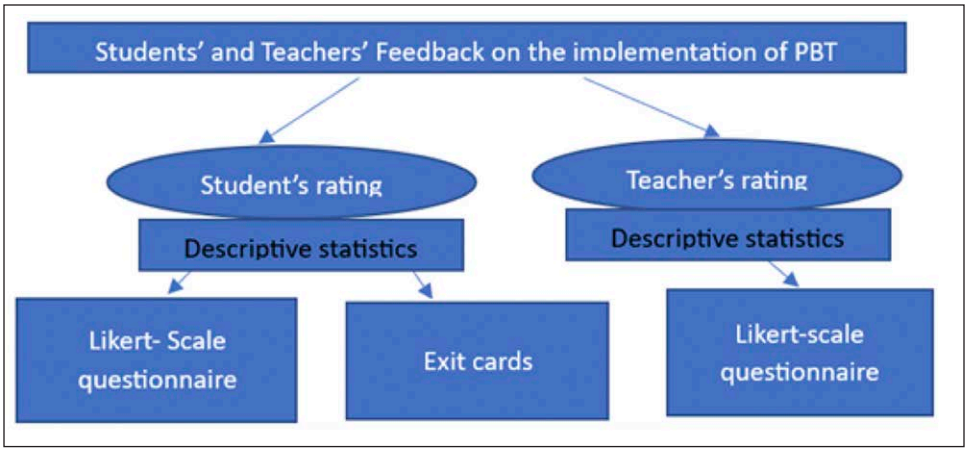


Figure 3: Descriptive Research Design

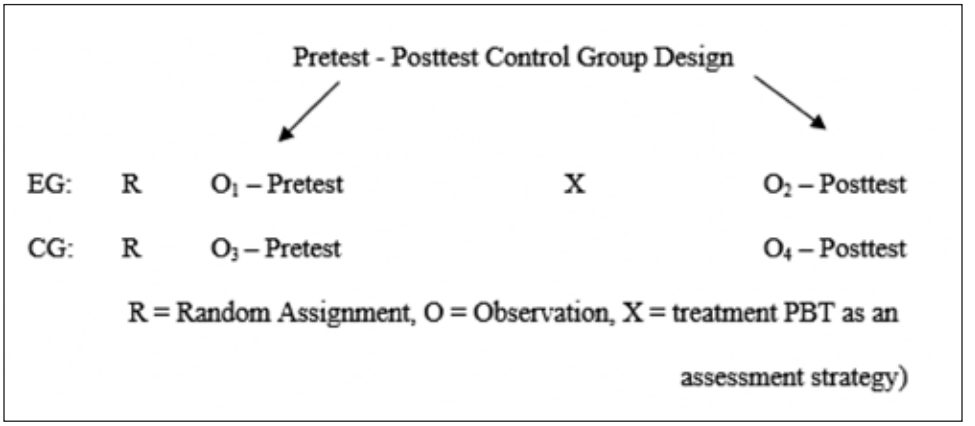


Figure 4: The Pretest – Posttest Control Group Design

experimental group (O2–O1), and the difference between the pretest and posttest scores for the control group (O4–O3), and then comparing those differences for both groups (O2–O1) – (O4–O3).

Data collection method

Three quantitative data-gathering methods were utilized, i.e., test scores, exit cards, and two quantitative Likert-type scale questionnaires: "Teacher's experience and feedback Questionnaire" and "Student's experience and feedback Questionnaire". The study utilized three instruments and the validity and reliability of the instruments were confirmed (see table 1).

Table 1: Pretest, posttest, and Questionnaires validity and reliability scores

	Test type	Pretest score / 1	Post test score/1	Student Questionnaire	Teacher Questionnaire
Validity	Pearson Correlation Coefficient	0.91	0.91	0.78	0.75
Reliability Internal reliability	Cronbach's Alpha	0.82	0.82	0.84	0.77
Stability	Pearson Correlation coefficient	0.76	0.93		

The Selection site and context

The research took place at a rural, co-educational government high school in central Jamaica. The school operates on a shift system, with classes running mornings and afternoons, hosting two populations of students. Eighty percent (80%) students matriculate into Charm school after completing their primary exit exams (PEP), while the remaining 20% were transfers or placements. It's important to note that around 35% of incoming students face challenges with literacy and numeracy. To address this limitation and ensuring successful engagement with real-world tasks, the researchers selected participants who achieved an average entry score of 50% or higher across all subjects.

Each math class receives six 30-minute sessions per week, totalling three hours of math instruction. This exceeds the National Standards Council's minimum recommendation of 2 hours weekly for STEM subjects at the secondary level. The researchers capitalized on this existing 3-hour schedule to implement the performance-based tasks (PBTs) as part of the math curriculum.

Access to the site

This was via a formal approach and the Institutional Review Board certified processes were undertaken. Several ethical considerations were taken to ensure that the research process was safe and fair to all participants.

The research setting

Classes were face to face on the 9th block and school operations had been fully face-to-face since January 2022 following online classes which lasted for over 2

years. Only 30 percent of the students attended classes online during the COVID lockdown because the internet reach was limited in the rural region where the school is situated.

The Sample

The study used a convenience sample of 60 Grade 9 students (30 girls, 30 boys) with an average English score and overall subject score of 50% or higher. These students came from two homogenous math classes (Streams 2 and 3). To ensure group balance, a simple random sampling technique assigned 30 students each to the control group (CG) and the experimental group (EG) (see Figure 3). This sample size (60) meets the minimum requirement for a valid t-test at 95% confidence interval (Zach, 2021). This sample of students allows for data collection relevant to Research Questions 1 and 2. The school's math department boasts 20 teachers, including the researcher and the department head and this was the data source for research question 3.

Method of data analyses

The inferential statistics – Levene's t-test, was used to formally test the hypothesis and make estimates about the population. To understand the distribution and characteristics of the data, descriptive statistics were used to comment on the effect of PBT as an assessment strategy on the academic performance of Charm students (RQ1), and how teachers and students rate their experience with the use of PBT (RQs 2 & 3).

The Intervention

The duration of the study was five weeks, based on the recommended duration of the lesson unit and the time needed for meeting with participants, conducting pre and post-tests, and collecting feedback. However, the strategy must be implemented for at least two hours weekly so that students will develop confidence in responding to PBTs (Hollandsworth & Trujillo-Jenks, 2020). The contextual basis for the intervention in the table 2, highlights the importance of designing a coherent and research-informed curriculum that addresses student needs and aligns activities with specific objectives (Foster et al., 2021). These are key geometry topic concepts, circles, arcs, sectors, segments, and spheres. Misconceptions students display include: (1) shape recognition and classification (confusing shape and depending on familiar orientation to identify shapes); (2) properties of shape (misunderstanding

angles or the symmetry concept); (3) spatial reasoning (the shape from different perspectives may be confusing), as well as (4) measurement (units, scaling applying formulae or visualizing the problem).Teachers must possess specialized knowledge in geometry and measurement to effectively address common misconceptions and facilitate meaningful learning (Acevedo-Rincon, 2020; Weiland et al., 2021). By integrating geometry into real-world contexts, students can better appreciate the significance of mathematics and apply their knowledge to practical situations (Hwang et al., 2020).

Table 2: Intervention Plan

Date	**July 3, 2023**		**July 4, 2023**			**Context**
Activity	-Meet with participants -Issue permission letters		-Randomly assign participants to control and experimental groups -Collect returned permission slips from students -Conduct pretest			This step was used to obtain consent and inform participants of their rights and responsibilities.
Comment	This step was used to obtain consent and inform participants of their rights and responsibilities.		The researcher used a pretest-posttest design. The experimental group received PBT as a treatment.			
PBT Lessons begin with an experimental group						
	Topic	**Specific Objectives**	**PBT activity (level 1–6)**	**Duration**	**Comment**	**Context**
Lesson 1	Parts of a circle Circumference of a circle	-Identify the different parts of a circle -Identify the relationship between the radius, diameter, pi, and the circumference of the circle	Group Task: Circular Garden Bed (Level 3) Fencing task Individual Task: Theme Park circular path task	July 4–14, 2023 (4 hrs)	-These group task allows for collaboration and communication as supported by the NSC. -Exposure to problem-solving in real-world contexts - Develop students for the world of work	Topic Choice: Geometry concepts were chosen based on identified learning gaps. Alignment: The "Circular Garden Bed" task aligns with curriculum objectives on circumference. Addressing Challenges: The "Water Park Circular Pool Area" task addresses common misconceptions about sector area.

Table 2: Intervention Plan (*cont'd*)

	Topic	Specific Objectives	PBT activity (level 1–6)	Duration	Comment	Context
Lessons 2 &3	Length of an arc Area of a circle Area of a sector Area of a segment	-Calculate the circumference of a circle -Correctly find the length of an arc using angles Correctly calculate the area of a circle Find the area of a sector that corresponds with a given angle with accuracy Calculate the area of a segment accurately using angles	Group Task: -Garden circular steppingstone construction task -Circular flower bed design task Individual Task: Water park circular pool area task	July 17–28, 2023 (6 hours)	-Learning experience from the real world -Students immersed in the teaching and learning process -A student-centered classroom.	Students struggled with calculating the area of a sector correctly, so the "Water Park Circular Pool Area" task was designed to provide hands-on experience and improve their understanding. Connection to Real-World: The use of real-world contexts, such as gardening, construction, and amusement parks, was intended to make the learning experience more relevant and engaging for the students. The practical value of these topics is to develop a deeper understanding.
Lesson 4	The volume of a sphere	Calculate the volume of substance within a sphere with at least 80% accuracy	Group Task: Bearing ball construction: Volume task Individual: Sphere glass production	July 31–August 4, 2023 (3 hrs)	Students made use of creativity, HOTS, and problem-solving skills	Topic Choice: Understanding is essential for calculating the capacity of containers, the mass of objects, and other practical applications, needed for scientific or architectural applications. Alignment: the topic volume in geometry or measurement contribute to students' overall understanding of three-dimensional shapes and their properties. Addressing Challenges: Students often struggle with the concept of volume, especially when dealing with irregular shapes or complex formulas. Connection to Real-World: The "Bearing ball construction" and "Sphere glass production" tasks provide students with opportunities to see how the concept of volume realistically

Table 2: Intervention Plan (*cont'd*)

Date	Activity	Comment
August 7, 2023	– Conduct posttest – Issue and collect questionnaires to teachers and students – Thank the participants	Students and teachers' feedback was collected and secured in a safe cabinet

Note: Table 2 guided the intervention. The teacher-researcher engaged students for 60 minutes three times per week which was the number of hours timetabled for mathematics for each class during summer school. The duration for a complete lesson at Charm High is two weeks. However, each lesson covered at least two topics so the assessment strategy was used as part of the elaboration and evaluation activity at least four times during the intervention. The teacher-researcher was responsible for monitoring the intervention and recording statistical data in the form of test scores, questionnaire responses, and exit card responses. The activities used allowed for a student-centered classroom. The use of real-world questions in PBT assessments encouraged principles outlined in the constructivist learning theory such as active involvement for the learners in the teaching and learning experience. The NSC also encourages communication, collaboration, creativity, and critical thinking which students apply in problem-solving in PBTs.

The study compared two approaches to teaching mathematics, the Experimental Group (PBT) with the intervention and the Control Group. The PBT method employed a hands-on, collaborative approach, emphasizing group projects, presentations, and peer assessments to develop critical thinking and real-world application skills in a student centered context. The researcher facilitated these activities, guiding discussions and encouraging exploration. Conversely, the Control Group followed a traditional pedagogical approach, focusing on lecture-based instruction, individual worksheets, and standardized testing without application or higher-level questioning. Evaluation in the Control Group relied heavily on traditional testing methods, measuring only mathematical operations and recall, with limited feedback. The PBT group engaged in more in-depth elaboration through discussions and problem-solving, while the Control Group had limited opportunities for elaboration. Assessment methods also differed, with PBT using formative assessments like peer review and self-assessments, while the Control Group primarily used standardized testing. To ensure consistency and minimization of teacher effects, both groups were taught by the same instructor. (See appendix for sample lesson activities of the PBT Control group.)

Results

Response Rate

Table 3 shows the exit card response rate per lesson. Lessons 2 and 4 had a 100 percent response rate while lesson three had a 97 percent response rate and lesson one had a 93 percent response rate. All students responded to the questionnaire used to collect statistical data on their rating of the use of PBT at the end of the summer session.

Table 3: Experimental Group Exit Card Response Rate

Lesson	Topic	Sessions 2hrs/session	Frequency	Rate (%)
1	Parts of a circle; circumference of a circle; and arc length	3	28	93
2	Area of a circle	2	30	100
3	Area of sector and segment	3	29	97
4	Volume of a sphere	2	30	100

Exit cards were used to gather immediate student feedback after each lesson. These cards contained two Likert-scale questions using smiley/sad faces (later converted to numerical values for analysis) to assess student attitudes and experiences with the day's Problem-Based Tasks (PBTs). The response rate indicates the percentage of students who completed the exit card for each lesson. A 100% response rate means all 30 students in the experimental group completed the exit card. The frequency column shows the actual number of responses received. Each lesson consisted of multiple 2-hour sessions, focusing on specific geometry topics as listed. This approach provided quick, consistent feedback and allowed for comparison with the end-of-intervention questionnaire, which had a 100% response rate from all students.

Research Question 1a. A paired-samples t-test was conducted to compare student performance before and after exposure to Problem-Based Tasks (PBT) as an assessment strategy. Assumptions were first checked: a Shapiro-Wilk test conducted on difference scores ($W = 0.97$, $p = 0.523$) indicated normal distribution, and no significant outliers were confirmed through box plot inspection.

Table 4: Statistical results for research question 1b.

Pretest: M = 42.2, SD = 14.7
Posttest: M = 62.7, SD = 19.5
Mean difference: 20.5, 95% CI [13.5, 27.5]
Paired t-test: t(29) = 5.98, p < 0.001, d = 1.09

Charm students who were exposed to PBT showed an increase in test scores by an average of 20.5% (range: 3% to 51%). There was a statistically significant improvement in student performance after exposure to PBT, with a large effect size. The null hypothesis was rejected ($p < 0.001$).

Research Question 1b. An independent-samples t-test conducted to compare posttest scores

Shapiro-Wilk test conducted for EG ($W = 0.96$, $p = 0.317$) and CG ($W = 0.97$, $p = 0.581$), indicating normal distribution for both groups. The homogeneity of variances: Levene's test, $F(1, 58) = 0.72$, $p = 0.400$, indicating equal variances. Independence of observations was confirmed through study design.

