How Principal Leadership Affected ICT Integration in Antiguan Secondary Schools: Successes and Challenges

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ABSTRACT
The present article focuses upon particular findings from a mixed-methods study that examined the leadership strategies Antiguan school principals employed to incorporate technology into the teaching and learning process. The aim was to provide greater insight into these strategies, as well as, to identify some of the successes and challenges associated with the incorporation of ICT by these secondary school principals. This study was anchored by the International Standards for Technology in Education (ISTE) model, an established technology leadership theoretical framework. Qualitative data were gathered from school principals and teachers through the use of semi-structured interviews (N=27). Furthermore, the qualitative data were manually coded and subjected to thematic content analysis. Regarding ICT integration, findings on leadership strategies highlighted a number of developing themes related to successes and challenges, in areas such as communication with key stakeholders, ICT resource allocation, attitude of educators towards ICT integration, and administrative activities.
Keywords: Principals leadership, ICT integration, ISTE standards

INTRODUCTION
ICTs are now an integral part of the curriculum in many secondary schools (Mogas et al., 2022). The recent Covid-19 pandemic proved that technological integration was crucial. School administrators in this context must therefore be strategic technology leaders that promote the use of technology in the classroom (Thannimalai & Raman, 2018). Moreover, school administrators face the challenging task of integrating technology into the curriculum in order to enhance teaching and learning in 21st-century classrooms (Thannimalai & Raman, 2018). Nevertheless, many countries, especially developing ones and those with limited financial resources are making significant investments in education through ICT (Mogas et al., 2022). Consequently, schools must present a solid rationale for making such an investment. This article presents an examination of some of the findings from the integration of ICTs in Antiguan secondary schools.

LITERATURE REVIEW
ICT integration in education has had an incredible impact and has been acknowledged as one of the major factors influencing the learning process (Prasojo et al., 2019). An educational setting that prepares students for the realities of the modern technology dispensation is not only critical, but fundamental to the smooth operation of society (Harrell & Bynum, 2018; Schindler et al., 2017). In view of this, the Fourth Industrial Revolution demands that school administrators and educators alike be proficient and fully cognizant regarding technology related concerns (Raman et al., 2019). On the other hand, if educators and school administration are uneasy or fail to possess the necessary technological integration abilities, students will suffer (Krawchuk, 2022; Waxman et al., 2013). Therefore, in order to support digital natives in their classrooms, school principals must constantly evolve. Notwithstanding this, a significant number of school administrators and educators continue to use antiquated techniques in their curricula, which is concerning (Harrell & Bynum, 2018). These factors situate the current study, which aims to identify the context and content of principal-led technology integration in Antiguan secondary schools. It also aims to highlight the successes and challenges of these principal leadership strategies.

To promote educators' use of technology in the classroom, school administrators must be well-versed in how technology might enhance pedagogical techniques (Garcia et al., 2019; Waxman et al., 2013). In order to effectively manage the integration of technology to enhance learning, school administrators must also be innovative thinkers (Ugur & Koç, 2019). Furthermore, since our world is becoming more and more perceived as globally connected, educational leaders must proficiently embrace the modern technology landscape (Hamzah et al., 2016). Therefore, it is imperative that school leaders create cutting-edge, modern institutions of learning that provide outstanding educational possibilities to every student (Hamzah et al., 2016).

Education administrators must lead by example in incorporating technology into everyday tasks (Ugur & Koc, 2019). If school leaders are well-acquainted with the appropriate use of technology, then teachers and students are more likely to embrace it (Ugur & Koç, 2019). School administrators must first encourage, then skillfully model the use of these instructional resources as the first step in incorporating technology into the classroom (Shyr, 2017). Moreover, in order to improve teachers' digital competency and pedagogical efficacy, educational administrators must plan, coordinate, and supervise their institution's technological initiatives (Waxman et al., 2013). There must also be cooperation between educational technology staff and school administration for optimal educational outcomes (Ugur & Koç, 2019). Ultimately, joint efforts among all stakeholders are necessary to optimize the integration of ICTs in the education eco-environment.

Additionally, the body of research clearly indicates that ICT integration has numerous advantages for academic institutions, as well as principals themselves. Teachers and students now have easier access to significantly more modern learning resources and tools thanks to technology (McKnight et al., 2016). Students can learn in a variety of ways when ICT is used in the educational process (McKnight et al., 2016). They also have more control over their education when technology is utilized in the classroom (Ruloff & Petko, 2022; Yarbro et al., 2016). ICT integration also affords students tailored and diversified learning opportunities (McKnight et al., 2016). ICT-enhanced learning environments also enhance students' ability for a better understanding of the learning process than standard classroom settings (Uygur et al., 2020). Similarly, through online forums, digital communications, and interactive websites, technology can be leveraged to enhance student feedback and communication (McKnight et al., 2016).

