Bridging the Digital Gap: A Quantitative Study on ICT Integration in Antiguan Secondary Schools

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Abstract

In this article, specific quantitative findings from a mixed-methods study that examined the leadership strategies Antiguan school principals employed to integrate technology into the curriculum are examined. The goal was to provide a critical analysis of the impact of ICT integration in Antiguan Secondary Schools from the perspectives of teachers and students. This study was anchored by the International Standards for Technology in Education (ISTE), as well as the TPACK theoretical frameworks. In order to gather data about participants perceptions of the impact of integrating technology into the curriculum, online questionnaires were administered via Google Forms to educators (N=163) from nine secondary schools, as well as to students (N=256) in Forms 4 and 5. The quantitative data were then subjected to descriptive analyses, independent Samples T-Tests, and One-Way ANOVAs using SPSS 26. The quantitative data analyses highlighted findings that included significant T-Tests related to ICT training and perception of the value of technology among teachers, as well as positive correlations related to higher levels of principal's involvement and support of ICT integration. To make ICT integration smoother, schools should invest in both pre-service and in-service training for teachers and principals. Additionally, having an up-to-date technology use policy can provide clear guidance for everyone.

Keywords: ICT integration, secondary school, digital pedagogy, learning outcomes

1. Introduction

The role of technology in education is quickly evolving, and can be considered one of the key elements impacting instructional processes (Prasojo et al., 2019). As a result, academic institutions must be designed to prepare students for the realities of this technology age (Schindler et al., 2017). The conventional teacher-led classrooms, textbooks, and blackboard methods cannot satisfy generations of learners who have grown up with ICT tools (Vishwakarma, 2015). Research indicates that many educators and school administrators are still stuck with outdated educational approaches (Harrell & Bynum, 2018). Notwithstanding this, students can benefit from the usage of technological devices in the classroom by conducting research more easily, having better access to online learning resources, and finding it easier to finish and turn in assignments (personal communication, MoESCI, n.d.). In addition, a noticeable transition from teacher-centered pedagogies to student-centered instruction has occurred over the years to accommodate the demands of modern learners in the digital age (Brown & Jacobsen, 2016). Thus, from the viewpoints of educators and learners, this study offers a quantitative analysis of findings pertaining to ICT Integration in Antiguan Secondary Schools. As such, this study may have implications for the wider Caribbean region and other Small Island Developing States (SIDS) in terms of the management and use of technology in education.

2. Literature Review

2.1 The Value of ICT Integration for Teachers

With e-learning technologies, teachers may provide knowledge to students more effectively and with better proficiency. With ICT, teachers can design interactive lesson plans that encourage inquiry, projects, and collaboration (Rabah, 2015). ICT integration gives students the ability to use learning applications without the direct supervision of a teacher. ICTs and computer-aided instruction can potentially increase the amount of instruction students receive overall, while also providing teachers with the opportunity to monitor students' academic progress (Rabah, 2015). More than ever, contemporary educators act as educational facilitators rather than the center of attention in the classroom because of ICT integration.

Teachers can now provide students with a variety of personalized learning experiences thanks to the use of technology (McKnight et al., 2016). Technology in education may also enable teachers to teach a variety of subjects to a larger student body (Rabah 2015). Pedagogical approaches must change from the traditional lecture method to the incorporation of the newest technology because ICT integration is highly desired in today's academic environment (Omar & Ismail, 2020). Through ICT integration, teachers can link their local classrooms to locations throughout the globe (Rabah, 2015). ICT resources can be used in classrooms to give students a taste of what is going on in the world. For instance, video conferencing systems offer educators a chance to interact with people worldwide (Rabah, 2015).

Incorporating technology into the classroom has improved teachers' daily tasks of delivering the school's curriculum (Omar & Ismail, 2020). Technology integration promotes self-directed learning and investigation. Due to the fact that they can also use technology to find information related to their coursework, students are not entirely dependent on their teachers (Yarbro et al., 2016). A study on the use of digital technologies by college students found that they used ICTs to research information for class assignments, both in terms of the number and quality of the content (Henderson et al., 2015). This is essential because there is a wealth of information available on the internet that students can explore. However, as students become more reliant on ICT tools to complete tasks, the incorporation of technology like artificial intelligence (AI) may have a detrimental effect on their writing and critical thinking skills, necessitating close supervision by educators (Chan, 2023).