Table 5: Statistical results for research question 1b

EG Posttest: M = 62.7, SD = 19.5
CG Posttest: M = 53.4, SD = 18.2
Mean difference: 9.3, 95% CI [0.15, 18.8]
Independent t-test: t (58) = 1.97, p = 0.027, d = 0.51

Students exposed to PBT performed statistically significantly better than those who were not, with a medium effect size. The null hypothesis was rejected ($p = 0.027$; $p<0.05$).

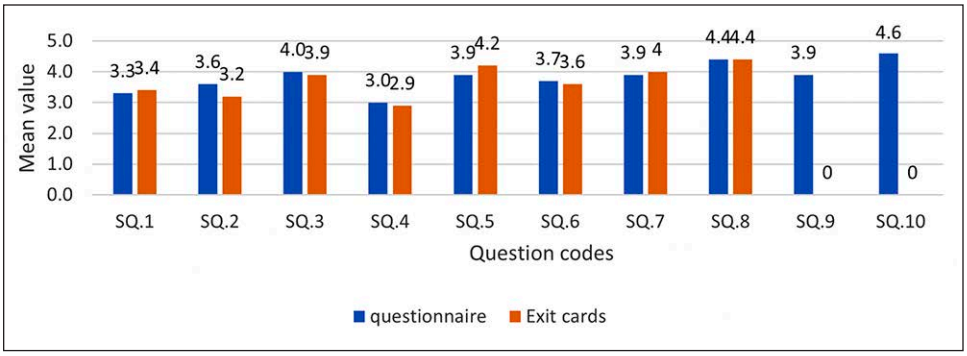
Overall the power analysis revealed:

RQ-1a: Achieved power = 0.99, given $\alpha = 0.05$, n = 30, and observed effect size d = 1.09

RQ-1b: Achieved power = 0.81, given $\alpha = 0.05$, n1 = n2 = 30, and observed effect size d = 0.51

These power analysis results indicate that both tests had sufficient statistical power to detect the observed effects, with RQ-1a having particularly high power due to the large effect size.

Research Questions 2 assessed students' perceptions of PBT. The student's feedback showed a positive overall viewpoint, with high agreement (out of five) on PBT's ability to increase self-assessment ($\bar{x} = 4$), motivation ($\bar{x} = 3.9$), and interest



in learning mathematics ($\bar{x}$=3.9). They also found the PBTs to be appropriate for their background knowledge (=3.7 $\bar{x}$), leading to satisfaction with the overall use of PBT in class.

Table 6: Complete Profile for Two Students

Effect	Student 18 (S.18)	Student 6 (S.6)
Pretest score/100	62	19
Posttest score/100	98	16
Student's overall rating of PBT	4.3	3.1
Student's Feelings after PBT lessons	4	2.3

Table 6 shows that the test score for S.18 statistically significantly improved by 36 percent ($p<0.05$). This student had an overall rating of the PBT intervention 4.3 which indicates that the student agreed with the use of PBT in mathematics lessons because of its ability to increase motivation, interest, and ability to self-assess, its application of students' background knowledge in problem-solving, and its appropriateness and effectiveness as an assessment strategy. S.18 also had an overall happy feeling about PBT lessons which corresponded with his/her rating of the PBT intervention. On the other hand, S.6's test scores declined by 3 percent. This student had a neutral rating of the PBT intervention and generally felt sad after the lessons. The possible meanings of these results is discussed.

Research Question 3 assessed the teachers' perceptions. Teachers reported positive views of Performance-Based Tasks (PBTs). Their average ratings (out of 5) showed benefits for student learning (3.6), applying knowledge (4.1), and overall experience (4.1). Figure 5 summarizes their feedback with key questions and average scores (≥ 3.5 indicates agreement). Teachers agreed or strongly agreed that PBTs benefit learning (TQ.10, $\bar{x}$ = 4.6), improve real-world application (TQ.4, $\bar{x}$ = 4.1), and create a positive student experience (TQ.6 & TQ.8, $\bar{x}$ = 3.6 & 4.1). However, their response to one question (TQ.2, $\bar{x}$ = 3.3) was more neutral.

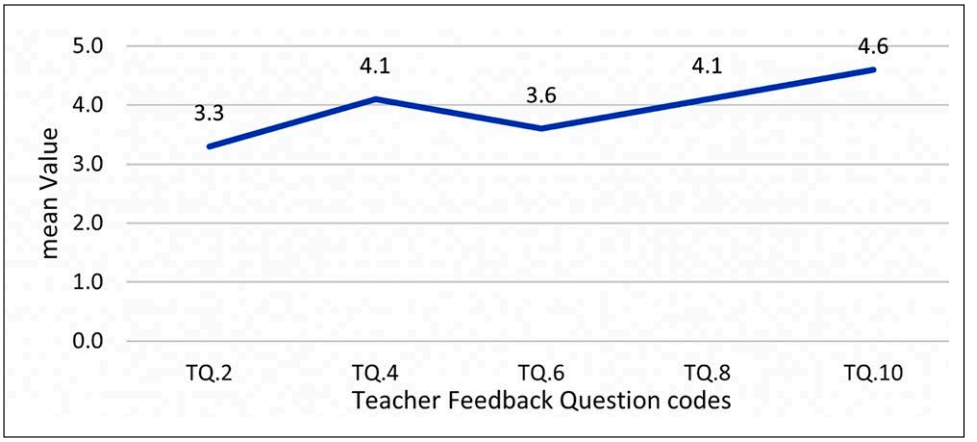


Figure 5: Teacher Feedback Questionnaire – Mean Value

Key – TQ: teacher question

Discussion

Student Performance Post Exposure to PBT as a Mathematics Assessment Strategy

Research question 1a. Charm students' math performance was assessed using performance-based tasks (PBTs). A statistical test rejected the null hypothesis (no difference in scores), suggesting PBTs led to a statistically significant improvement (alternative hypothesis: scores differ). There is an observable significant statistical difference between the mean scores received by Charm students in the experimental group before and after the intervention. The majority of students (24) 80 percent improved and the study shows an 80% improvement in test scores with performance-based tasks (PBT), challenging traditional Jamaican teaching methods. PBT aligns with Jamaica's NSC curriculum, promoting active, student-centered learning and critical thinking. It addresses performance disparities by creating inclusive, relevant experiences, often using local contexts with references to familiar Jamaican spaces or items. PBT's hands-on nature increases motivation, especially for previously marginalized students. The findings advocate for adapting teaching practices and enhancing teacher training to incorporate PBT, benefiting both students and teachers. This research supports educational innovation that respects local culture while serving Jamaica's diverse student population more effectively.

However, (6) 20 percent of students showed no improvement or a decline one-20 percent. While Pan & Sana (2021) note post-test scores might be higher due to the nature of the assessment, factors like anxiety or a bad day could also play a role (Moore et al., 2019). This study's pre-test/post-test design limits exploring these possibilities. Arguably, among at-risk APSE students in this marginalized non-traditional Jamaican high school, this 20% of students, already struggling with low reading levels, face additional challenges including socio-economic disparities, cultural attitudes devaluing certain subjects, and ingrained passive learning habits. Psychological factors and non-inclusive environments may further hinder their engagement with PBT, highlighting the need for comprehensive support in these challenging educational contexts. Additionally, factors like motivation or engagement could be at play. The decline in scores for some student (20 percent) highlights the need for closer monitoring of problem-solving abilities (Arhin, 2015). This might require an individualized teacher-student approach to enhance problem-solving skills for all students. Overall, improvement scores varied three-51 percent, suggesting the impact of PBTs differed per student. Classroom size, teacher approach, and students' metacognition (Wafubwa & CsÁkos, 2022) might also explain these variations.

At Charm this varied improvement (3–51%) with performance-based tasks reflects diverse challenges including personal factors like low confidence, but the impact of socio-economic issues and limited resources can critically impact academic success (Daniele, 2020). Therefore, students' success often depends on intrinsic strengths, family support, and effective study habits. Then there is the factor of teacher effectiveness and tailored instruction for addressing individual needs and promoting consistent improvement among these at-risk learners. This study is a pivotal reinforcement for the researcher to maintain a student centered classroom for Charm students, even those who struggle with reading.

Performance Comparison Between Grade 9 Students' Exposures to PBT

Research question 1b asked if the PBTs improve performance compared to a control group being taught without PBTs. Statistical analysis rejected the null hypothesis (no difference), indicating a significant difference in favour of the PBT group (EG) compared to the control group (CG). PBT exposure (EG) led to a 20.5% test score increase compared to the control group, potentially due to increased student motivation and engagement (Chemeli, 2019; Mahendra et al., 2019). Jamaica's student success is aligned to high stakes exam and if Charm students continually improve scores, it can significantly enhance these Jamaican students' academic and career prospects. By fostering a deeper understanding of

mathematics, these improvements can boost confidence, open doors to higher education, and increase employability. Additionally, improved mathematical skills can positively impact performance in other subjects, raising student morale and creating a ripple effect of achievement throughout the Charm community. Ultimately, this can lead to long-term economic benefits for Jamaica. However, lower improvement scores suggest exploring social factors that might hinder some students (Goldstein, 2016). It also highlights the competency gap between children and teachers' ability to distinguish between students who can work independently (Demirel et al., 2013).

In addressing students' self-reported perceptions (RQ2), while PBTs increased motivation and interest for most students, those with lower literacy and numeracy levels struggled (Goldstein, 2016). Addressing these foundational skills is crucial. Scaffolding instruction (Vygotsky) could address knowledge gaps, and additional numeracy support especially since Charm students are at risk, but the research shows that they too can benefit from such teaching approaches.

Encouragingly, students expressed a desire to use PBTs again, suggesting some level of self-directed learning (Reid-Brown, 2017). Self-assessment fosters autonomy, self-awareness, and responsibility and this is positive for Charm Jamaican students, promoting personalized learning and critical thinking skills for further development. Interestingly, low-scoring students also had low satisfaction scores, potentially indicating self-awareness of their academic needs (Fastré et al., 2010). Further research is needed to explore the link between PBTs and self-assessment skills. However, Charm students' perceptions of PBTs may be influenced by cultural, educational, and socioeconomic factors, but their emphasis on community and collaboration makes PBTs relevant. Exposure to diverse assessment styles encourages positive attitudes, while the traditional rote learning and socioeconomic factors can influence perceptions, thus emphasizing the importance of the research understanding these contexts for effective PBT implementation.

Teachers' Rating of Their Experiences Using PBT in Mathematics Lessons (RQ3)

Research question three explored teachers' perspectives on implementing performance-based tasks (PBTs) in their mathematics lessons. Overall, teachers reported a positive view of PBTs as an assessment strategy in mathematics for Charm students ($\bar{x} = 3.6$ of 5). Furthermore, all teachers expressed an intention to integrate PBTs into future lesson plans. This is noteworthy considering that

(5) 26% of teachers did not consistently implement PBTs throughout the study.

PBTs align with Jamaica Charm's cultural values of community and teamwork, but challenge traditional teaching methods focused on rote learning. Implementing PBTs requires a shift towards critical thinking, collaboration, and real-world problem-solving, which may face resistance from educators accustomed to standardized testing and pressure to complete a syllabus for high stake exams (Haywood, 2019).

Admirably, their intention to use them in the future suggests that, despite initial challenges, teachers now recognize the potential benefits of PBTs for student learning and their own teaching approach. This aligns with the emphasis on problem-solving and mathematical reasoning within the national curriculum (National Council of Teachers of Mathematics, 2000; Program for International Student Assessment, 2003). By utilizing PBTs, teachers can engage students in meaningful learning practices that are consistent with global trends in mathematics education, ultimately benefiting Charm students.

Performance-based tasks (PBTs) can significantly impact learning and knowledge retention (Kon, 2015). By requiring practical application of concepts (O'Rourke, 2021), PBTs can nurture STEM skills and higher-order thinking (analysis, evaluation, synthesis) through tasks aligned with Bloom's Taxonomy or Webb's Depth of Knowledge (Ernst & Glennie, 2015). Furthermore, making them relevant to real-life scenarios can boost student motivation.

While STEM goals highlight the importance of technology and real-world application in math education, they create challenges for teachers who need both pedagogical knowledge and ICT competence, to cope with the "complex, dynamic process of constructing/developing mathematical knowledge" (Kohen & Kramarski, 2018, 279). Despite these challenges, the positive teacher ($\bar{x}$=4.1 of 5) and student ($\bar{x}$=4.1 of 5) experiences suggest that motivated learners can improve teachers' approach and inspire creative teaching methods (Chemeli, 2019) and the enjoyment level which should be associated with math.

Conclusion

The changing trend in mathematical research in Jamaica shows the growing importance of performance indicators and educational attainment along with the need to measure and compare educational outcomes. Drawing on constructivism, this research was designed to use PBT to support students' learning in mathematics. It was also designed to adjust teaching, meet learner's needs to influence more effective mathematics instructions, and make the educational processes more

effective. Findings indicated positive impacts on student achievement, aligning with theories that link learning experiences to academic performance. Furthermore, based on the results of this study, it can be said that the use of Performance Based Tasks (PBTs) positively impacted the academic performance of Charm students. The statistically significant difference found between the test scores of the (EG) students before and after intervention ($P<0.001$) and of the experimental and control groups ($P = 0.027$, $P < 0.05$) suggests that PBTs can be an effective tool for improving academic performance in this group of students.

Additionally, the positive views expressed by teachers and students about the use of PBTs further support the potential for it to be accepted and used in effective engagement for improving learning outcomes. In support of these overall positive results, Arhin (2015) said that students' attitudes generally improved along with their academic performance when exposed to performance-driven instructions. Koné (2015) studied the same phenomenon and observed an overall positive response by the students exposed to performance task activities just as in this research project. Based on the evidence of improved performance in this context, the researcher intends to advocate for and monitor the systematic adoption of PBTs in Charm's classrooms.

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Appendix: Portion of Lesson 2 – Area of a circle

Group task: Garden circular steppingstone construction and Water park circular pool area task

Task 1: You are planning to create circular steppingstones in your garden. You want to know how much concrete you will need to purchase to create the steppingstones. Calculate the area of a circular steppingstone using the following measurements:

- The diameter of the circular steppingstone is 24 inches
- Round your answer to the nearest hundredth.

Task 2: The town amusement park is creating a new water park with a circular pool. The pool has a diameter of 50 meters. The park engineer needs to calculate the area of the pool to determine how much water the pool can hold. Calculate the area of the circular pool.