ICT integration in schools also pose notable challenges. One such concern for school administrators is learning how to use appropriate technologies for communication, instruction, and administration in an effective manner (Schrum & Levin, 2016). While many western countries have widespread access to ICTs in their classrooms, only a small percentage of teachers reported utilizing them in teaching (Shemshack, 2021). Regretfully, instructional tools are not equally accessible to all schools (Sincar, 2013). Moreover, school administrators are only somewhat prepared to establish contacts outside of their institution, which is a limiting factor in facilitating the effective use of technology (Esplin et al., 2018). Furthermore, studies indicate that bureaucracy has impeded the advancement of instructional technology (Sincar, 2013). Another disadvantage that affects educators and school principals is a poor understanding of the usefulness of an ICT resource which can significantly limit its efficacy (Claro et al., 2017). It should be noted that when technology leadership is applied in education, the problem is not always the hardware, computers or e-learning infrastructure but rather the attitudes and behaviors of the leaders, the organizational philosophy, the readiness of the staff, and the staff members' resistance to change (Chua & Chua, 2017). ICT integration ultimately necessitates a high degree of dedication, support, and active participation from school administration; otherwise, initiatives for implementing new technologies will fail. Given this context for ICT integration in schools, the research questions below emerge.

Research Questions:
1. What Principal Leadership Strategies were used for ICT integration during and beyond Covid 19?
2. What successes did principals and teachers identify as a result of the ICT integration?
3. What challenges did principals and teachers identify as a result of the ICT integration?

METHOD
This study was built employing the NESTS-A theoretical leadership framework. The study population consisted of approximately 769 teachers, 18 deputy principals, and 12 principals. In total, 27 semi-structured interviews were conducted with two teachers from each school (n=18) and nine out of twelve (9/12) school principals, or 75% of public secondary school principals. The researcher thought that 27 interviews would be adequate to reach data saturation, which is the point at which learning more about a problem would not provide any new information (Hennink & Kaiser, 2022). To collect qualitative data from participants, the researcher used a purposive sample approach. Based on the researcher's judgment of who will offer the most useful information to achieve the study's objectives, this sample plan was formulated (Etikan & Bala, 2017). According to research, there is no minimum or maximum number of participants needed for this nonrandom technique (Etikan et al., 2016).

Participants
Pseudonyms were assigned to each participant to protect their identity. Teacher participants were identified as T1, T2…to T18, whereas principal participants were identified as P1, P2, ...to P9. Out of the nine principals, four were male and five were female. Five of the principals were between the ages of 36 and 50, while the remaining four were beyond 51. Two of the principals had more than 20 years of experience, while the majority, six, had over 30 years of experience in the field. Among the teacher participants, there were three males and fifteen females. Twelve teachers were between the ages of 36 and 50, five were in the 20–35 age range, and only one was older than 51.

Teacher participants included deputy principals, social studies, IT, Math and other educators. Teacher participants have been teaching at their current school for a minimum of one year, and a maximum of 19 years.

Data Collection and Analysis
The Ministry of Education, the research sites, and the Institutional Review Board (IRB) at the University of Trinidad and Tobago all granted the necessary permission in order to carry out this study. These relevant authorities were consulted verbally, in writing, and through electronic means during the approval process. Participant consent forms were then prepared for distribution. Once study participants received and signed the consent forms, the data collection process began. Teachers and school principals were scheduled for in-person interviews at a time and location that best suited them. Depending on the availability of the respondents, the sessions were held on the school premises during regular school hours. The approximate start and end times of the interviews, which went up to an hour were also disclosed to the interview subjects. Participants were asked for their prior consent before audio-visual recoding and a verbatim transcription of the sessions could begin. In addition, participants were informed that they are free to withdraw from the study at anytime without consequences.

After the interviews were concluded, the researcher utilized a Microsoft Word function to transcribe the data. Before continuing with the process, all participants received an email with the transcription of the data in the form of a Word document, so they could verify that the information was accurate. The qualitative data was then subjected to thematic content analysis. The six-step theme analysis approach described by Braun and Clarke (2006) was used. These consist of getting acquainted with the data, coming up with preliminary codes, looking for themes, going over themes, identifying and labeling themes, and writing the report (Braun & Clarke, 2006). One of the most significant steps within this process was for the researcher to immense himself into the data by reading and rereading in order to create a preliminary set of codes. From these codes, themes were developed and refined. Overall, the study revealed that while employing a range of leadership strategies to support the integration of technology into the curriculum, administrators faced both successes and challenges.

RESULTS
The qualitative analysis of the data from the principals and teachers' interviews revealed a number of themes in answer to each research question. Moreover, the themes were categorized under the broad headings of successes and challenges. Table 1 below captures themes in these categories, as well as those identified as the leadership strategies employed.