2.2 The Value of ICT Integration for Students

ICT integration offers academic institutions many benefits. Technology has made it easier for students to access much more up-to-date learning materials and tools (McKnight et al., 2016). When ICT is effectively employed in the classroom, students can learn in a number of ways (McKnight et al., 2016). Similarly, when technology is proficiently applied in the classroom, students have greater self-regulation over their learning (Ruloff & Petko, 2022; Yarbro et al., 2016). Students now have the opportunity for individualized learning because of the application of technology (McKnight et al., 2016). Compared to traditional classroom settings, ICT-enhanced learning environments provide students with more opportunities to comprehend the learning process (Uygur et al., 2020). A greater level of student creativity and unique expressions are encouraged by the integration of digital technologies. In a similar vein, technology can be used to improve student feedback and communication through blogs, emails, and interactive websites (McKnight et al., 2016).

Therefore, it is not only essential but also imperative to the smooth functioning of society that learning institutions educate students for the realities of our contemporary digital era (Harrell & Bynum, 2018; Schindler et al., 2017). Because of this, the Fourth Industrial Revolution requires that educators and school administrators alike be knowledgeable about all aspects of technology (Raman et al., 2019). Additionally, learners will suffer if teachers and school administrators lack the requisite technological integration skills or are uncomfortable using them (Krawchuk, 2022; Waxman et al., 2013). As a result, school principals and educators need to continuously improve their digital capabilities in order to help digital natives in the classroom. Consequently, schools must build state-of-the-art, modern academic facilities that offer each student unparalleled educational opportunities in the area of ICT integration (Hamzah et al., 2016). Thus, given the role of principals as education leaders, the importance of teachers in curriculum delivery and the value of students as the key consumers, it is imperative that the relevant perspectives on ICT integration be explored. This exploration can provide important insights and understandings that can be used to improve and enhance the integration of technology in present education paradigms and in the future.

2.3 Research Questions:

1. *What are teachers' and students' views of the principal led ICT rollout at their schools?*
2. *What is the relationship between teachers' value for ICT integration and perceived administrative support for ICT Integration in Antiguan Secondary Schools?*
3. *What are the teachers and students perceived benefits of ICT integration?*
4. *What are the teachers and students perceived challenges of ICT integration?*

3. Method

This research was built by employing the TPACK, as well as the International Standards for Technology in Education (ISTE) theoretical frameworks. The study population for this research comprised of the 12 public secondary schools in Antigua. These institutions have a combined population of approximately 5, 784 students and 769 teachers. Purposive sampling was the method employed to generate quantitative data from participants. This sample plan was created based on the researcher's assessment of who will provide the most helpful information to meet the goals of the study (Etikan & Bala, 2017). According to Singh and Masuku (2014), a sample

size of 222 is appropriate for a population size of 500 to 1000. Therefore, approximately 256 students were surveyed, along with 163 teachers in order to establish a precision level of ± 5%, a 95% confidence level and p = 0.5.

3.1 Participants

The sample consisted of 256 students, of which 26.6% (68) were male and 73.4% (188) were female. The 16-19 (years) age group accounted for a comparatively larger proportion of the students 68.8% (176), while the 12-15 (years) age group accounted for 30.5% (78). Less than 1% (2) were between the ages of 20-22. Approximately 50% (129) of the students were in fourth form while 48.8% (125) were in fifth form. The number of teachers surveyed totaled 163, of which 22.1% (36) were male and 77.9% (127) were female. Teachers who fell within the 41-60 age group accounted for a 48.5% (79), of the sample. The 26-40 age group followed, accounting for 43.6% (71) of the sample. Teachers in the 18-25 age group accounted for a comparatively smaller proportion of 6.7% (11) of those surveyed, while the 60+ was a mere 1.2% (2). Teachers who spent between 1 to 5 years at their current school constituted 34.4% (56) of the sample, while those who spent 6-10 year were 27.6% (45). The longest serving teachers (15+) constituted 19.6% (32) of the sample, while those who served between 11-15 years accounted for 14.1% (23) of the sample. Only 4.3% (7) of the teachers served less than one year. (see tables 1 & 2 below).