- Round your answer to the nearest square meter.
- Rubric

Activity	Level	Possible score
Correctly identify the formula for the area of a circle	1	1
Calculate the area of the circular pool using the correct formula	4	2
Round the answer to the nearest square meter	4	1
Show your work and explain your process of solving the problem	5	2
Properly label the units and use correct mathematical notation and conventions (e.g., using parentheses, multiplication symbols)	2	1
Total		**7**

Individual task: Circular flower bed design task

You have been hired as an intern at a local engineering firm, and one of your first projects is to design a circular flower bed. Your goal is to design the flower bed so that it has an area of 50 square feet.

- Create a temporary model of the circular flower bed that you was presenting in a meeting to your team before the actual construction of the flow bed (use an appropriate scale for your model).

- Calculate the radius that you would need to use to achieve the assigned size flower bed

Rubric:

Activity	level	Possible marks
Create a temporary model of the circular flower bed. The model should be durable and creative	6	10
Calculate the radius of the circular flower bed using the formula for the area of a circle and the given measurements	4	3
Present the model to your team in a meeting. Your presentation should be organized and interesting Show your work and explain your process of solving the problem	 5 4	 5
Properly label the units Use correct mathematical notation	2	1 1
Total		**25**

Portion of Sample Lesson 3 – Volume of a sphere

Group Project and presentation – Volume of a sphere

In groups of five create a presentation on applying the volume of a sphere in real-life. Your presentation should outline 3 different areas/ industries in which the volume of a sphere is applied. Also include diagrams or pictures showing different use of spheres in the real world. You are required to include the formula for calculating the volume of a sphere.

Rubric

Criteria	0–1 mark	2–3 marks	4–5 marks
Creativity	There was little to no creativity shown in presentation	The presentation showed signs of creativity	The presentation was very creative
Completion	Only one application of the volume of a sphere was presented along with the diagrams and formulas	Only two application of the volume of a sphere was presented along with the diagrams and formulas	There were at least three application of the volume of a sphere presented along with the diagrams and formulas
Accuracy	The information presented had many errors	There was some information, diagrams, or formula not very accurate	The information, diagrams, and formulas were presented correctly
Collaboration	The presentation was planned and executed by only 1 or 2 member of the group	There were persons who did not participate in the presentation from the group	All group members participated in the planning and presentation.

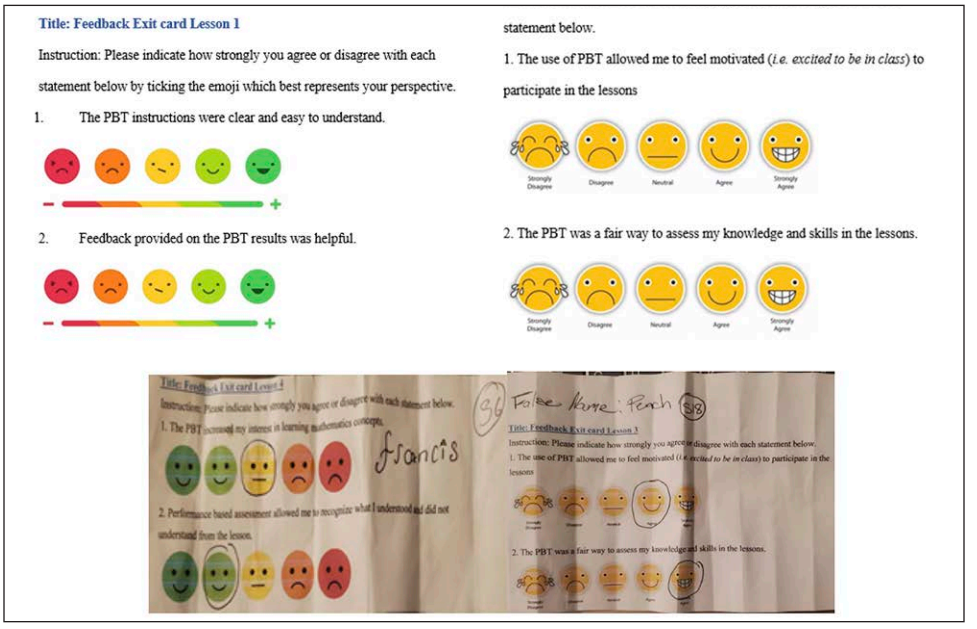
Individual task: Sphere glass production: material volume task

A glass manufacturing company is tasked with producing a large batch of glass spheres with a diameter of 10 cm. However, the company is unsure of the volume of glass material required to produce these spheres. As the production cost is directly linked to the volume of glass material, the company wants to calculate the exact volume of glass material needed to produce this batch of glass spheres. You are the project manager. Calculate the volume of glass needed for one sphere.

Rubric:

Activities	Level	Possible marks
Correctly identify the formula for the volume of a sphere	1	1
Calculate the volume of the ball bearing using the correct formula and the given measurements	4	2
Round the answer to the nearest tenth	4	1
Show your work and explain your process of solving the problem	5	2
Properly label the units and use correct mathematical notation	2	1
Total		7

Appendix



Each lesson had a different exit card.
Students appreciated the use of pseudonyms for the teacher ensuring anonymity.

Table 7

Teachers' Feedback Questionnaire Frequency Table

Codes	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
TQ.1	I am familiar with the term PBT and have used it before in my lessons.	0	5	0	6	8
TQ.2	PBT has made teaching more engaging and relevant for my students.	1	3	6	8	1
TQ.3	The implementation of PBT has required significant planning and preparation.	0	0	0	4	15
TQ.4	PBT has improved my students' ability to apply knowledge in real-world situations.	0	1	4	7	7
TQ.5	PBT has increased my workload and added to my stress levels.	0	3	10	5	1
TQ.6	My students feel positive about the use of PBT	0	3	6	5	5
TQ.7	I have received sufficient support and resources to implement PBT in my teaching.	3	13	1	2	0
TQ.8	Overall, my experience in utilizing PBT in my teaching has been positive.	1	2	2	4	10
TQ.9	I would be willing to attend professional development training to learn more about PBT.	0	0	0	5	14
TQ.10	In my opinion, PBT is an effective teaching strategy that benefits student learning	0	0	5	3	12

Table 8

Student's Feedback Questionnaire Frequency Table

Codes	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
SQ.1	The PBT was a fair way to assess my knowledge and skills in the lessons.	1	5	12	8	4
SQ.2	The PBT instructions were clear and easy to understand.	1	5	5	12	7
SQ.3	Performance based assessment allowed me to recognize my strengths and areas for growth.	0	2	7	11	10
SQ.4	The PBT allowed me to demonstrate my learning effectively.	3	6	11	8	2
SQ.5	The PBT increased my interest in learning mathematics concepts.	0	2	8	10	10

Student's Feedback Questionnaire Frequency Table continued

Codes	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
SQ.6	I felt prepared for the PBT based on my background knowledge about the scenarios used.	0	4	8	12	6
SQ.7	The use of PBT allowed me to feel motivated to participate in the lessons	1	2	5	12	10
SQ.8	Feedback provided on the PBT results was helpful.	0	1	0	16	13
SQ.9	I would like to see PBT used as an assessment strategy in future lessons	1	2	3	16	8
SQ.10	Overall, I am satisfied with the use of PBT as an assessment strategy in this subject.	0	1	1	6	22

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People Leadership:

Succession Planning in Health Information Management

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Abstract

This study was conducted to get a deeper understanding of practices, challenges, and strategies that could be adopted to enhance succession planning in the field of Health Information Management (HIM) in Jamaica. The significance of the study was to reinforce the need for deliberate succession planning as a path toward effective people leadership in HIM in Jamaica. A convergent-parallel mixed-methods study was conducted using survey questionnaires and interviews to concurrently collect quantitative and qualitative data. The study found that identifying potential talents among HIM practitioners in order to develop them to lead was not an easy feat; there was no established succession plan for HIM in Jamaica; and there was paltry succession planning in some departments. No comprehensive assessment or measurement of succession planning in the HIM practice was done; and there was no assessment of the roles that HIM leaders and external stakeholders play in succession planning in HIM in Jamaica. The study concluded that succession planning is deficient in HIM and there is need for new approaches to unveil leadership prospects and build capacities for effective people leadership in HIM. It is recommended that, to cultivate people leadership, HIM organisations need to take a multifaceted approach toward capacity building and professional development given that these are the pillars of effective succession planning.

Keywords: People Leadership, Succession Planning, Health Information Management, Capacity Building, Professional Development

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Introduction

The health information management (HIM) discipline pools aspects of business, information technology, and science to collect, analyse, integrate, protect and report health information that is essential to health service planning and delivery, healthcare policy development, and research. HIM supports healthcare decision-making by ensuring timeliness and availability of relevant data (AHIMA, 2021). An allied health profession, HIM is responsible for ensuring accuracy, availability, and security of health information that is needed to further healthcare services and to support healthcare-related decision-making (Sayles & Gordon, 2020). With the responsibility for executing such critical functions, the HIM department is considered the hub of a healthcare institution, and health information management professionals (HIMs) are "custodians of health information" (Kemp et al., 2021, p. 248). As custodians, HIMs are integral in managing healthcare data; and in sharing aspects of such data with internal and external stakeholders to inform decision-making. For the HIM discipline to be effective, it requires people leadership.

People leadership, as conceived by Miller (2016), is being keenly attentive to individuals in organisations with intent to address their needs. Miller opined that "people leadership is a serious political business" in organisations "where there are multiple personalities and competing interests" (p. 99). Accordingly, people leadership demands a strong sense of purpose coupled with the right resources and initiatives to advance capacity building and professional development. Hence, a vital aspect of people leadership is succession planning.

Succession planning has two arms – capacity building and professional development. Succession planning is preparing to meet human resource needs, that is, ensuring the right number, type, and mix of skills, competencies, and talents while pinpointing and grooming individuals for personal development, for leadership development, or for replacing leaders to meet the growing organisational needs (Rothwell, 2010). Succession planning is also empowering individuals to sharpen their skills and to acknowledge the critical roles they play in their organisations' processes. Through succession planning, organisations shore up leadership development and preparedness for leadership roles. Through this process, organisations facilitate and coach leadership aspirants to heighten their personal development and readiness to shoulder leadership positions (Heritage, 2011). Succession planning is therefore geared to equip employees to assume key positions when the more experienced and talented employees move up or out of the organisation. This process incorporates a plethora of training and development

activities that can be quite expensive and extensive for any organisation (Fuller, 2007; Rothwell, 2010).

Assessment of the changing roles in HIM revealed the need for active engagement in succession planning for future HIMs (Cooper, 2009). This need "is driven by the rate of change in healthcare, the introduction of new technology in the workplace, and the increased demand on maximising productivity" (Fuller, 2007, p. 900). Another driver of this need is interest in upward mobility and seeking to build the required capacities. Done appropriately and meaningfully, succession planning allows for observation, assessment and development of leadership potentials and skills, and further engagement in capacity building and professional development.

In Jamaica, there is generally little attention to succession planning and the Ministry of Health & Wellness is not exempted. Specifically, myriad issues challenge HIM leadership and succession planning. These issues include sparse people leadership, HIMs lacking confidence among themselves which is a deterrent to them assuming leadership positions, and lack of interest in leadership among HIMs. Together, these issues make the process of identifying HIMs for leadership positions a difficult one. A study conducted by Hill-Berry (2023) noted challenges identifying HIM leadership potentials and employing leadership skills among HIMs for capacity building to meet the needs of the HIM profession. Hill-Berry's study highlighted the need for further investigation into people leadership. Besides, the literature on succession planning within the context is sparse. Hence, the rationale for this study as a first step toward in filling that need.

The aim of this study was three-fold - to deepen understanding of the subject of succession planning, to pinpoint possible challenges with succession planning, and to identify strategies that could be adopted to enhance succession planning in HIM in Jamaica. The significance of the study was to highlight the need for active succession planning as a path toward effective people leadership in HIM in Jamaica.

In addition to the foregoing, the researcher currently works in the training institution for this allied health profession. The researcher's interest in this study was kindled from ongoing relationships with HIMs, and the growing needs for such skills and competencies in the HIM practice and in the academic institution, which are both difficult to meet. This relationship between the HIMs and the researcher's work unit provides an avenue for the researcher's awareness of the mentioned needs. Thus, the need for this study to share the results with the healthcare institutions, and the academic unit to which the researcher is aligned, to inform their decision-making.

Research Questions

Consistent with the objectives, this study was guided by three research questions:

1. What are the succession planning practices in HIM in Jamaica?
2. How involved are external stakeholders in succession planning for HIMs in Jamaica?
3. What strategies could be adopted to enhance succession planning for HIMs in Jamaica?

Literature Review

As a strategy toward smooth succession, organisations engage in identifying and developing future leaders (Othman & Sumardi, 2013). Separations are unavoidable in every organisation thus adequate succession planning is widely encouraged (Miller, 2014; Valentine, 2011). Succession planning is a vital process for ensuring personal and professional development of prospective leaders; and to broaden the pool of qualified prospective candidates from within. This process involves grooming candidates to equip them with the knowledge, skills and competencies required to execute new roles. Succession planning ensures continuity of organisational leadership and HIMs readiness for any contingency (McKinney, 2023).

Although organisations are encouraged to engage in succession planning and the practice is widely supported, some organisations do not participate in the process (Valentine, 2011). Even with this wide-scale recognition, there is limited understanding of who should be involved in the process, when it should start, and how it should be executed. However, there is no one answer to the 'who, when, and how' of succession planning. An organisation may decide to have a hybrid of succession planning activities as part of their internal processes; or they may choose to incorporate formal aspects (Skipper & Bell, 2008).

Succession planning necessitates a leadership team to identify key positions for which succession planning should be done, to initiate the development of the related succession plans, and to be involved with the process of identifying and training employees as prospective successors (Ellinger et al., 2014), as a strategy to equip employees to assume new roles (Green, 2011). This active and continuous succession planning could help to ensure availability and currency of talents and skills within that organisation (Strachan, 2009).

According to Miller (2014), a prudent human resource management practice is for organisations to identify potentials in their employees and make efforts to harness those skills as a means of building capacities and enhancing professional

development. This does not mean allowing an incumbent to choose a candidate whom they feel is the best successor as such subjective handpicking could introduce bias and manipulation of the process (McKenna, 2018; Miller, 2013). Organisations may find that the most appropriate approach is intentional early engagement in the process to address the issues rather than waiting until the organisation is in a predicament, where it is forced to make hasty and poor decisions (Carlson & Stanger, 2017).