Table 1: *Emerging Themes from Principal and Teacher interviews*

Research Questions	Emerging Themes
	Principal and Teacher Interviews
1. What leadership strategies did school principals use to integrate technology in curriculum delivery?	**Principal Leadership Strategies** Theme 1- The Integration of Technology **Principal Leadership Strategies** Theme 2- Technological Resources and Infrastructure **Principal Leadership Strategies** Theme 3- Professional Development
2. What are the key success factors experienced by school principals concerning the integration of technology in curriculum delivery?	**Principal Success** Theme 1- Communication **Principal Success** Theme 2- Time-saving and paper reduction **Principal Success** Theme 3- Working remotely
3. What are some of the challenges faced by school principals concerning technology integration in curriculum delivery?	**Challenges faced by Principals** Theme 1- Inadequate Internet Infrastructure **Challenges faced by Principals** Theme 2- Insufficient ICT Hardware **Challenges faced by Principals** Theme 3- Teacher resistance

Emerging Themes from Principal and Teacher Interviews

RQ1- What leadership strategies have been utilized by school principals to integrate technology into curriculum delivery?

Three main themes emerged from participants' responses when asked about the strategies that school principals employed to integrate technology into classroom instruction, as shown in Figure 1. All participants collectively confirmed the development of these themes. By setting up staff ICT training and acquiring the necessary technology for the school, administrators would have tried to incorporate technology into the curriculum. A significant attempt was also made by school administrators to intentionally incorporate technology into the school's everyday operations.

Theme 1- The Integration of technology

The majority of participants identified deliberate and decisive technology integration initiatives for administrative, instructional, and communication objectives as a key leadership strategy that school principals used to incorporate technology into the curriculum. Research participants reported that in order to guarantee efficient coverage of subject matter, school principals actively promoted the use of technology throughout the school.

Communication Purposes

Any organization's management, including that of educational institutions, must prioritize effective communication. The majority of respondents highlighted the use of WhatsApp as one of the most often used forms of communication. This is an online social networking site where users may, among other things, make and receive phone calls and message one other. It is an easy-to-use platform that gives educators highly useful ways to communicate with each other. P7 made the following observations about using technology to further communication objectives by stating, "*when it came to reaching out to teachers, I used WhatsApp. I brought WhatsApp in because it was quicker to get to the teachers, even to parents, utilizing emails and WhatsApp.*" Correspondingly, T13 observed, "*She (principal) has organized meetings via Google Meet. She's always using WhatsApp to reach us 24 hours, anytime she wants to reach us.*" The utilization of such technologies for communication purposes is vital since both educators and school administrators must be able to quickly share information in order to get timely feedback that may aid with effective decision-making.

Administrative Uses

Additionally, the results showed that administrators and educators emphasized the value of using technology in administrative tasks. A significant number of school administrators have adopted technology to manage their institutions on a regular basis. P1 commented "*from the standpoint of school management, the Sydavi system is used for reports, keeping tab on our students in terms of classroom management, in terms of the number of students in class, particular classes, houses, their grades etc.*" The administrative responsibilities of school principals include supervising employees, monitoring efficient classroom management, and keeping an eye on and disciplining students. ICTs may also prove very helpful for teachers in carrying out their numerous administrative responsibilities since they are also responsible for managing daily administrative duties including marking student registers.

Instructional Application

The results of this study showed that the most popular instructional technology used to support the school's curriculum was Google Classroom. P3 noted that "d*uring COVID, we all had to use the Google Classroom. So even though COVID is not so prevalent, we still continue to use the Google Classroom platform.*" Educators also indicated that school principals monitored and supported educators' use of technology to achieve instructional goals. T16 commented "*She (the principal) encourages the staff to use technology, for example, the Google classroom, there is Onelearn. Teachers are encouraged to use projectors, they are encouraged to place lessons or videos, on the Google Classroom for students to use*." School principals in Antigua made sure that instructional technologies were strategically embedded in their schools with the goal of effectively delivering subject content, especially since the Ministry of Education had mandated that all public secondary schools use programs like Google Classroom when students were forced to stay at home during COVID-19.

Theme 2- Technological resources and infrastructure

Another leadership strategy that educators and school administrators both mentioned was the acquisition of ICT resources. In this regard, administrators saw the importance of lobbying the Ministry of Education, Board of Education, and other stakeholders in education to purchase the infrastructural and technological resources that were needed. In some cases, several school principals went above and beyond the call of duty, for example, P4 commented, "*we have tried to acquire those resources from computers to projectors, just about what you need to assist you in that process.*" Another principal outlined the tactic of lobbying the Ministry of Education in an attempt to get them to put things in place so that the technology can actually work at the school. P2 remarked "*going into the Ministry of Education, encouraging them to put certain things in place in terms of getting the actual*

infrastructure in the school itself, so that the technology can be functional." Given that technology integration cannot be implemented without these ICT components in place, this leadership push to secure the necessary technological capacity is essential (Ruloff & Petko, 2022). Schools need laptops, projectors, smartboards, printers, and reliable internet access with enough coverage in order to achieve the required results (Raman & Thannimalai, 2019).