Table 1. Descriptive Statistics for Students: Age, Sex, Form

Variable	Frequency	Percentage
Age (Years)	N = 256	N = 100 %
12 - 15	78	30.50%
16 - 19	176	68.80%
20-22	2	0.80%
Sex		
Male	68	26.60%
Female	188	73.40%
Form		
Fourth	129	50.40%
Fifth	125	48.80%
Other	2	0.80%

Table 2. Descriptive Statistics for Teachers: Age, Sex, Time Teaching at Current School

Variable	Frequency	Percentage
Age (Years)	N = 163	N = 100 %
18 - 25	11	6.70%
26 - 40	71	43.60%
41 - 60	79	48.50%
60 and Over	2	1.20%
Sex		
Male	36	22.10%
Female	127	77.90%
Time at Current School (Years)		
< 1	7	4.30%
1 - 5	56	34.40%
6 - 10	45	27.60%
11 - 15	23	14.10%
> 15	32	19.60%

3.2 Data Collection and Analysis

Permission to conduct this study was obtained from the Ministry of Education, the research sites, and the Institutional Review Board (IRB) at the University of Trinidad and Tobago. Throughout the approval process, these pertinent authorities were consulted orally, in writing, and electronically. Forms requesting consent from participants were then created and distributed. The data gathering process started as soon as research participants

received and signed the consent forms. The researcher then administered online questionnaires via Google Forms on the perceptions of the benefits of integrating technology into the curriculum to educators (N=163) from all nine secondary schools, as well as to students (N=256) in Forms 4 and 5. In addition, teachers had the opportunity to share their thoughts on principals' participation in ICT integration through this online survey. Once the online survey was completed by participants, the data were exported into Microsoft Excel then uploaded to SPSS version 26 for analysis and subsequent visual display.

Descriptive analyses were used to assess teacher demographics, teacher use of ICT and technology in curriculum delivery, perceptions of technological infrastructure and principal support of ICT integration. Additionally, a Spearman's Rank Correlation was carried out to ascertain whether a relationship existed between teachers' perception of principals' involvement and support for technology use and teachers' perceived value of technology. Moreover, Independent Samples T-Tests were utilized to establish student's opinions on the benefits of technology based on gender, form level, and IT subject completed, along with the value that teachers placed on technology integration based on training status and gender. Finally, a One-Way-ANOVA was employed to ascertain teachers' perceived value of technology use based on age range. This was to determine if younger teachers perceived a difference in the benefits of ICT integration compared to their older colleagues.

4. Results

The quantitative data were analyzed using descriptive and inferential statistics.

Descriptive Statistics

Teacher Questionnaire Results

Figure 1 shows that, while 65% of teachers completed formal technology training, as much as 35% indicated that training was not completed.
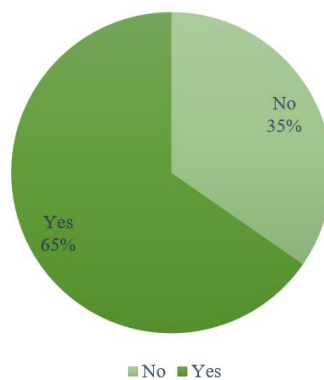

Figure 1. Distribution of teachers who completed formal technology training

Figure 2 shows that a significant majority (88%) of teachers indicated that they use technology in the classroom.
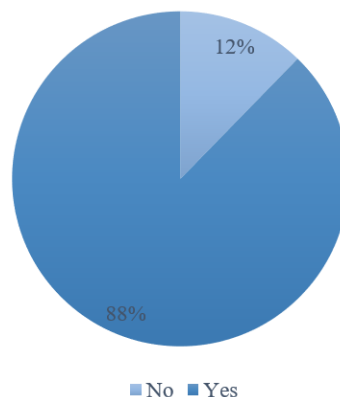

Figure 2. Distribution of the use of Information Communication Technologies (ICT) in lessons

It can be seen in Table 3 that approximately 38% of teachers felt that their school did not have reliable and good quality internet connectivity. However, an equal amount believed that it did (37%). Unexpectedly, as much as 25% remained neutral on this question.