Participating in leadership is a critical step toward capacity building and professional development, there is an interlock between leadership training and professional development (McWay, 2014). In some Jamaican organisations, the practice is that individuals in leadership positions 'hold on to those positions'. This 'hold' is averse to succession planning and preparation for upward mobility which is unfavourable for succession planning (Hill-Berry, 2015), and effective people leadership. In the meantime, in some Caribbean organisations, while succession planning is neither active nor formal, and while not engaged in formal succession planning, they provide leadership training and other initiatives to support employees' career and professional development; and to prepare aspiring leaders for positions when they become available (McLean et al., 2016). Today's succession planning cannot be approached with the usual casual attitude (Carlson & Stanger, 2017). Instead, it may require an approach to shared leadership (Smith, 2013); to intensify succession planning using varied strategies (Hill-Berry, 2016).

As previously noted, succession planning may necessitate identifying interests and abilities in individuals and fully engaging them (Guay, 2011); while mobilising stakeholder engagement (Bush, 2003). However, one challenge to succession planning is to identify, develop, and assign new leaders without using work time for grooming (Skipper & Bell, 2008). Overcoming this challenge may require a more transformational type of leadership to breed new perspectives, prompt a transformation, and challenge the existing state of affairs (Daft, 2010); and ultimately yield positive results (Bass & Riggio, 2006). Organisations could benefit if they develop internal talents as those individuals are already part of their human capital and are acquainted with the internal processes (Olson, 2008). This capacity building and harnessing of talents could support the organisation having the right mix of talents and a qualified pool of candidates who are equipped to vie for positions when others are promoted or separated from the organisations (Pinnix, 2015).

New developments in HIM are coupled by the growing need for capacity building and professional development among HIMs (Stoltz, 2013). To meet this growing need, succession planning could involve mentoring, assigning new job roles, arranging occasions to understudy, participating in special projects,

workshops, and formal training (Skipper & Bell, 2008). These may be facilitated by classroom learning (Schatz, 1997); or learning-by-doing (Troupe, 2010) buttressed by experiential learning (Keeton, 1983). An appropriate blend of which could provide avenues for leadership development (Johns, 2013); and more specifically, succession planning.

To summarise the literature reviewed, people leadership demands adequate succession planning (Miller, 2016). Other than the mentioned benefits, organisations can gain from succession planning by building competencies, boosting internal talents, and preparing future leaders for upcoming challenges. Additionally, succession planning can allow individuals who are aspiring for upward mobility to tap into the experiences of their predecessors and to understand organisational resources. Further, succession planning is the route to acquaint with an array of organisational activities - processes, issues, and problems; and to basically know the ins and outs of organisations (Valentine, 2011).

The literature around succession planning in healthcare in Jamaica is sparse. Hence, most of the literature reviewed is external to the context in which the research was done.

Methodology

This convergent-parallel mixed-methods study of succession planning for HIMs was undertaken over a period of twelve weeks. This approach was used to collect and analyse both quantitative and qualitative data in one study, using the qualitative data to complement the quantitative data (Creswell, 2014). For content validity, the researcher had an item construction expert review the questionnaire items and provide feedback on their comprehensiveness; following which the researcher made the necessary adjustments. The researcher used Cronbach's alpha to calculate reliability of the questionnaire items. The reliability coefficient was $\alpha = 0.90$.

The population for this study was all 513 HIMs in public primary, secondary, and tertiary healthcare facilities throughout the four health regions in Jamaica. The health regions are South-East Regional Health Authority (SERHA), Western Regional Health Authority (WRHA), Southern Regional Health Authority (SRHA), and North-East Regional Health Authority (NERHA). SERHA is the largest of the four health regions. To determine an appropriate sample size for this study, the researcher used the Sample Size Calculator by Raosoft. Using a confidence level of 95% , a 5% margin of error, and a 50% response distribution, a minimum sample size of 220 was returned. Considering the possibility of non-response, the researcher added another 10. Hence the targeted number of participants was 230 ($n = 230$).

Prior to initiation of data collection, the researcher sent letters to inform intended participants and request their participation. Following permission, the researcher visited participants and asked them to complete the questionnaires while she waited for them. Mutually convenient appointments were made with those who consented to participate in the interviews.

Participation in this study was completely voluntary. No name or identifying/identifiable information was used. A code number was assigned to each questionnaire, and this was used to track the information. Survey participants were from the HIM practice category only, while interview participants were from three categories – HIMs in public healthcare institutions in Jamaica, representatives from the policy division of the Ministry of Health & Wellness, and representatives from managers and leaders of the HIM courses of study in the academic institution. According to these categories, participants were described in the study as Practice, Policy, and Academic with numbers attached (descriptive pseudonym such as Practice 1) to differentiate them. Participation in this study was restricted to individuals in these categories who were actively engaged in one of those roles at the time of data collection. Following the interviews, the researcher read or restated the responses and asked participants to verify whether their responses were accurately captured.

All relevant ethical considerations were observed. The researcher requested ethical approval from both the academic institution and the directors at the Ministry of Health and Wellness to conduct this study. After receiving ethical approval, the study was conducted.

Results

This section details the data collected to answer the research questions concerning the succession planning process, external stakeholder participation succession planning for HIM, and strategies that could be used to identify, manage and mitigate challenges related to succession planning. It begins with the results of the survey and continues into interviewees' responses.

Survey results

Of the targeted 230 participants, 207 completed and returned the questionnaires, a response rate of 90%. However, five were rejected as they were incomplete. The distribution of participants by health region is illustrated below (Table 1). Majority of the responses came from participants in SERHA.

Table 1: Participants by Health Region

Health Region	# of targeted participants	# of actual participants	% of actual participants
SERHA	98	81	40
WRHA	58	47	23
SRHA	47	42	21
NERHA	37	32	16
Total	**230**	**202**	**100**

Survey respondents were 84% females and 16% males. This yielded a wide cross-section of respondents with representation from each health region (Table 1).

Of the targeted 14 interview respondents, 13 (93%) participated in the interviews. Interview respondents were 62% females and 38% males. Interview respondents worked in different contexts within the healthcare and education sectors – in HIM departments in public health facilities, in the policy and monitoring arm of the health ministry, and in a university that teaches HIM courses. For this reason, they shared different perspectives of, and different orientations to, succession planning.

Survey participants responded to seven Likert-type items. Each question had five response options ranging from strongly disagree, the lowest (1) to strongly agree, the highest (5). Formal training for HIMs has been a disquieting issue. Respondents were asked to share their views on whether they felt that adequate support was in place for them to access formal training. (See Item 1 in Table 2). According to the survey data, 34% of respondents agreed that adequate facilities were available to support formal training. Just below 23% agreed that their department had a succession plan for HIM leadership (Item 2).

Concerning whether their departments were identifying potential talents in HIMs and developing their staff to assume senior positions (Item 3), less than one-third of the responses were in the affirmative.

Just over one-third of respondents agreed that it was likely that their next head of department would be identified from within (Item 4); and 33% agreed that succession planning was practiced in their department. In response to whether succession planning was practiced by grooming and promoting leaders from within (Item 5), 33% agreed. Meanwhile, about 34% of respondents agreed that appropriate measures were in place to ensure that when senior HIM staff vacate positions, they can be easily filled (Item 6). Altogether, 40% of respondents agreed that as part of succession planning, department heads were coaching and mentoring their staff (Item 7).

Table 2: Respondents' perceptions of HIM leadership succession planning in their department (%)

Perception items	NR	SD	D	U	A	SA
Item 1. Adequate support is in place for me to access formal training	1.5	14.4	29.7	20.8	30.2	3.5
Item 2. My department has a HIM leadership succession plan in place	0.0	10.4	26.2	40.6	20.3	2.5
Item 3. My department is identifying potential talents in HIMs and developing them for senior positions	1.5	12.9	28.7	27.2	26.7	3.0
Item 4. It is likely that my next head of department would be identified from within	0.5	11.9	16.8	35.6	28.7	6.4
Item 5. Succession planning is practiced by grooming and promoting leaders from within	1.0	10.9	25.7	29.2	27.7	5.4
Item 6. Appropriate measures are in place to fill positions when senior HIMs leave the department	0.5	11.4	26.2	28.2	29.2	4.5
Item 7. As part of succession planning, department heads are coaching and mentoring their staff	0.5	13.9	23.3	22.8	35.6	4.0

Note: N = 202. NR = No response, SD = Strongly Disagree, D = Disagree, U = Undecided, A = Agree, SA = strongly agree

The emphasis here was respondents' perspectives concerning succession planning in HIM. Undecided responses to the items were high with affirmative responses ranging between 23% and 40%. A subsequent study could help to clarify these responses. In the meantime, with much clarity lacking here, the results of the interview were relied on to shed light on these responses.

Interview results

To generate answers to the research questions, interviewees were asked to respond to three main questions along with some clarifying/probing questions. Consistent with the research questions for this study, the three main questions were What are the succession planning practices in HIM in your department/organisation? How involved are external stakeholders in succession planning for HIMs in your organisation? and What strategies could be adopted to enhance succession planning for HIMs?

Four main themes emerged from the interview results. These are awareness and availability of succession plans/succession planning practices, stakeholders' involvement in HIM succession planning, challenges to succession planning, and strategies to address succession planning challenges. These results are presented in the order of how the themes are mentioned.

Theme 1: Awareness and availability of succession planning

Respondents were asked about their awareness of any succession plan and succession planning practices in their department/organisation. One negative response was offered without clarification or expansion; while other responses indicated that specific staff members were handpicked and groomed for particular leadership positions. This was mainly done in three instances – before separation from the organisation (mainly because of retirement), as a contingency measure, or for instance, when the head of department was away from office. One respondent stated that a succession plan was in place that incorporated personnel from different ranks – organisational level, parish level, and regional level.

> Anything can happen so we have to put things in place to identify those persons and try as best as possible to build a certain working relationship with these personnel to guide them in certain areas . . . (Practice 3, female).

For another respondent, a succession plan was in place that focused on grooming staff to replace those who were nearing retirement.

> [These senior staff] would observe people who are there for a very long time and their track record over the years, and other staff members who have a good amount of experience if they are responsible enough to assume leadership roles (Practice 2, male).

As a step toward professional development, some HIM leaders in the practice reported occasionally having invited speakers to do motivational talks and presentations on other related topics.

> We invite guests to do talks on how we can propel ourselves . . . in terms of training, schooling, upgrading skills. . . . We attend workshops – maybe once per year and it is not every year (Practice 2, male).

Another respondent reported:

> I make sure the person knows everything that I do, is trained, and gets the right types of training. So, if and when the position comes . . . or if there is a day when I am not here, no one should suffer. We also have capacity building training like one week, three week, and we attend workshops (Practice 4, female).

Analogous responses were provided by another respondent who highlighted subjectivity in the practice of filling positions that were created by people who were either close to retirement or were migrating.

> We have persons who are going on retirement, we are now in the process of looking at whom we can replace them with. Persons are migrating . . . , I will have to now look at who is the next best person to fill that gap. It means that I am moving somebody from one area to another area, maybe in a leadership position. I now need to find two persons . . . moving one and filling that gap (Practice 6, female).

A less detailed but similar response was:

> I don't know of any [succession plan] except when people are getting close to retirement. That person usually has someone training, preparing them to take over their position (Academic 3, male).

Other respondents admitted no knowledge of any HIM succession plan:

> I don't know that that happens anywhere in the ministry (Academic 2, female).

> Within the ministry, I am not privy to that information, but I would want to think that if there is one, it's not altogether transparent because of an occurrence that took place not so long ago (Academic 4, male).

> That's one of the areas that needs strengthening. Because it's a small department, it should not be difficult. . . . The framework is there but if persons should leave, the gap would be there. So probably that's one of the areas that we need to look at and give some support (Academic 1, female).

The question of whether there was a succession plan for HIM was answered by policy leaders who confirmed no succession plan for HIM. Notwithstanding, they admitted the need for more attention to this area and shared that plans were being made to execute succession planning for different categories of staff, including HIM.

> It's interesting that you ask because just yesterday the director of HR said there needs to be such a plan (Policy 2, male).

> It's something that we are contemplating – doing one for every group. We are looking at our critical areas and HIM is in that group (Policy 3, female).

From these responses, the absence of a succession plan for HIM was evident. However, it seems reasonable to understand that in some HIM departments, there were selective handpicking of successors.

Theme 2: Stakeholders' involvement in HIM succession planning

Regarding external stakeholders' involvement in succession planning for HIMs in Jamaica, some interviewees expressed ignorance of any external stakeholder involvement in the process. However, they provided explanations such as:

> I am not seeing much of that in my setting. . . . I see where PAHO/WHO has had keen interest in the profession. At some point in time there were discussions about funding for training (Practice 6, female).

Another shared that external stakeholder involvement was minimal. For example,

> We only invite guest presenters to share presentations in our meetings (Practice 2, male).

Efforts by HIM leaders to engage stakeholders were apparently lacking. If there was any, there was no evidence, and respondents noted that HIM leaders needed to be more intentional and purpose-driven in their efforts to engage external stakeholders. This strategy is important because:

> Stakeholders are not going to run to the institutions and say I have some money; I want to train these persons . . . The initiation must come from somewhere and I am just not seeing it. So, it is the lack of the initiation or engagement by the HIM [leaders in the] institutions (Academic 4, male).

Policy leaders expressed similar views as academic leaders.

> Any external stakeholder support is mainly toward capacity building. PAHO has been a major external partner; and to a far lesser extent STATIN has also assisted (Policy 1, male).

An expansion to this point was:

> PAHO plays some roles in capacity building. Exposing leadership to various workshops and conferences related to HIM, ICD-10 coding, exposure to HIS workshops, and those sorts of things. There is no [other] external stakeholder (Policy 2, male).

The above data showed that there was sparse involvement of external stakeholders in succession planning for HIMs in Jamaica, and this was mainly through capacity building endeavours.

Theme 3: Challenges to succession planning

Respondents reported several challenges to succession planning in HIM.

Specifically, interviewees noted reticence of some practitioners to access formal training, and inadequate support systems to address the noted challenges.

> Those who sit and are not trained, you can't put them in your succession plan, because you need persons to be leading and managing your department (Academic 2, female).

Compounding this challenge was that training for HIM leadership can be costly and initially inconvenient for the healthcare institution as it means time away from work for those who are being trained.

> A challenge is relieving individuals of their duties so they can access training and be equipped (Policy 3, female)

This was a real issue because releasing one HIM practitioner for a period of training creates a gap that is not easy to fill, and there were associated expenses attached to coverage for that period. Additionally,

> The problem with succession planning is that such a plan has not been developed [and there is no] arrangement in place to address these challenges (Policy 2, male).

Based on the responses provided, the lack of a HIM succession plan for HIM in Jamaica was clearly evident. However, it seemed that there were bits and pieces of succession planning in some organisations. A thorough evaluation or measurement of succession planning in the HIM practice has not been done. Likewise, an assessment of the roles that HIM leaders play in succession planning has not been done. However, after assessing the HIM practice and identifying training needs, one stakeholder organisation continues to assist with capacity building.