Theme 3- Professional Development
Lack of qualified professionals capable of successful technology employment is perhaps one of the biggest obstacles to fully integrating technology into secondary school curricula (Raman & Thannimalai, 2019). Frequent professional development helps teachers become more productive in their work and contribute more meaningfully to educational institutions. One crucial leadership strategy that school administrators used was to involve staff members in ICT professional development sessions. Many of the participants said that the administration of the school would have given teachers training on how to use Zoom, Sydavi, Google Classroom, and other tools, as well as how to integrate technology into the classroom more effectively. P9 expressed the opinion that "*we have had PD sessions, and they have been very successful in terms of not only the Google Classroom, not only how to utilize the Zoom platform. We've had training with regards to our Sydavi system and ChatGPT.*" P6 remarked, "w*e would have given teachers training every beginning of the school term, just to get them up to date.*" Professional development activities led by school administrators should be planned to give teachers the opportunity to acquire and use new knowledge and abilities that will support them in facilitating learning and instruction (Day et al., 2020; Hero, 2020).
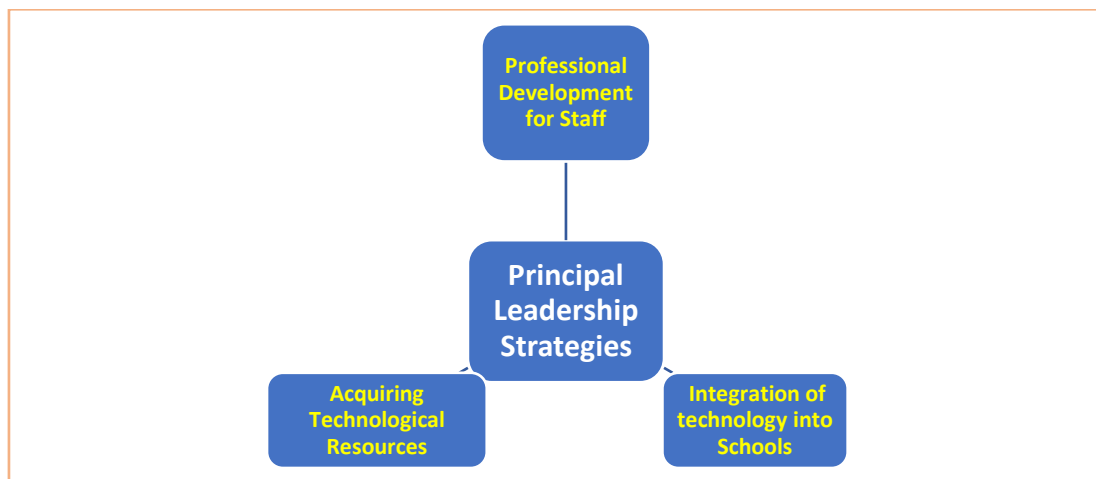

Figure 1: *Principal Leadership Strategies for Technology Integration*

RQ2- What are the key success factors emphasized by school principals concerning the integration of technology in curriculum delivery?
Theme 1- More Effective communication
More effective communication is made possible by technological integration, which is a major benefit that both teachers and school principals have noted in relation to the function of school leadership. To communicate effectively with all education partners, a significant number of school administrators rely heavily on technology. Through email and mobile apps, school principals communicate with educators, learners, and parents. The idea that technology dramatically improved communication speed and quality was endorsed by a significant number of participants. P2 believe that "c*ommunication has improved dramatically because I could just send a WhatsApp and the majority of persons are informed at the same time.*" P8 likewise highlighted the efficacy of using technology to communicate. In terms of improved communication with stakeholders and staff members alike, technological tools have significant implications for all school principals (Saraih et al., 2022). P8 remarked "*as it relates to the successes of technology, one of them is that you're able to have real time responses, feedback, instant feedback, that's a plus in this setting.*" T1 similarly noted that ICT integration enables for greater effectiveness in communication. This is a promising finding, given that a variety of modern technologies enable instantaneous response. Being a good communicator is one of a school administrator's most significant responsibilities, which makes the aforementioned theme crucial (Kempa et al., 2017). Since school principals regularly interact with teachers, parents, students, and a host of other stakeholders, this specific issue stands out as particularly important. Technology facilitates improved flexibility and collaboration with all stakeholders in education, as well as greater connectivity (Froment et al., 2017; Stronge & Xu, 2021).