According to the same table, about 74% of the teachers agreed that technology had helped to enhance their students' learning. And while a mere 4.3% disagreed with this view, there were as much as 21% who were neutral.

It can also be seen in Table 3 that as much as 69.4% of teachers agreed that technology use was encouraged and supported by the school administration. However, a significant proportion, 23.9% were neutral and 6.7% expressed some degree of disagreement.

Table 3 also revealed that the majority of 82.8% of teachers believed that utilizing technology within their classes can significantly improve their chances of covering the subject curriculum. While 11.7% were neutral on the matter, as little as 5.5% expressed disagreement.

Table 3. Teacher Perception About Technology Usage in Schools

Question No	Question	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
Question 13	My school has reliable and good quality internet access.	1.80% (3)	35.0% (57)	25.2% (41)	25.8% (42)	12.3% (20)
Question 15	The use of technology in my classes has helped to enhance my students' learning.	19% (31)	55.2% (90)	21.5% (35)	3.7% (6)	0.6% (1)
Question 19	The use of technology is encouraged and supported by school administration.	21.5% (35)	47.9% (78)	23.9% (39)	5.5% (9)	1.2% (2)
Question 20	I think utilizing technology within my classes can significantly improve my chances of covering my subject curriculum.	28.8% (47)	54% (88)	11.7% (19)	4.9% (8)	0.6% (1)

Participants seem doubtful (approximately 30%) or ambivalent about the plans that principals engaged with to integrate ICT in the curriculum as the majority (47%) were neutral. Notwithstanding the negative perspective about these plans, at least 25% of teachers felt that principals actually had plans in place for ICT integration (as seen in Table 4). While the latter is a good start, it is clear that much more work needs to be done to bring teachers up to speed with the actual ICT integration plans of school administrators.

More than half of the teacher participants agreed that school principals employed varied technologies at schools. However, almost 45% were uncertain or disagreed that any such application of technology to school or administrative tasks existed. Again, it appeared that ICT integration roll-out was either minimal or not as visible as it should be in the school context.

In terms of the proven effectiveness of principal guided ICT integration, only about 30% of participants had positive ideations. On the other hand, the majority were either uncertain about it or thought that it was not effective at all, a combined 70% of all participants.

Table 4 shows that an overwhelming majority of participants (approximately 70%) did not find that the Ministry of Education/Government offered support to principals in terms of ICT integration in schools. Since significant resources reside with these entities, then more needs to be done to encourage their involvement in a real and practical way.

It is encouraging to note that a significant number of participants (42%) felt that ICT integration precipitated changes in classroom pedagogy. This response validates the importance of ICT integration in subject content delivery. It is a major challenge that many were uncertain (39% neutral) or disagree (approximately 20%) that any change can be observed in classroom pedagogy as a result ICT integration.

Similar to the lack of perceived support from the MOE/govt, the majority of participants (>70%) felt that principals did not receive support from the key school stakeholders. Otherwise, approximately a quarter of all participants had a positive view concerning support from the said stakeholders.

While the majority of participants agreed that principals were suitably qualified to lead the integration of ICT process, at least one third did not agree or disagree. The reason for this ambivalence might need to be further explored as well as the fact that almost a quarter of participants felt that principals were not equipped to advance ICT integration in schools.