Theme 4: Strategies to address succession planning challenges

Interviewees proposed several strategies that could be explored to deal with the identified challenges associated with succession planning in HIM in Jamaica. For example, the training institution could utilise different modalities to deliver the HIM leadership courses. These modalities could include online or off-campus delivery to increase accessibility for HIM capacity building and professional development. In addition, interviewees suggested that after a specified period, there should be an automatic transition into positions of leadership and management. For example, implementing a system where HIMs:

> . . . who are in the service for a period, like 10 years, and they are qualified, it would be automatic that they are given certain positions if they have the qualifications and meet the requirements. That would help to address some of the biases (Practice 2, male).

However, that approach could be problematic mainly because by themselves, academic qualifications and years of employment do not qualify an individual for preferment. Furthermore, instead of assuaging biases, that approach could introduce more bias and disadvantage prospects with better or similar qualifications and or experiences and who may be more equipped to contribute to the organisation.

Another respondent emphasized the need to fill the resource gaps suggesting that:

> The training institution could recommend a pool of individuals from which the Ministry could select using a competitive process (Policy 2, male).

Along with abovementioned initiatives, other suggestions were that policy leaders can pursue standardisation of study leave opportunities/benefits, internal capacity building activities, and mandatory HIM leadership training. Policy leaders should also support the training institution's offerings and solicit more support from external stakeholders toward professional development of HIMs.

Responses suggest that practice leaders have various expectations of academic leaders and policy leaders regarding possible strategies that could be adopted to fix the challenges associated with succession planning in HIM. Importantly, strategies to address these challenges require synergy from all three groups of HIM stakeholders.

Among the several key findings, the researcher noted that it was not an easy feat to identify potential talents among HIMs and to develop individuals to lead. There was evidently no comprehensive succession plan, or succession planning for HIM in Jamaica. However, there was paltry succession planning in some departments, and handpicking in others. External stakeholders played miniscule role in succession planning in HIM in Jamaica. In essence, succession planning is lacking in HIM in Jamaica.

Discussion

Succession planning is intended for smooth transition to higher positions (Nugent, 2008). The miniscule number of respondents who agreed that their department had a HIM leadership succession plan was a particular concern to probe to determine their view of succession planning. Of note was the low number of affirmative responses that their department was actively seeking to identify and develop potential talents internally, and that it was likely that their next head of department would emerge from within. Yet, in the literature, organisations are encouraged

to pursue early and purposeful initiatives to identify and develop potentials toward succession planning rather than making poor and hasty decisions when the organisation is in a predicament (Carlson & Stanger, 2017; Miller, 2014).

These findings threaten HIM people leadership because if department heads cannot identify potentials from within, how will organisations strategise to develop their staff? Furthermore, what impact will this likely have on future HIM leadership? The low affirmative responses indicate a need for urgent action on the part of HIM leadership for ongoing succession planning to ensure that when there is upward movement or separation from the organisation, the resulting gaps can be easily filled (Pinnix, 2015; Olson, 2008).

Interviewees reported pockets of succession plans, mainly subjective targeting of 'best fit' HIMs to understudy individuals who were nearing retirement; and on rare occasions, to replace individuals who were separating via migration or were being promoted. Both data sets, (surveys and interviews), indicated no succession plan for HIMs; and what some deemed succession planning was basically handpicking specific HIMs and grooming them for specific positions whenever there was an impending separation from the organisations – mainly via retirement. However, such subjective handpicking is discouraged to avert bias and manipulation of the process (McKenna, 2018; Miller, 2013).

Respondents reported that while there were snippets of succession planning, there was no plan to fill gaps created through promotion or separation, and no arrangement to equip HIMs for upward mobility or transition. Hence, there was lack of people leadership to advance capacity building and professional development for effective succession planning (Miller, 2016).

Absence of a HIM succession plan should not be interpreted as had there been one, it would have allowed for handpicking of particular HIMs for leadership positions. Rather, through succession planning, employees who were already acquainted with the organisation's processes and practices would have been equipped as possible successors (Green, 2011). This ongoing talent development from within would supply a new pool of leaders and with the right mix of talents that the organisation could continue to draw from through transparent human resource processes (Pinnix, 2015).

Active and purposeful engagement of relevant stakeholders is germane to effective leading (Bush, 2003). The data suggested that the status quo created unease for HIMs, and they desired changes. Implementing these changes could necessitate HIM stakeholders adopting a shared leadership approach (Smith, 2013); or a transformational leadership approach to "bring about innovation and change . . . and [challenge] the status quo" (Daft, 2010, p. 424).

The reported exiguous involvement of external stakeholders in succession planning for HIM in Jamaica by a single international organisation, and interviewees' concern that external stakeholders were scarcely involved due to lack of initiation or engagement by HIM leaders should not go un-noticed. This does not prevent external stakeholders from offering support to train and equip HIMs for mutual benefits (Green, 2011; Pinnix, 2015). However, for this to be accomplished, HIM leaders and managers must initiate and continue engagement with external stakeholders (Ellinger et al., 2014).

Respondents' suggestions for training and developing HIMs aligned with the literature – leadership training and development initiatives (Johns, 2013; Sheridan et al., 2016); mentoring, making arrangements for the staff to understudy their seniors, and formal training (Skipper & Bell, 2008); and other professional development initiatives (McWay, 2014; Rothwell, 2010). Other suggestions were more communication and collaboration by academic and policy; more interaction to identify strategies and implement them for succession planning (Carlson & Stanger, 2017), and ensure a sustainable system for continuing education (CE) outside of formal training. Meanwhile, policy leaders could mandate leadership and management courses for senior HIMs. This need for CE to boost the HIM profession complimented Stoltz' (2013) suggestion for capacity building. These recommendations, though not far-fetched, may necessitate transformational leaders to steer stakeholder engagement toward goal achievement (Daft, 2010).

A reported generic challenge to succession planning was identifying HIMs from within who were equipped to assume HIM leadership roles as such talents were not readily identifiable. Some respondents suggested they could identify specific leadership qualities in HIMs that could be nurtured based on observation of HIMs' demeanour while in training. Again, this suggestion is problematic for two reasons. One, it reifies one of the main findings that there is no clear system of succession planning and capacity development in the Jamaican HIM context. Two, leaving the identification of future leaders to individuals is fraught, and can only increase perceptions of nepotism and corruption, already steeped in the system (Miller, 2013); and more widely in Jamaican organisations (Miller, 2014). Instead, a transparent strategy is identifying employees with interest and capacity for leadership development and upward mobility (Hill-Berry, 2023). Subsequently, recommendations can be made to equip them for leadership positions (Nugent, 2008), and ultimately strengthen people leadership within the organisation (Miller, 2016).

The current modus operandi in HIM in Jamaica demonstrates the opposite of succession planning, and lack of effective people leadership. As the literature indicate, if succession planning is properly done, when a HIM is reassigned or

is separated from the organisation, the transition would be seamless (Olson, 2008). Likewise, HIMs would be constantly learning, retooling, and equipping for goal achievement (Daft, 2010). This reciprocal learning would provide HIMs with a sense of support (Troupe, 2010), and enthusiasm for pursuing objectives and achieving targets. This would allow both parties to develop practices that are instrumental to their career as leaders and aspiring leaders in the HIM field; and ultimately equip their organisation with required talents – an expectation of effective people leadership (Miller, 2016).

Succession planning for HIM should also be systematic and be all-inclusive to equip everyone for the organisation's mission. In the absence of an organisational succession plan, departments and leadership should synergise to develop one. If opportunities are available to further succession planning, then HIMs will continue to grow and bear fruit for the organisation (McKinney, 2023).

Implications

This study appeals for people leadership and has implications for succession planning and the future of HIM leadership. In the absence of succession planning and supporting initiatives, HIMs could thwart their own capabilities and their potential to grow, develop, and equip to meet changing HIM leadership needs and produce desired results (Cooper, 2009; McKinney, 2023). To address the dearth of literature within the specified context, this study also has implications for more studies around succession planning in HIM and in the wider the Jamaican context, and by extension, people leadership.

Conclusions

In this study, the researcher uncovered an intriguing dichotomy that senior HIMs are shunning leadership roles in fear that they are incompetent to manage and lead. The remedy for such fear should incorporate new approaches to people leadership to unearth leadership potentials and build capacities for effective HIM leadership (Hill-Berry, 2023). These should include applying the learning-by-doing theory, implementing initiatives so individuals continue to engage and interact with leadership (Keeton, 1983; Schatz, 1997) as they develop into leaders; and seeking to teach those who manage how to also lead (Troupe, 2010). Besides, HIM organisations need to incorporate targeted capacity building and professional development initiatives toward succession planning and ultimately effective people leadership (Miller, 2016).

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COMMENTARIES

‘B-STEM’:

Integrating STEM Approaches with Business Education

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Abstract

The literature posits that the terms ‘interdisciplinary’ and ‘integrated’ are frequently used to describe theoretical and instructional approaches to STEM education. This commentary aims to add to the discourse of STEM as an educational approach, where it can be integrated with business education disciplines, and similarly, business education can be integrated with STEM approaches. The proposed model could better prepare the future workforce with strong business and scientific aptitudes and attitudes. This is based on the deduction that both business education and STEM approaches have similar expectations to create and enable critical thinking and problem-solving skills and therefore, they can be integrated to create one learning paradigm. It is recommended that Jamaican policymakers must ensure that the implementation of STEM takes on a stakeholder approach to generate relevance and currency in the curriculum, facilitate the transfer of aptitude and attitude, and encourage innovative teaching strategies and learning experiences. The ultimate goal is to have an integrated curriculum, ‘B-STEM’, with a transformative role in developing a more skilled workforce that is capable of driving economic progress.

Keywords: Business Education, STEM, STEAM, Jamaica, Integrative approach

The STEM Evolution

The Russian satellite 'Sputnick' launched in 1957 had an indomitable impact on the United States of America (USA). This caused the leaders of the country to call on its citizenry for greater interest in science and engineering to enable competition with the Russian's innovation and technology. As a result, the National Aeronautics and Space Administration (NASA) was formed in 1958. Almost three decades later, the National Commission on Excellence in Education published "A Nation at Risk: The Imperative for Educational Reform" in 1983. This was to further communicate the need for education in science and technology. Several initiatives stemmed from this assessment including the 1985 "Project 2061" which was developed to create a science literate population in the USA and the 1989 "Science for All Americans" as well as "Benchmark for Science Literacy" (Mohr-Schroeder et al., 2015).

The STEM educational approach was actually concretized in the early 1990s in the USA to integrate the pure and applied sciences into a single model (Cambridge Assessment International University, 2022). Hence, the disciplines of Science, Technology, Engineering and Mathematics were integrated as an interdisciplinary approach to learning. This movement was initiated by educators in association with the National Science Foundation (NSF) as SMET – Science, Mathematics, Engineering and Technology (Cambridge Assessment International University, 2022).

In 2012, the United States Research Council proposed STEM as a new form of teaching at the elementary, middle/secondary and post-secondary schools. This was based on the premise that a strong foundation in the sciences is imperative for technology advancement amidst their identified shortfall in the areas of science. The intention is to build human capacity by implementing STEM education that will prepare the workforce with strong scientific and mathematical backgrounds and ultimately develop the needed skills across STEM disciplines (Ejiwale, 2013). The aim of STEM literacy is to apply rigorous academic concepts within real-world situations. This will allow students to apply science, technology, engineering, and mathematics whilst including relevant stakeholders such as the community in order to compete in the new economy (Tsupros et al., 2009). STEM is also propelled as a principle of validity, reasoning for thinking sensibly, and problem solving for finding solutions to complex issues. Hence, STEM is viewed as a basic need of the 21st century (Cambridge Assessment International University, 2022).

STEM education is designed to prepare the 21st century workforce. Students will be able to apply what they have learnt in the classroom or laboratory to their

future jobs in a realistic way (Ejiwale, 2013). This problem-based learning method applies technological knowledge and processes to real world experiences with the use of up-to-date resources (Cambridge Assessment International University, 2022). The Institute for Arts Integration has broadened the components of STEM to include the Arts, thereby indicating that the educational paradigm of STEAM is an approach to learning that uses Science, Technology, Engineering, Arts and Mathematics. STEAM is viewed as an access point for guiding not only students' inquiry and dialogue, but also their critical thinking aptitude.

Hypothetical Analysis of Business and STEM Education Approaches

Whilst the educational approach of STEM / STEAM is appreciated, especially since the world is in the era of digitalization and innovation, driven by the 4th Industrial Revolution, it is also important that business education is not left outside of the S*T*EM / S*T*EAM Movemen*t*. Business education is likewise needed to prepare the future workforce and business strategies are required alongside technical solutions for the sciences and arts. Overall, business education is paramount to the growth and development of any nation including Jamaica. People who are knowledgeable in areas such as management, marketing, entrepreneurship among the other business disciplines can foster innovation, build new businesses and create job/employment opportunities for others. Profoundly, the creation of small- and medium-sized enterprises (SMEs) is critical in driving economic growth. Individuals will be well-informed about the dynamics of not only the local but also the global business environment. Business education whilst highly on the side of the social sciences which relate to behavioral, attitudinal and psychological theories, models, frameworks and practices, also guides student inquiry dialogue, critical thinking and problem-solving in a similar way to the educational approach of STEM/STEAM.

Depending on the contextual application of STEM, the approach can be interdisciplinary, transdisciplinary and multidisciplinary. As an interdisciplinary approach, STEM can be integrated with business education to create new ideas and solve real-world problems. This prepares and enables interdisciplinary thinkers to consciously apply methodology and language from the sciences to make connections with business content, thereby cutting across the subject areas. They will be able to make connections between the disciplines, and foster creativity and innovation. This interdisciplinary approach can be useful in dealing with current issues such as health and wellness, climate change, technology and business competition. For instance, using the STEM knowledge to conduct data analytics

through market research and supply chain approaches. This interdisciplinary approach could be an enabler for the new economy in terms of ensuring that the new technologies are aligned to business goals.

As a transdisciplinary approach, STEM knowledge will be integrated with the business disciplines resulting in collaboration and co-creation of knowledge. This allows for the combination of theoretical and practical approaches. The case study approach to teaching and learning in business education is paramount in this process as it allows business students to analyse technological / technical challenges faced by companies to which they are to apply their problem-solving skills by way of business theories and models.

As a multidisciplinary approach, STEM can be integrated with several other disciplines including the gamut of courses in business education such as general management, human resource management, finance, accounting, entrepreneurship, production and operations, and hospitality and tourism management. This infusion of distinct disciplines will enable the students to make connections between the sciences and business. This multidisciplinary integration approach establishes themes and fuses skills, knowledge and even attitude (Drake and Burns, 2004).