Theme 2- Time-saving and paper reduction

Some participants felt that one of technology's most important features is its ability to do away with paper, while also saving time on mundane tasks. Electronic solutions allow for the faster completion of some tasks that were previously labor-intensive when done by hand. The fact that there is less need for paper is in line with Sustainable Development Goal (SDG) 12 of the United Nations. Goal 12 of the SDG places a strong focus on responsible production and consumption, especially in relation to the effective use of natural resources like trees (Chan et al., 2018). Cutting back on paper use in schools corresponds to saving trees, which is better for the environment. P2 stated *"we found it very beneficial to electronically post a lot of work, lessons and so on, on Google Classroom, which will eliminate all the paperwork, all the photocopying and save the trees."* Similarly, P1 expressed *"the use of the technology becomes alive again with CXC when we need to upload our students into the system for CXC, registering them for CXC, you are alleviating the paperwork."* Massive volumes of information can be entered, stored, and retrieved given the many functions that ICTs offer. Information technology has revolutionized storage with its blazingly quick read and write speeds. The electronic limitations of antiquated hard disk drives have been lifted by these technological developments, enabling quicker information access.

Theme 3- Working remotely

The success that school principals had from implementing technology was found to be closely associated with their capacity to work remotely. Technology has made it possible for teachers, administrators, and students to work remotely in a variety of ways. People can use asynchronous communication methods like videoconferencing and instant messaging services like WhatsApp, in addition to real-time communication. Teachers can work together as if they were on school property thanks to this. P7 remarked on this issue *"it makes my life a little easier using the technology. I can work from home."* Similarly, P2 emphasized the Zoom platform's ability to host remote meetings by stating *"I find the zoom platform, that has helped a lot, because sometimes persons are not able to be in the physical location."* The ability to access fast internet from anywhere has completely changed the landscape of remote work. It makes it possible to communicate without interruption, share files, hold video conferences, and use cloud-based technology from almost anywhere in the world. P4 commented on the capacity of educators to work from home under this new dispensation, *"teachers can work from anywhere, they can work from their homes, they can send work for children at any point in time."* This specific theme has strengthened the notion that educators can now work from anywhere, even the comforts of their own homes, owing to advancements in technology. Unfortunately, giving students the choice to finish their work remotely may not always be beneficial since many of them may not have the same possibilities for peer interaction as they would in a traditional classroom (Winter et al., 2021). Additionally, there have been concerns expressed regarding students exploiting ChatGPT and other text-generative AI tools to plagiarize written assignments (Chan, 2023).

RQ3- What are some of the challenges mentioned by school principals concerning technology integration in curriculum delivery?

Theme 1- Inadequate Internet Infrastructure

Regarding technology integration, many educational institutions face a range of issues, such as a lack of technology policies, insufficient technological resources (Raman & Thannimalai, 2019), a shortage of teachers skilled in technology integration, resistance to innovation (Chua & Chua, 2017; Harrell & Bynum, 2018), and a dearth of opportunities for educators to pursue professional development (Chen, 2015; Chua & Chua, 2017). Three main themes emerged when participants were asked to explain the challenges faced by school principals when integrating technology. To begin with, most participants thought that principals lacked adequate internet infrastructure in their schools to encourage students to use technology effectively. P2 stated *"I think the infrastructure and the reliability of the internet. First, the infrastructure needs to be in place. We need the bandwidth."* Although there is frequent internet connectivity available on some school property, not all areas are properly covered, which poses a significant problem for teachers who work in those areas. P3 briefly remarked on this difficulty, "w*e don't have reliable Internet access.*" Teachers likewise endorsed the administrators' responses on the issue of insufficient internet access in schools. T8 stated *"in the beginning, the Internet was very unstable. It is still not all of that some days."* This issue effectively highlights the fact that unless dependable internet connectivity is available, educators can do very little in the classroom, even with the best training possible.

Theme 2- Insufficient ICT Hardware

While many schools may have the opportunity to implement technology programs, there are a number of factors that affect how well technology is deployed in classrooms, one of which is a lack of adequate technology, including projectors, printers, smart TVs, IT lab space, and other items. A number of participants believed that in order to effectively encourage the use of technology in the classroom, school administrators had the difficult task of supplying adequate technological tools. P1 stated *"the limitation from the school standpoint, we only have one lab and so for us to really make the integration of technology a reality, there needs to be more facilities, computers."*

Due to a lack of devices, the usage of technological tools in some cases must be planned ahead of time, as P3 reported *"one of the problems with using technology at the school is that sometimes we have this book in which you have to be scheduling the use of the projector at this time, because we don't have enough."* It is critical to address the aforementioned issue if technology is to be used in classrooms efficiently. Even though educational institutions employ educators with experience implementing technology and have sufficient internet access in the classroom, these other factors will be useless if the ICT infrastructure such as computers, projectors, lab spaces, and other items are not in place.

Theme 3- Teacher resistance
Teacher anxiety was one of the significant issues that participants brought up in relation to the use of technology by principals. According to participants, teachers may be reluctant to employ technology because they are hesitant to try something novel. Many educators may find it challenging to change the methods they have been using in the classroom for years if they feel compelled to step outside of their comfort zone. This is because they may have become so accustomed to using tangible educational resources like textbooks, chalkboards, and the like. T7 observed, "*I don't know what it is about technology and teachers, I have found us to be one of the most resistant group of persons when it comes to the use of technology."* T9 believed that educators are opposed to change and unwilling to venture out of their zone of expertise. T9 asserted *"we are people who are averse to change, so we are accustomed to seeing it on the bulletin board, we don't necessarily want to check our e-mail. There's a lot of resistance against technology integration from staff.*" There will be significant limitations on the use of technology in the classroom if educators are reluctant to employ it. Administrators in schools need to come up with creative ways to motivate teachers to use technology. An objective assessment of this anxiety among educators is necessary, as is the implementation of practical remedies to allay them.

DISCUSSION AND CONCLUSION
This study investigated the leadership strategies adopted by Antiguan public secondary school administrators to incorporate technology into the school's curriculum. Thus, the purpose of this section is to provide a brief discussion of these findings based on the data provided in the results section. The theoretical framework of NESTS-A provides a strong foundation for investigating these various concerns.

Principal Leadership Strategies
Theme 1- The Integration of technology
A primary leadership strategy employed by school principals to integrate technology into the curriculum was recognized by the majority of participants as intentional integration of technology for the purposes of ***administrative, instructional, and communication goals***. Principals were compelled to employ fresh approaches to outdated communication strategies. In order to interact with teachers, students and other educational partners more swiftly, messaging apps like Gmail and WhatsApp augmented traditional methods of communication such as email. According to these results, vitally significant methods of connecting with people needed to be explored in view of the communication difficulties principals had encountered as a result of the lack of face-to-face engagement brought about by COVID 19. By combining these new and old forms of communication to communicate with parents, educators, and students in real time, interpersonal relationships were improved and critical feedback was given more quickly. Research indicates that social networking platforms like WhatsApp gives individuals the chance to communicate constantly, both within and outside of the traditional classroom (Froment et al., 2017).

The results also showed that participants used technology when performing ***administrative responsibilities***. Some administrative duties, such as preparing student transcripts, storing data, and creating grade reports, were digitized by administrators and educators using a variety of technologies, including Google Classroom and the School Management System (SMS) Sydavi. Consequently, work may be done more quickly and with greater efficacy and efficiency. Even though the Covid 19 protocols were the primary driving force behind these findings, these administrative uses of ICTs remained in place even after the restrictions were lifted. According to research, SMS supports school administration procedures by increasing productivity, time management, resource utilization, and information accessibility (Leong et al., 2016). A number of participants also underlined the advantages of delivering the school's curriculum via Google Classroom and other pedagogical resources.

This study further indicated that educators, especially in the midst of the COVID-19 crisis, recognized that Google Classroom was an invaluable resource for assigning work and teaching students, all while reducing the need for paper. This resulted from educators in Antigua and many other parts of the world being forced to transition to virtual instruction during the Covid 19 era (Daniel, 2020). Studies have shown that most educators primarily utilize educational technology for communication and administrative purposes rather than for instruction (Depew, 2015).

However, the results of this study showed that by using strategic planning, school administrators helped educators to integrate technology into the classroom.

Theme 2- Technological resources and infrastructure
The procurement of technology resources was mentioned by the participants as an additional leadership strategy employed by school principals to improve curriculum delivery. Participants said that in order to provide educators and students with the tools they needed to properly incorporate technology into their classrooms, school administrators purchased ICT equipment, including PCs, laptops, smart televisions, projectors, printers, smart boards, etc. Participants confirmed that financial contributions from the school and business community, the Ministry of Education, the Board of Education, and alumni assistance were some of the different sources from which the ICT resources were acquired.

Participants cited the acquisition of technology resources as another leadership strategy that school principals used to boost curriculum delivery. Participants stated that educational administrators acquired ICT equipment such as PCs, laptops, smart televisions, projectors, printers, smart boards, etc. to give teachers and students what they required in order to appropriately integrate technology into their classes. Participants affirmed that among the various sources from which the ICT resources were obtained were financial contributions from the school and business community, the Ministry of Education, the Board of Education, and alumni support. Despite these efforts, the COVID-19 pandemic caused a decrease in per capita GDP in around 90% of the world's economies (Yeyati & Filippini, 2021). Therefore, the effort to acquire ICT resources was an enormous undertaking spearheaded by Antiguan school principals. Thus, in order to successfully integrate technology into classrooms, critical technology equipment was purchased (Rabah, 2015).

Theme 3- Professional Development
Hosting IT staff training was the last leadership strategy employed by school administrators to incorporate technology into secondary education. Administrators planned many ICT training sessions for teachers at various points throughout the academic school year, based on data from participants. Many educators were compelled to use Google Classroom and Zoom due to the unexpected worldwide increase of Covid-19 without the necessary training; yet, new skills and competences were swiftly gained. According to research, organizing teacher training sessions to ensure that educators can integrate ICT across the curriculum is one of the increasingly important duties of administrators (Hero, 2020). Given how quickly ICT is evolving, it is imperative that educators have access to appropriate professional development opportunities within the context of ICT (Albion et al., 2015).