The integration of business education into the STEM curricula is, therefore, not far-fetched as the latter also focuses on critical thinking and problem-solving as well as on data analysis, and these are critical for strategic decision-making in businesses. The integration is critical in providing one cohesive teaching and learning paradigm in conjunction with STEM. Similarly, business students can benefit from a STEM background, enabling them to leverage technology for efficiency, acquire digital transformation aptitudes and competitive advantage.

The aforementioned is suggesting that business education and STEM are strongly integrated especially in this era when the modern business landscape is requiring the merging of technical and managerial skills and, a more skilled workforce. STEM students/graduates are likely to benefit from a combination of technical and business expertise that could reduce the knowledge gap that occurs when individuals with the technical expertise are given management positions. Notably, engineering and manufacturing companies are business based. Likewise, many organizations are aiming to address sustainability issues by way of technology. A deep understanding of both environmental science and business strategies will be useful in employing effective and profitable solutions in this regard.

The propensity for business and STEM disciplines to be integrated can be realistically achieved. Further exploration shows that there are current variations of STEM to include entrepreneurship and innovation as indicated below:

- STEAME: Science, Technology, Engineering, Arts, Mathematics and Entrepreneurship (European Digital Learning Network, 2022).
- STEMI: Science, Technology, Engineering, Mathematics and Innovation (Mhlane, n.d)

There is also the view that economics should be recognized as a STEM approach as it applies mathematics to communicate findings (Gomez, 2018).

In addition, Dixon & Hutton (2016) encouraged Integrative STEM/STEAM education to use models and frameworks that integrate the learning of several STEM/STEAM concepts linking or cross-mapping them during the learning of a main concept. As a starting point, this integrative pedagogy can be applied to the area of business. Figliano (2007) proposes that integrative instruction includes presenting abstract topics in a practical, application driven way and making logical connections.

Jamaica Declared a STEM Country

The Honourable Prime Minister of Jamaica at the opening ceremony of the Future Ready Conference held at the University of Technology, Jamaica on April 24, 2024, declared the island a "STEM Country". In his remarks, the prime minister pointed out that the future of Jamaica is dependent on STEM education to the younger generation. The literature supports this view. Dixon and Hutton (2016) posit that it is especially important for the younger generation to be scientific and technological literate so that as citizens, they will be living productive lives, even if they will not be working in a STEM-related field.

Several initiatives have been put in place to enable the S*T*EM Movemen*t* in Jamaica. These include the designation of STEM schools and Centres of Excellence for STEM among several other resources and facilities. At the opening ceremony of the Future Ready Conference, the Chairman of the Jamaica STEM for Growth Foundation pointed out that the future of Jamaica depends on STEM. As understood, there are several schools in the country that are utilizing a STEM curriculum. Having this facility in place along with the required resources is progressive despite the challenges in acquiring them for STEM implementation. The World Bank reported that the availability of adequately trained teachers in mathematics and key science subjects is of concern for the Caribbean Region (Caribbean Centre for Competitiveness, 2014). In addition, Ejiwale (2013) highlighted some barriers to the successful implementation of STEM/ STEAM education to include the lack of investment in teachers' professional development, poor preparation and inspiration of students, lack of connection with individual

learners in a wide variety of ways, lack of support from the school system, lack of research collaboration across STEM fields, poor content preparation, delivery and method of assessment, poor condition of laboratory facilities and instructional media, and the lack of hands-on training for students. The lack of funding, resistance to change by stakeholders and coordination of the process can also be added to the list of challenges relating to the implementation of STEM.

The designation of Jamaica as a STEM country according to the prime minister, is to propel "'peace, productivity, prosperity, and equity to achieve and create a virtuous society to sustain the Vision of Jamaica". In addition, the prime minister purports that STEM is the solution to fixing the economy of Jamaica; the super solution to solve the problems in Jamaica as growing and expanding the economy is a challenge. Dixon and Hutton (2016) likewise believe that instituting a STEM/STEAM programme for the education system would assist in solving the dire economic problems.

The chairman of the Jamaica STEM for Growth Foundation emphasized the role of teachers in the STEM initiatives as having the greatest multiplier effect. However, as Jamaica embraces STEM to be a national priority, it is important to be reminded that a stakeholder approach is necessary to achieve the outcomes. This requires a wide range of stakeholders to include educational institutions (teachers / educators), industry partners, government, non-governmental organisations and the business community to develop curricula that will enhance this expectation, and facilitate internships, mentoring and the delivery of hands-on activities in the classroom. The stakeholder approach will generate relevance and currency in the curriculum, facilitate the transfer of knowledge, skills and attitude, and encourage innovative teaching strategies and learning experiences.

It is also important for teachers to be trained (Talib et al., 2019) to deliver the curriculum. Dixon & Hutton (2016) recommend that syllabi are to be updated to include STEAM approach to teaching and learning, and that there should be activities both inside and outside the classroom. This commentary is recommending that students should not only be introduced to the fundamental skills in careers across STEM/STEAM but also to the business disciplines by way of a business – STEM/STEAM integrated curriculum to make them well-rounded with more career choices.

The prime minister also emphasized that ICT (Information and Communication Technology) is driving the 4th Industrial Revolution which requires human minds and that the Jamaican people are the greatest assets of the country. These ICT developments will most likely require businesses to monetize their initiatives, hence, the importance of business education in the STEM Movement.

Furthermore, STEM/STEAM education is not only about Science, Technology, Engineering, Arts and Mathematics but it is a "meta-discipline", which requires the integration of other disciplinary knowledge into its approach. Business disciplines must be an integral part of the STEM movement to drive entrepreneurship and the proper management of businesses in Jamaica. More cross-disciplinary courses that combine business and the STEM disciplines are required. For instance, at the high school level, a combination of business and STEM subjects and at the tertiary level, a Bachelor / Master of Business Administration with specialization in ICT or a major in ICT and a minor in Business Administration. A stakeholder approach is needed to drive the infusion of STEM in business education or vice versa. This is in keeping with an evolving approach in India where they have institutionalized a collaborative approach to STEM Education which is a critical component of their curriculum. So as not to have a restrictive curriculum, they have integrated the STEM subjects with other subject areas (MIT, 2024). Through their National Education Policy, they have reformed their curriculum to integrate business and STEM subjects in order to fill the industry gap with professionals who have business, analytical and technical skills. The ultimate purpose of this vocation is to build critical thinking and problem-solving skills and a strong, innovative and entrepreneurial workforce that will improve economic growth and competitiveness.

Jamaica can learn from this model as business education and STEM integration can allow for knowledge sharing and skill transfer, facilitate practical / real world learning, encourage innovation and entrepreneurship, foster industry collaboration for resources, training and employment, and derive life-long learning, equity, diversity and inclusion. In doing so, a B-STEM model, where 'B' represents business subjects/courses, would be an ingenious vocation for education in Jamaica.

Conclusion

Both business education and STEM approaches have similar expectations in terms of creating and enabling critical thinking and problem-solving skills and therefore, they can be integrated. This 'inter-, trans- and multi-disciplinary approach' to learning has the propensity to reduce aptitude and attitude gaps. Students and graduates of the STEM disciplines will require business and management education, particularly if they want to advance from their technical areas to management or entrepreneurship. Similarly, the STEM disciplines can be integrated into business education to build the technical skills of these students/ graduates.

Having knowledge of both STEM and business can be a catalyst for launching

and advancing technology-based business startups by way of product development, market dynamics, and research and development management, thereby bridging the gap between technical feasibility and commercial viability. In summary, business education is needed to drive the STEM movement at all levels of the education system and not only in Jamaica but across all geographical spaces. This advancement, however, requires stakeholder buy-in and a transformative shift to a B-STEM model.

A major limitation of this commentary is that the "A' component of STEAM comprising cultural indicators and communication was not adequately discussed in relation to business education. This is due to the word count restriction of the article but can be addressed in future analysis.

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Decoding Ancestral Food Matrix to Address Food Insecurity

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Food insecurity is defined as the lack of consistent access to enough food for an active, healthy life. Around 735 million people globally grapple with this issue, and the Caribbean stands out as one of the hardest-hit regions.

The latest Food and Agriculture Organization (FAO) State of Food Security and Nutrition in the World report paints a grim picture for Jamaica: more than two-thirds of the population can't afford a healthy diet, and more than two million Jamaicans are food insecure. But has Jamaica ever truly been food-secure? In the days of the transatlantic trafficking in enslaved Africans, racial and economic disparities left many without reliable access to food.

Today, Caribbean food insecurity is still driven by structural inequalities and economic constraints, coupled with climate change vulnerability and an over-reliance on imports. Governments and multilateral organizations often resort to handouts and short-term fixes, but these Band-Aid solutions do not address the underlying issues.

The real solution lies in our history – in the survival strategies and tactics of our ancestors. We can learn from how they navigated scarcity, and their resilience in the face of severe adversity.

Two historical factors have played a major role in the region's legacy of food insecurity – European colonisation and the existence of plantation societies that used forced labour of Africans and Indigenous peoples.

Colonisation and the transatlantic trafficking in enslaved Africans resulted in the plunder of lives, history and culture. The Europeans didn't just colonise lands and people. They also attempted to colonize African and indigenous peoples' culinary identity – to the detriment of the enslaved. There are historical accounts of enslaved Africans getting severely ill, many fatally, from being fed unfamiliar foods on trafficking voyages.

In their book, in the Shadow of Slavery, Carney and Rosomoff note that one European trafficker literally said they had to feed the enslaved Africans mainly

yams, as foreign foods disagreed with their stomachs. European owners of the ships used for trafficking had to include indigenous African foods, such as root crop tubers, peas and rice, in the ship's rations. These were the very same foods that were being taken by the enslaved aboard ships. There are historical and oral records of enslaved Africans, especially women, taking seeds and root tubers in their clothes as well as their hair.

Some historians note that enslaved Africans often brought plant parts from the ships to plant in their new settlements. As culturally skilled agriculturalists, they had extensive knowledge of soil, plants, and crop cycles. When tasked with feeding themselves or given subsistence plots on the outskirts of plantations, they planted specially selected foods that would meet their nutritional and medicinal needs.

The book recognises this as a fundamental practice of displaced communities of people. These prized foods were deliberately chosen and can be found in large volumes on lands that used to be plantations, near great houses and in Maroon enclaves, where free Africans engaged in rich and diverse farming strategies.

Some of these foods are yam, dasheen/taro, plantain, banana, okra, tamarind, and black-eyed peas. These nutrient-rich staples sustained our ancestors despite the many hardships they had to endure, and they remain essential to the nutritional well-being of our people today.

Within these historical accounts lie valuable insights into overcoming food insecurity. They highlight a concept I believe is crucial in combating hunger and undernourishment globally: cultural relevance. Culturally relevant foods are foods that identify an individual as part of a culture and which the culture has identified as vital to its own survival. These foods represent a shared culinary tradition and diet, forming the backbone of a community's identity and resilience. Embracing and nurturing these cultural foods can pave the way to a more food-secure future.

For Jamaicans, these foods are all around the country: green banana, plantain, cassava, dasheen, yam, sweet potato . . . Our ancestors didn't plant and consume these foods just out of familiarity; they chose them for their nutritional value, high yield, and versatility. As a society, moving away from these traditional staples that nourished our grandparents and great-grandparents has diminished our ability to feed, nourish, and sustain ourselves. The rise in consumption of imported and processed foods laden with sugar and sodium has coincided with a decline in our collective health and resilience.

From time immemorial, our elders have been encouraging us to eat a certain kind of food and have chided us when we do not ("Den yuh nah eat good food! How yuh suh fluxy? Yuh nah nyam up the yam and banana."). The foods they encourage us to eat are the very same ones that our ancestors took into the island

and planted everywhere they went. It's time for us to lean in and truly embrace this ancestral wisdom.

People should eat not only for their own betterment but also for the betterment of future generations. This was a principle our ancestors adhered to with great effort and sacrifice. If we acknowledge that we have, in many ways, lost our cultural identity, it stands to reason that we have also lost our culinary identity. This culinary identity is closely linked to the consumption of culturally relevant foods. A more targeted focus on the expansion of our production of culturally relevant foods – as recommended in the heritage and legacy of our wise ancestors – might be a revolutionary start to solving our nation's hunger problem.

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UTech, Jamaica:

The Centre for STEM Education and Enabler of a Highly Skilled Workforce

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In today's rapidly evolving global economy, the demand for highly skilled professionals in Science, Technology, Engineering, and Mathematics (STEM) fields is increasing. However, access to higher education in Jamaica, particularly at the grades 10 to 13 level and tertiary institutions, remains limited. This has resulted in the creation of many unattached and uneducated youths, hindering the nation's social and economic progress (Jackson, 2015; JETC, 2021; Thomas-Brown, 2020). To bridge this gap and pave the way for a brighter future, it is imperative to establish strong linkages between the HEART Trust/NSTA, City and Guilds, and institutions like UTech, Jamaica – Jamaica's national STEM university as the centre for educators and technology. Moreover, UTech, Jamaica must adapt its curriculum to accommodate lower-trained vocational and co-op education institutions, thus enabling the creation of a highly skilled workforce capable of propelling Jamaica's economy forward.

In advancing this idea, one must critically assess the current gaps in the educational system and within our institutions of learning that militate against germination and development of this transformation. From a government policy perspective, the following questions are apposite: What is the current state of higher education in Jamaica? How are the actors and institutional linkages being created? Have the determinants of the system and subsystems been mapped to anchor the industries that will drive national economic growth?

At present, many talented individuals in Jamaica face numerous barriers when trying to access higher education (Hylton, 2022; Sweeney and George, 2024; Thorpe, 2023). The limited opportunities available at the grades 10 to 13 level, as well as the lack of support and resources for tertiary education, are major challenges (JETC, 2021; William, 2020). As a result, a significant number of young people are left disengaged and without the necessary skills to contribute effectively

to the workforce. This situation calls for urgent action and a comprehensive transformation of the education system (JETC, 2021). It goes beyond scholarships and free tertiary education. We need trained STEM educators, labs and facilities and importantly institutional linkages in place (Hylton, 2021).

The Sixth Form Pathway Programme represents a promising solution to the issue of limited access to higher education (Feraria, 2016). By bringing tertiary education down the K-12 pipeline, this programme aims to provide opportunities for students who may not have otherwise pursued further studies (Thomas-Brown, 2020). It offers a viable pathway for unattached and uneducated youth, enabling them to develop the skills and knowledge necessary for success in STEM fields. Tertiary institutions must embrace this programme and actively participate in its implementation to ensure maximum impact.