Technology Integration Successes of School Principals

Improved Communication
The results of this study showed that administrators of schools routinely used a variety of communication channels as a leadership strategy to improve the integration of technology in the classroom. Furthermore, all participants concurred that the use of these communication technologies have improved communication in the educational setting. The use of WhatsApp, for instance, and how quickly it can deliver important information to the appropriate individuals were highlighted by participants. In order to connect with people who did not have access to WhatsApp, emails were also used. The study also discovered that, in contrast to setting up in-person meetings, employing technology allowed principals to connect with staff members more quickly, particularly in emergency situations. The capacity of administrators to communicate with staff and other partners in education outside of regular school hours is another advantage that participants mentioned. School principals needed more efficient means of communication in response to the Covid-19 pandemic, which drastically reduced face-to-face interaction. The results above showed that school administrators used technology to enhance communication; nevertheless, for the process to be successful, educators and students need to have sufficient access to digital devices and the internet in their classrooms (Ratheeswari, 2018).

Furthermore, to gain the trust of their employees, principals need to communicate truthful and reliable information (Tschannen-Moran & Gareis, 2015). According to research, teachers' attitudes about technology use are improved and students' understanding of it is enhanced when parents, students, and educators emphasize the value of incorporating digital tools for communication outside of the classroom (Blau & Shamir-Inbal, 2016).

Additionally, in order to acquire the confidence of their staff members, principals must communicate honest and accurate information (Tschannen-Moran & Gareis, 2015). Research has shown that when educators, students and parents place value on the importance of integrating digital technologies for communication outside of the boundaries of school, it boosted educators' attitudes and student learning regarding technology use (Blau & Shamir-Inbal, 2016). Research indicates that social media networks are becoming the preferred means of communication for Malaysian school principals (Saraih et al., 2022). The results showed that ICT media have

surpassed in-person communication in frequency and may even improve job performance and productivity in the office. The current study's findings thus demonstrate the significant effects that these technological tools have on school administrators across the board in terms of improved communication with stakeholders and staff alike.

Saving Time and Paper
Participants also mentioned that one benefit of technology for school principals was that it reduced the amount of time and paper needed to perform their tasks. This study showed that technology might be used to lessen the demand for paper by displaying notices, lessons, and other relevant information. This decrease in paper consumption aligns with Sustainable Development Goal (SDG) 12 of the UN. SDG 12 places a strong emphasis on responsible production and consumption, particularly when it comes to using natural resources like trees (Chan et al., 2018). It was agreed upon by participants that students might now register online using a portal for CSEC exams instead of utilizing paper forms. Furthermore, as the study's results showed, ICT integration made it possible to store and retrieve more material than was possible with traditional textbooks. The participants agreed that educational institutions, particularly secondary schools, can employ technology to create grades and class assignments, as well as to electronically record student absences and punctuality.

The aforementioned result indicates that school principals chose to share information predominantly online, particularly through Gmail and WhatsApp, instead of on paper documents, as a result of the physical restrictions imposed by COVID-19. According to research, students' use of digital technology led to time savings through quicker turnaround times, more instantaneous outcomes, and simpler task organization (Henderson et al., 2015). Instantaneous access to information technology in a number of domains is made possible by the internet, which eventually leads to increased productivity and time savings and is becoming an important tool for decision-making, particularly for school administrators (Szymkowiak et al., 2021). According to the study's findings, teachers can now work smarter than harder. It might very well signal the end of days for large filing cabinets, heavy books, and papers taking up unnecessary space.

Working Remotely
Finally, the results of the study showed that administrators could now work remotely thanks to technology. Through the effective use of technology, administrators are now able to effectively perform their jobs from locations other than the actual school. The findings of this research demonstrated that principals of schools can now have meetings, interact with personnel, and instantaneously distribute important information from the comfort of their homes or from any location, provided that appropriate internet connectivity is available. The absence of school principals due to illness or travel does not have to significantly interfere with the school's operations. Thanks to technology, important decisions may be made and communicated from any location in the world. This implies that a variety of administrative tasks can be carried out virtually. Once there are internet-connected devices, some level of work can be done even in the event of a pandemic, natural disaster, or other kind of disruption.

Schools were not required to stop all academic activities altogether during the Covid-19 pandemic. Technology like Google Classroom, Zoom, and WhatsApp allowed administrators and other users to continue working from home or any other location. Digital technology advancements for increasingly remote applications have generated enormous excitement (Henderson et al., 2015). Due to online learning, students can continue their education with little disruption to the regular learning process, even in the face of lockdowns and the incapacity to physically attend classes (Shamir-Inbal & Blau, 2021). Using e-learning to its full potential in educational institutions offers chances to improve efficiency, reduce costs, and increase flexibility (Lee, 2016). Administrators and schools may ultimately save money and become less wasteful by utilizing the remote benefits of ICT integration.