On the same theme, to achieve the desired transformation, it is crucial to establish strong linkages between key stakeholders (Feraria, 2016, JETC 2021, Smith et al., n.d). The HEART/NSTA, City and Guilds, and institutions like UTech, Jamaica must collaborate to create a seamless educational ecosystem. This partnership will facilitate the integration of lower-trained vocational and co-op education institutions into a continuous vocational learning system. By leveraging the expertise and resources of these institutions, we can unlock the potential of thousands of young Jamaicans and equip them with the skills needed to thrive in the modern workforce (Hylton et al., 2019; Jackson, 2015; JETC, 2021).

According to Al-Zubaidy and George (2000), UTech, Jamaica, as the leading STEM centre for educators and technology in Jamaica, plays a pivotal role in shaping the future of the country's workforce. On the same theme, Thorpe (2023) argued for the increase of micro-credentialling, cross pollinated curricula infused with digital skills and increased need for cyber-security and data science across all disciplines. To meet the demands of the changing economy and provide greater opportunities for all, UTech, Jamaica must adapt its curriculum to embrace a more inclusive approach. By incorporating the talents and experiences of students from lower-trained vocational and co-op education institutions, UTech, Jamaica can create a diverse learning environment that fosters innovation and collaboration.

Continuous vocational learning is the key to unlocking the potential of Jamaica's untapped talent (Galhardi and Mangozho, 2003). By offering specialized programmes, certifications, and opportunities for upskilling and reskilling, UTech, Jamaica can empower individuals from various educational backgrounds to thrive in STEM fields (Heath, 2018). This approach recognises that not all students follow a traditional academic path and emphasizes the importance of lifelong learning. Through continuous vocational learning, we can nurture a

workforce equipped with the necessary expertise to drive growth and innovation in Jamaica's economy. Further, this approach presents the present a positive loop in the education system for scaffolding on the various pathways through the K-12 pipeline, by continuing the skills training programme right through and up to terminal degrees at the tertiary level. This also critically gives a non-traditional approach to attain higher education and skills certification outside of the traditional pedagogical approaches at polytechnic institutions such as UTech, Jamaica.

By focusing on expanding access to STEM education and training, Jamaica has the potential to cultivate a thriving Knowledge Processing Outsourcing (KPO) industry (Haughton and Ivey, 2023). This sector relies heavily on highly skilled professionals in engineering, technology, and computer science. By aligning UTech, Jamaica's curriculum with the needs of the KPO industry, we can create a pipeline of talent that directly meets the demands of the global market. This not only enhances Jamaica's competitiveness but also provides opportunities for economic growth and job creation (Jackson, 2015; Thomas-Brown, 2020).

The ultimate goal of transforming STEM education at the tertiary level is to build a highly skilled workforce capable of driving economic growth (Hylton, 2022; JETC, 2021; Jackson, 2015; Sweeney and George, 2024). Against the background of Jamaica's current labor force demands, by providing access to quality education and training, we can aspire to a future where 27,000 engineers, technicians, and computer scientists are prepared to meet the demands of the job market. This would represent a significant step toward achieving a target of 3% of the labor force being engineers, who will act as the growth drivers of the economy (Hylton et al., 2019). In conclusion, the transformation of STEM education at the tertiary level in Jamaica is crucial for creating a more inclusive and prosperous society. By addressing the lack of access to higher education and embracing the Sixth Form Pathway Programme, we can bring tertiary education down the K-12 pipeline and empower unattached and uneducated youth. In this regard, collaboration between HEART/NSTA, City and Guilds, and institutions like UTech, Jamaica is vital.

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STEM Education:

Empowering Creativity and Problem-Solving for a Better Future

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It was a wild ride this past semester, but I am so excited to be here to speak with you all today. When I was 9 years old I woke up one Christmas morning and decided that I wanted to learn to code. No one could explain why; honestly, sometimes I don't even know why. I just woke up and decided I wanted to learn something new. Why not try coding? At the time, I'd never even met a software engineer. I come from St. Elizabeth, and for those of you who aren't from Jamaica, St. Elizabeth is the south side of Jamaica, where we're primarily known for our farming, but from there, tech never really seemed accessible to me. So, I informed my brother of my new aspiration, and he asked me, "Why do you want to learn coding all of a sudden?", and I told him, "That's where the world is going, and I want to be a part of it". So fast forward a couple of years, and what I learned to enjoy the most about programming is problem-solving, it's what I find joy in. You can spend weeks pouring and pouring over a problem, and then when you finally solve it, it's the best sensation in the world.

Yet, even as I spent all that time pouring over problems, not once did I consider programming as a serious career choice. To tell you the truth, a year ago I was 100% certain I was going to become a neurosurgeon. You can see how that went. One funny story is that I was working on a problem while building a program for my mom because she's the kind of person who writes down her To-do list on 5 different pieces of paper and she can't figure out where one list is, and she forgets it and I have to remind her two days later. As a solution, I was working on building a program where she could store all her To-do lists on a website, and then the website would remember everything. I was working on it and working on it, and it took me weeks to solve that problem but when I finally did I got so excited that afterward someone came up to me and told me that if they didn't see that smile on my face, they were going to call an ambulance because I looked

like I was having a heart attack. But my point, in a roundabout way, is that STEM education is all about finding solutions to problems, it's all about being able to see a problem and then find the solution, and it's about learning how to innovate.

I'll share another story with you. Last year the main thing I learned from programming as I built applications and websites was not variables and loops, but that for every problem, there's a solution. It's similar to a concept we learn in Physics where for every action there's an equal and opposite reaction. I think as the younger generation, our responsibility is to take on the mantle of seeing these problems and finding the solutions lying just beneath the surface. This is exactly why STEM education is so important, it teaches us to be problem solvers, and it teaches us to use our most important resource, which is our creativity. One of the things I absolutely love about the younger generation is that we are so full of creativity, ideas and inspiration and STEM education allows us to channel that creativity into something that can make not just our nation, but the world a better place. We need to empower everyone in the country, all our young people to know that they have the ability to change the world and all we need are the resources, the empowerment and the motivation to make that meaningful change. I truly believe that STEM education is the future, it's how we're going to be able to solve the many problems we are being faced with and it's how we're going to get our young people, including myself, to be able to think creatively and apply that creativity to not just be able to innovate today but build a better tomorrow.

Editor's Note: The author made these remarks in a speech delivered at the 'Future Ready International STEM Conference' held at the University of Technology, Jamaica, April 23, 2024. At 14 year's old, she is the youngest student admitted to the University of Technology, Jamaica where she is pursuing the BSc in Computer Science.

Police Stop and Search

What Does the Law Say?

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The Jamaica (Constitution) Order in Council 1962 enacted the Constitution of Jamaica which is to be found in the second Schedule of that Order in Council. The constitution can be defined as a body of law containing the rules which determine the structure of the state and its principal organs. It establishes the fundamental principles according to which the state is governed. The rights of each citizen of Jamaica were reenacted in the Charter of Fundamental Rights and Freedoms which was brought into being in 2011, by the Parliament of Jamaica.

The Jamaican Charter of Rights guarantees that no person shall be subject to the search of his person or his property except with his own consent. It also provides that no person shall be deprived of his freedom of movement, meaning the right to move freely throughout Jamaica.

Thus, no person is to be deprived of his personal liberty unless it is permitted by the law. A person who is detained against his will without legal justification, that is, unlawfully arrested or detained by any other person which amounts to false imprisonment is entitled to compensation from that person for the arrest.

In the case of Gary Hemans vs. The Attorney General of Jamaica (CLAIM NO. 2009 HCV 02800, the Claimant successfully sued the State for false imprisonment and malicious prosecution and was awarded over $2.8M after being arrested and charged by the police. Justice David Batts at paragraph 57–58 opined that:-

> [57] "It is still the law of this nation that persons under the Queen's peace are entitled to freedom from search of their person or property unless such a search is legally justified. I hold that it is not a lawful reason to stop and search a car, based on the fact that cars with similar features are often stolen and used in the commission of crime.

It would really be no different saying that an individual walking on the road bears "similar features" to most persons convicted of crime. e.g. He is of dark complexion and wearing shorts below the waist. There is in some quarters, (see

for example obiter dicta of Daye J in Foster v. A.G. F135/1997 unreported), the belief that Section 58 of the Road Traffic Act gives a power to the police to stop and search vehicles without reasonable cause. That Act does no such thing. The Act allows redirection of traffic or stopping of vehicles for the purposes of traffic flow or some reasonable purpose. The request for documents and driver's licence similarly follow on some existing cause such as a reasonable suspicion that a crime has been or is about to be committed.

> [58] The reasonable cause to suspect that an individual has or is, or is about to commit a crime must relate to peculiar characteristics of the persons or the vehicle he is driving or the manner in which it is operated, or to information received. In Jamaica the citizen is free to move about without an obligation to carry a pass and is not to be subject to arbitrary or random search. This is still a constitutional guarantee."

When we consider the case of Gary Hemans vs. The Attorney General of Jamaica, the Learned Judge was reinforcing the legal principles that the rights of all citizens must be respected and that the police have the authority to stop and question you at any time but for them to search you or your property, they must either have seen you commit a crime, have reasonable suspicion to believe you committed a crime, or have a judge-issued search warrant. A stop and search must be based on reasonable suspicion of a crime to be detected, based possibly on intelligence, based on the conduct of the persons, or based on a complaint given to the police by another person that must be grounded. Therefore, police officers cannot arbitrarily stop and search motor vehicles, as random search, especially a stop and search, is likely to breach your rights as guaranteed by the Charter of Rights.

Section 58 of the Road Traffic Act, which states that

> "the driver of a motor vehicle shall obey all directions whether verbal or by signal given by a constable in the execution of his duty to stop the vehicle or to make it slow down or to pass on any indicated side of the constable or to keep to any indicated line of traffic and any person who fails to obey any such direction shall be guilty of an offence and shall be liable on summary conviction before a Resident Magistrate to a fine not exceeding five thousand dollars."

This section empowers the police to stop vehicles, whether or not they suspect the driver of committing an offence. The Act also grants the police the power to request drivers' licences and vehicle documents for inspection, however, it does not give power to the police to search without reasonable cause.

It is important to also note that pieces of legislation which grant the police the

power to stop and search, grants this power as long as "the search is grounded by reasonable cause". They include:

- Section 19 of the Constabulary Force Act which empowers the police to stop and search, without warrant, vehicles and the occupants thereof, known or suspected to be carrying stolen or prohibited goods, as well as any dangerous or prohibited drugs and gambling materials.
- Section 42 (1) and 42 (2) of the Firearms Act which empowers the Police without warrant, to stop and search any vehicle and its occupants on reasonable suspicion that firearms and/or ammunition are being unlawfully conveyed therein.
- Section 11(3) of the Praedial Larceny (Prevention) Act which gives powers to the police without warrant to stop and search any person or vehicle suspected to be carrying stolen agricultural produce, livestock or fish and search such person or vehicle and the driver or any person conveyed therein.
- Section 204 of the Customs Act which states that any officer with reasonable suspicion may stop and examine any carriage to ascertain whether any unaccustomed or prohibited goods are contained therein, with the definition of carriage including motor vehicles.

The Constitution as we know it is parent law by which all other laws are measured, or the supreme law of the land. It is the authority base from which a rule of law originates and derives its validity and further validates other sources.

In his text, Professor Fiadjoe, *Commonwealth Caribbean Public Law*, 1999 pp. 121–122, outlined the function of the rule of law in our constitutions:-

> "In West Indian public law, it is submitted that the rule of law has come to mean the exercise of State power according to law and the subjugation of state power to the constitution. The phrase 'the rule of law' is thus a useful compendium to define the bundle of citizens' rights or legitimate expectations to hold the State accountable for its actions".

All laws, acts or omissions of government officials and bodies must therefore comply with the Constitution. Police Officers are therefore expected to conduct themselves in a way which upholds and observes the rule of law.

In light of the foregoing, it is a breach of one's constitutional right to be stopped and searched by the police "without reasonable cause". A breach of one's constitutional rights to freedom of movement and freedom from unlawful searches can give rise to a claim and entitles an individual to damages (monetary compensation). The amount of damages a defendant will be ordered to pay is at the judge's discretion. The judge may take several factors into consideration

including, loss of liberty, injury to feelings, injury to reputation, physical injury, pecuniary loss as a consequence of search, detention, aggravated damages and exemplary damages.

It should be noted that Section 33 of the Constabulary Force Act Jamaica reverses the burden of proof in actions against police constables by requiring the plaintiff to prove malice or lack reasonable and probable cause of the arresting officer. At common law, it is for the defendant in an action for false imprisonment to prove he acted with reasonable and probable cause. It is important that one is mindful that evidence of reasonable and probable cause must be proven in order for there to be a successful claim.

Finally, it is also important to note that one's rights can be suspended, and the police will have a greater power to search and arrest, for example, a state of public emergency, curfew and Zone of Special Operation. In those instances, one cannot claim for breach of one's fundamental rights and freedoms.

BOOK REVIEW

Innovation Policy Formulation for Socioeconomic Transformation of Developing States

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Innovation Policy Formulation for Socioeconomic Transformation of Developing States. 2022, 115 pp. **Author:** Dr. Andrea Barrett. **Publisher:** University of Technology, Jamaica Press.

Description: Focussing on developing states, this book captures and deliberates on the best models to build their capacity and capability to become innovative. It emphasises the organic links among economic growth, innovation, and wealth creation through entrepreneurship. In addition, it identifies and discusses some of the key factors that are required for the development of national systems to support an innovation-centric culture that is essential for the sustained socioeconomic transformation of developing states.

I want to talk first about the importance of innovation. The author spoke about this in the book – Jamaica is so far behind in terms of technology, in many different sectors – How do we leapfrog? Because there's no point in trying to catch up – you cannot. How do we jump ahead?

The book is timely. It is very, very timely. Why? Because Jamaica has dabbled in bits and pieces around the idea of innovation, but we have not embraced it fulsomely. We have not embraced it conceptually; we have not embraced it pragmatically. But it is critical to move forward. In fact, the more I think about it and the discussions I've had with the author and others, it is that our Vision 2030 requires a National Innovation Policy, as a structural support to give it legs to move it in that direction. Because to achieve Vision 2030, we must get all the other pieces right, and the book speaks to a lot of that. This book is an important addition to the literature about innovation, because in the Caribbean we rarely write about innovation, innovation policy and the importance of it.

Entrepreneurship is underpinned by innovation and invention. Unfortunately, we don't invent. Let me take that back and say we don't really "do" invention. And I'll share a small story with you.