Challenges with Technology Integration Encountered by School Principals
Poor Internet Connectivity
The research found that schools' internet reliability and infrastructure were woefully inadequate. The participants agreed that there has to be a major improvement made to the quality and coverage of the internet within school premises. The study found that educators were frequently and for prolonged periods of time disappointed by the internet's unavailability. A participant said that the school did not have internet access for approximately a year. Participants also expressed concern over the internet's extremely poor performance when numerous people log on at once. Participants in the study indicated that poor internet connectivity significantly affected the communication and instructional processes both of which heavily depend on working technology. Internet stability and reliability play a major role in the successful integration of technology. The entire goal of technology integration is at risk if educational institutions' internet infrastructure is inadequate. The results of this study suggested that, even while school principals used a variety of leadership strategies to incorporate technology into their classrooms, one of the main obstacles they faced was the internet's unreliability. According to research, a number of schools in Northern Ontario did not have enough bandwidth to handle the amount of internet that students used, which made principals

think that the schools were failing (Chen, 2015). The findings of this study have consequences for government and educational officials working together to make sure that schools have the necessary internet service coverage and quality.

Inadequate ICT Equipment

Limited ICT equipment was another issue faced by school principals, much like insufficient internet connection. The limited physical space that school principals have to work with to effectively integrate technology was a complaint voiced by participants. In secondary schools, there is a growing need for more IT labs and technology such as laptops, projectors, and smart boards, according to the study's results. Participants contended that scheduling, sometimes on a first-come, first-served basis was necessary to ensure that ICT equipment usage was not oversubscribed in some schools. According to the study's findings, there were a number of instances where basic amenities like electrical outlets, which are required to power electronic devices were insufficient. In a learning setting, devices that cannot be charged cannot be used. This result implied that schools could not afford to buy adequate ICT equipment, most likely as a result of a shortage of funding.

During COVID-19, when national economies were crumbling, this problem was particularly severe. According to research, a major obstacle preventing administrators and teachers from using ICTs in schools is a lack of access to materials relevant to ICTs (Raman & Thannimalai, 2019). ICT integration in education requires large financial and budgetary efforts, which should go toward building new educational infrastructure, such as Wi-Fi connections, in addition to buying new hardware and software (Rabah, 2015). Despite having a strong technological infrastructure and being run in a technology-friendly manner, educational administrators still need to guide their institutions in this direction (Yorulmaz & Can, 2016). Aside from sufficient training for teachers and principals, suitable internet quality and ICT devices must be in place for school administrators to properly incorporate technology to support curriculum coverage.

Teacher Unwillingness

The last issue that principals of schools had to deal with was the resistance of educators to integrating technology. According to this study, certain educators were especially reluctant to use technology. The results of the study showed that a deficiency of ICT resources may have contributed to teachers' reluctance to adopt technology. Teachers shied away from ICT integration because they believed that schools lacked the necessary technology resources to carry out their duties. Participants emphasized the idea that some educators were more accustomed to teaching with books and chalkboards and were unwilling to put in the extra effort required for ICT integration. The results of the study indicated that some educators' resistance to change was a factor in their disinterest in integrating technology. According to this study's findings, some educators might have been reluctant to adapt since they felt more at ease carrying out tasks the old-fashioned way.

It is possible that teachers felt compelled to teach outside of their areas of expertise since they were so used to traditional teaching techniques, especially during the Covid 19 period. Despite the widespread availability of technology in the classroom, research indicates that many educators remain reluctant to fully integrate it (Holland, 2015). Because they think incorporating technology will add to their total burden, educators may occasionally feel nervous about doing so (Omar & Ismail, 2020). In addition, there is a possibility that some educators are reluctant to embrace technology because they do not know enough about it or are unsure of its value in improving student results (Schindler et al., 2017). Principals of schools ought to be able to convince teachers of the many benefits that integrating technology into the classroom may offer. Furthermore, providing sufficient training in effective ICT integration techniques may help educators feel less uncomfortable with technology.

CONCLUSION

The purpose of this study was to investigate the leadership strategies used by principals of public secondary schools in integrating technology for efficient curriculum delivery within and post Covid 19. It also covered some of these strategies' benefits, as well as drawbacks. New administrative, communication, instructional, and resource acquisition activities, as well as training for responsive professional growth emerged as three themes in leadership. Together with challenges such as internet connections and insufficient ICT resources, a number of successes were noted, including enhanced communication and a decrease in paper usage. Thus, pre-service and in-service training for principals and teachers, as well as the development of an updated technology use policy are among the recommendations. The study might also have an impact on how creative technology policies that address the particular needs of our contemporary society are developed in Antigua and other developing countries in the region. Further studies may concentrate on leadership strategies in private secondary schools setting.

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