At one point in my tenure at the University of the West Indies, I was asked by the then-Principal to go and sit with the science-based academics, to look at the patents they had to see how those patents could be operationalized. And it took me about a year, and I got frustrated. Because lecturers held on to the inventions so tightly, that by the time the technology was ready for them to release it, people had already leapfrogged it and gone ahead. One of the challenges we have in the region is the inability to transform inventions into innovations. Yes, we create the invention, but the process of transforming that innovation into a product that can be demanded by the public, that piece of it is missing. A couple of examples I am going to share that the book speaks to, that give you an idea of why we struggle in many respects, based on our economic development. We have not invested in some critical areas, but there are some pieces that we will have to get right.

I think this book really impacts the whole idea of a national system of innovation. Jamaica needs a national system of innovation. We are not short of ideas, we're not short of entrepreneurs, and for example, some of the data that the most recent GEM (Global Entrepreneurship Monitor) Report showed is that we are not different globally in terms of our ideas and startup businesses. But as the global data shows, 65% of the jobs that are created in some countries are created by small businesses. And in many cases, small businesses need a different set of systems and structures to move them from start-ups to promising businesses that can generate revenue and create growth. And we do some of that with the JBDC (Jamaica Business Development Corporation), but it is not enough. This is a structure that needs to be pervasive. So, what you will find is that most businesses in Jamaica fold after two or three years. They don't last long, because after they get to a certain point, they are not able to move beyond that. So, if you look at other countries in the world, they provide a systematic support structure that can move those small businesses into sustainable businesses that can generate wealth, create employment, etc. And anecdotally I'll share with you, that in India, whenever small businesses start in some cases the Indian government pays for light and water, utilities, just to give them the time to get the business moving, up and running.

I believe that an important contribution of the book is that it introduces what I regard as some innovative measurement tools that are critical to understanding the conceptual and practical framework of national systems of innovation. One example of this is the GERD (Gross Expenditure on Research and Development

per capita) as a percentage of GDP (Gross Domestic Product). It's a very important measure, but in the region, only Trinidad and Tobago tracks this. No other Caribbean country that I've seen tracks this kind of measure to say, 'How much money do we spend on R&D, whether it is done by the private or public sector, and what is that as a percentage of GDP?'

In the book, the author spoke about some critical countries in the world that demonstrated and have shown the impact of GERD on their science, technology, and innovation systems – we're talking about Ireland, Singapore, Hong Kong, Taiwan, China, and South Korea. So, these tools are very critical. While there are criticisms of GDP, we still have not found a better measure.

But what's important and what the book speaks of are those additional measures that can give an insight now as to what we do as a country to move the needle forward. For example, the finance minister, Dr. Nigel Clarke, announced during the 2022–2023 Budget Debate a $200 million fund for R&D. This to me was the most significant announcement in the entire budget cycle, as a researcher, because what it signals is an understanding of the importance – and the book speaks to it – it speaks to the fact that the government itself, the State has to take the lead in driving support for R&D within institutions and universities and so forth. Why? Because a culture of innovation takes a while to build up. And as you will see if you look at Korea for example, after 30 years, the spending on R&D moved to the private sector. So, it started with the government, but as the economy develops and the growth evolves and becomes more sustainable, people now understand the importance because you get to a firm-level competitive space, and firms are competing.

Now we do see examples of this in Jamaica. I believe the tourism sector is one example, and having been in that sector in the past, there are strong criticisms of what people call the "leakage rate" from tourism, but to me, that's not as important as figuring out how, in respect of the rest of the economy, how do we extract the value from tourism? Because the 'leakage rate' is driven by the fact that we have guests coming in. We have five million guests coming in. How do we feed them? Food for tourism, for the tourism worker, for the tourists, represents the average of nine or ten days of consumption when you look at the wider data structure, but the important part is what they consume is far greater on average than the average Jamaican, because food wastage in the tourism industry is massive. And the hotels are now using that food waste in the landfills and other things that can generate fertilizer. But the important thing to share is that – strawberries, grapes, whatever – it is not impossible to be grown here (locally). But what we need is a system that drives that, an underlying support system that allows the

small, medium, and large farmers into the tourism sector, and therefore reduces the need for importation.

One of the major policy frameworks of the government is import substitution, which I'm very familiar with because I wrote a lot of those policies at the time as a consultant. We need to start looking at data. We are not a data-driven society, and it is important that we move in that direction, because this is what is going to help us now to 'move the needle'.

The point is, and for those who will read the book, I want to look at that direct example of Trinidad's experience, and their economic growth. I struggle to see what Jamaica would look like, but it's something that we must consult . . . that graph, to see what it is that we need to be doing.

Investment in STEM (Science, Technology, Engineering, and Mathematics) is critical, because there's no doubt that what drives economic growth in the modern world is science and technology. We do a lot of research on, and we do a lot of writing about crime and sociology and the like, but these things are not moving the needle. We need hardcore scientific work that will enable our firms to be more efficient, will enable our students to be better trained. So instead of us buying robots, we build our own robots. We must create the frameworks and structures necessary to bring our people forward. Because our people are not dunces, I can tell you, and I'll give you an example. We sent 15 students from CASE (College of Agriculture, Science & Education) to Israel, now a very hotspot in the world [for innovation], and out of a group of 55 from around the world, one of our students was #2 for performance, and all our students performed very well. We sent them on an 11-month internship to Israel to expose them to agricultural technology and to change their mindset coming out of CASE, because the reality is that Jamaica's children don't have that kind of technology that can fuel the transition for us to move quickly. And so, for example, most of those students on their return to Jamaica have been snapped up by firms from all over, and you're seeing the change that they are making now in their contribution to the sector just by the exposure they got from that internship in Israel.

The fourth point I wish to make and conclude on is data analytics. Data analytics is big business, and we must now understand the value and importance of data. You can't make decisions based on what you're feeling; you must base it on the raw numbers, how do we deal with this? People get excited and say the sky is falling but the reality is that you must look at the data, and from that data determine what changes need to be made clinically to address this. And I think that this is something important that speaks to the idea of analytics. Speaking for example to our Sustainable Development Goals (SDGs), speaking to what we are trying

to achieve as an institution, and determining what is necessary to create this entrepreneurial-centric society that is so important for long-term development. I want you to consider this because some important data came out of UTech, Jamaica's College of Business and Management's Global Entrepreneurship Monitor (GEM) Report, which I track, because it provides an insight and provides a lot of guidance in terms of what is taking place at the entrepreneurial level in terms of start-up businesses. In terms of people who started a business, in 2021 it was 6.5%, down from 9.9% four years earlier, before the pandemic. So, you had a snapshot of before and after the pandemic. But the reality is that globally, while Jamaica was 6.5, globally it was 6.7% so in other words, Jamaicans are just as entrepreneurially minded as people in other countries. The challenges the book's author spoke about are the systems and structures to be put in place to get that transformation so that entrepreneurial-minded individuals can contribute to the cycle of job creation.

I want you to consider that in the United States, 65% of new jobs over the past 17 years were created by small businesses, and while sometimes we get caught up in the big companies, we lose sight of the cumulative value of small businesses. In our country we talk about the small farmer. COVID or no COVID, they are like the salt of the earth, always providing food – mostly subsistence, but the collective value of what they bring to the table is an important element of food security. And it's very important for institutions like CASE, for example, providing the support that we can provide to help them improve their production and productivity.

And in the book, the author talks about "leapfrogging" – for us, what does leapfrogging mean? It means, for example, getting our farmers to start thinking through innovations like drone technology, thinking about how to utilize drones in their production processes. Of course, this comes upon a critical point mentioned in the book – the future of innovation – because it really spoke to understanding the process by which people adapt to innovation. And you have innovators, and you have non-innovators. There are persons in Jamaica and elsewhere in the Caribbean, who will try something new just to try something new, and there are persons in Jamaica who will [stubbornly] not try it, in the industry we call them "laggards".

In one of my previous lives, I did some research on laggards (and people asked me why we studied laggards), because we want to understand the psychology of why an individual would take years to buy a smartphone for example. There are Jamaicans who are still walking around with the old Nokia phones; they are not interested in smartphones. And that speaks to the fact that not everyone is an innovator. So, if you're going to introduce that technology, you need to understand: How do I target? Who do I target, when do I target? Because the thing is that

those innovators, and the interesting thing about the new generation, they're now called social media influencers – the terminology is changing, so you must keep up with the terminology as well as the technology that is underpinning that change in terminology.

So, if we want to introduce a new technology, we know the price of drones, we know the process etc., how do we infuse these technologies into the Jamaican agricultural sector? We try to identify the innovative farmer, the farmer who is going to decide to take a chance on the drone technology. When you say "drones", these days people start thinking of 'drone strikes' . . . firing guns, they think about Ukraine, etc. But you must work with those who are open to seeing that drones can be useful for the agricultural sector.

But we must know our situation. If we just try to push ahead as we normally do in Jamaica, we won't get any traction – the idea of efficacious innovation, as the book speaks to, you must target the people who are most likely to adapt the innovations and then influence others to try that innovation. You must identify the businesses – large and small – that are willing to try the drone. And what we learned after spending many years in the agricultural sector is: when you introduce a new technology to the normal, average Jamaican farmer, you have to have the old plot and the new plot side-by-side, and you have to show the difference between fertilizer bricks versus what he normally does. As one farmer told me when we were trying to expand Irish potato production "Is 40 years me a do this, there's nothing you can show me to help change my mind. But here is my grandson, you can go teach him what you want to teach him, but you're wasting my time."

If you're talking about transforming and creating an innovative culture and making it central to how we do things, you must find a way to get to these kinds of people. And there's many of them. There's a high percentage of them that you must try to find a way to crack that code that allows you to get into their headspace and demonstrate the value of that new technology.

We need to develop a more pervasive support system for small businesses in terms of efficiency, knowledge creation, knowledge sharing, because as we try to move towards a knowledge economy, which is an important part of an innovative society, you have to try to provide the information, you have to be able to acquire, create, share and disseminate knowledge, so they begin to trust the process and the system. Jamaicans, one of our cultural traits is to distrust "the system", and they have all kinds of different reasons.

Now there's the Gini index, which measures equality – again, these are not things that we use regularly in Jamaica; these are not part of our regular speech, but it is important for us to look at these things as measures of our success or failure. So, for example, in 2004 the World Bank reported that Jamaica's Gini

index was 45.5 (a higher number means you are more unequal, a lower number means you are more equal of a society in terms of wealth distribution). The CIA Factbook for 2016 reported that Jamaica's Gini index was 35, which suggests that there has been an improvement, and if you look at the data you will see that there was an improvement in productivity; after the 2008 financial sector crash, there was a recovery and you saw that change. But that's middle of the road; the United States is 45, just to put it into perspective. The Nordic countries are usually in the twenties, so there's a greater level of wealth and income equality in those countries.

Of course, the book speaks of 'knowledge economy" and 'knowledge-based economies' – these are buzzwords, but they have critical underlying meanings. If we want to achieve Vision 2030, a knowledge economy is crucial . . . a necessary condition. If you go through Vision 2023, what you'll recognize is that we want to move towards a society that is knowledge and technology based.

The book spoke extensively about national systems of innovation, and this has been of interest for a long time. I want to share that technology-related analysis was traditionally focused on inputs and outputs, and less on interactions among the actors involved in technology development. These interactions are key to converting inputs to outputs, and the book speaks extensively about those processes. National systems of innovation focus on linkages and require fluidity of knowledge flows. You must have an ability to move knowledge across the systems, across the board, from different spaces, so that every Jamaican has the exposure to that knowledge and can use that knowledge for betterment of the self.

It's also important to understand that fluidity of knowledge takes place at two levels – at the level of codified language, what we write, and the tacit level, what we share based on cultural norms. Without fluidity of knowledge, one ends up with knowledge that is out of date with today's time. But it points to an issue in our society, where we must find ways to break down old tacit knowledge and create new ones. We need a mechanism for knowledge flows, and that normally includes collaborative research. Many of us studied in the United States. At Northwestern University in 1993, I took an entrepreneurship course, and a company approached Northwestern to figure out how they could compete with AT&T, and phone kiosks were then an emerging technology. If you look at the way developed countries work, knowledge creation is oftentimes at the institutional level, at universities and research institutes, and it flows into the private sector. That's a mature model. Private companies fund these research projects, which then feed the knowledge back into their companies, which then gets disseminated in books and reports. If you track for example the career of Prof. Michael Porter of Harvard University, you realize a lot of his research came from his interaction with companies trying

to solve their particular problems and that knowledge has now become widely available.

Professor Porter did a presentation in Trinidad about 10–15 years ago, and he presented on the interconnectedness of Caribbean economies – Jamaica, Barbados, Trinidad – and it was instructive. It was clear from the data that Jamaica in particular, Trinidad not too far behind, operated in silos. So, we have industries, e.g., sugar, agriculture, and tourism, and they don't share information. So, you develop innovative solutions to solve one problem here, but that innovation is not disseminated to the other part of the economy to do the same.

And tourism for Jamaica has been a center for innovation for 40–50 years, globally. When Jamaica started its own all-inclusive model, we took the Club Med model from the Mediterranean in Europe, and we created our own all-inclusive model, that the world has now adopted, and if you go to many countries now, they have adopted the Jamaican model, essentially which is an all-inclusive model. Now you're seeing Jamaica extending that model. If you recall, what happened was that we created what we now call "enclave tourism", because of the circumstances we faced (increasing crime and violence), but now you're seeing these hotels arranging trips for their guests in communities across Jamaica. So, they come to the hotel, and they sign up for these trips (to Portland, St. Elizabeth), and they go hiking, they go on these agro-trails, they want experiences outside the normal all-inclusive hotels, because the subsistence of all-inclusive hotels, what we call European plan or E-hotels, those hotels are practically dead.

But there's an emerging innovation now that's called Airbnb, and you see now Jamaicans have embraced Airbnb to the point that Airbnb is now driving our own real estate development systems. So, the book's point is the need to be constant with technology – you must keep going, you can't stop. You really can't rest, or you will be leap-frogged. And you look, for example, at the work that Sandals Resorts Ltd. has done, you see a company that is keeping abreast, driving technology, introducing AI into their training programme, those kinds of things. Tourism is an example of an innovative industry in Jamaica that we're not extracting much from, but we need to see, how do we replicate the tourism model in agriculture, in other parts of the economy, because it is clear that we don't lack ideas. What we lack is a system that underpins the development of those ideas so they can transform other industries.

I thank the author for writing this valuable contribution to the literature on innovation, especially for developing states, such as Jamaica.

Editor's Note: This book review was delivered at the official launch of the book on October 12, 2023, at the University of Technology, Jamaica.

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