Table 4. Teachers Perceptions of Principal involvement and Support for ICT integration

Question No	Question	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
Question 21	The plans put in place by my school principal to integrate technology into the school environment have been successful.	4.9% (8)	19.6% (32)	47.2% (77)	23.3% (38)	4.9% (8)
Question 22	My school principal has utilized different types of technologies within the institution, both in terms of instructional, communicative and administrative technologies.	8.6% (14)	48.5% (79)	27.6% (45)	14.1% (23)	1.2% (2)
Question 23	The school's initiatives to use technology under the guidance of my school principal has proven effective.	3.1% (5)	25.8% (42)	48.5% (79)	21.5% (35)	1.2% (2)
Question 24	In my opinion, the level of support offered to my school principal by the Ministry of Education/Government in regards to using technology in school has been adequate.	2.5% (4)	14.7% (24)	40.5% (66)	33.1% (54)	9.2% (15)
Question 25	Due to the use of technology, there have been some observable changes in the way subjects are taught at my school.	5.5% (9)	36.8%\ (60)	38.7% (63)	17.2% (28)	1.8% (3)
Question 26	From my observations, my school principal has received solid support from other teachers, parents, and students regarding the use of technology in the classroom.	1.8% (3)	23.3% (38)	43.6% (71)	27.0% (44)	4.3% (7)
Question 27	My school principal appears to be suitably equipped to handle the tasks of integrating technology in school.	12.9% (21)	30.7% (50)	31.3% (51)	22.7% (37)	2.5% (4)

Student Questionnaire Results

Figure 7 below shows that seventy-one percent (71%) of students either did or were presently doing Information technology as a subject in school, while a comparatively smaller percentage of 29% were not undertaking IT.
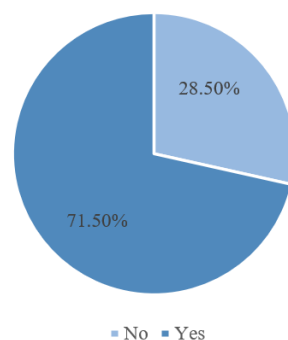

■ No ■ Yes

Figure 7. Have you done or are you presently doing Information technology as a subject in school?

Table 5 shows that as much as 55.1% of students indicated that their teacher *sometimes* used technology in their lessons, while 23.4% reported often and 14.5% reported always. Comparatively, much smaller percentages reported rarely (6.3%) and never (0.8%).

Moreover, the data in the table revealed that there was a fair amount of activity with respect to the use of technological devices. Approximately 36% of the students indicated that they *always* used technology devices at school, while 26.6% indicated *sometimes* and 16.8% indicated that they used them *often*. A mere 4.3% said they never used technology at school, and 16% said *rarely*.

The data in Table 5 also indicates that technology was used frequently to administer tests and quizzes. As much as 39.5% of the students indicated that this method was applied sometimes, while 24.6% reported often and 7.8% reported always. At the opposite end, 21.1% reported that technology was used rarely, while 7% indicated that it was never used.

Table 5. Student Ratings About Technology Usage In Schools

Question No	Question	Never	Rarely	Sometimes	Often	Always
Question 10	Do your teachers use technology (internet, computer, projectors, smart phone, etc.) in their lessons?	0.80% (2)	6.3% (16)	55.1% (141)	23.4% (60)	14.5 (37)
Question 12	How often do you use technological devices at school?	4.3% (11)	16% (41)	26.6% (68)	16.8% (43)	36.3% (93)
Question 18	Our teachers administer tests, quizzes, and other assignments using technology	7.0% (18)	21.1% (54)	39.5% (101)	7.8% (20)	24.6% (63)

According to Table 6, only 33.6% of the students reported that their school has reliable and good quality internet access. As much as 36.7% were neutral, while 29.7% disagreed that the internet was reliable and of good quality. These results suggest that consistent internet connectivity might be an issue that needs to be addressed for optimal ICT integration in Antiguan schools.

Table 6 also shows that as much as 55.1% indicated that their teacher used technology in their lessons sometimes, while 23.4% reported often and 14.5% reported always. Comparatively small percentages reported rarely (6.3%) and never (0.8%). Taken together, these findings indicate that students were very much aware of teachers' efforts at ICT integration and this augers well for their digital engagement in the classroom.

Additionally, the data in the table reveal that as much as 50.4% of the students agreed that their teacher used a variety of technology tools in the classroom to help students complete classroom assignments. 37.5% were neutral and a minority of 12.2% disagreed. While this 50/50 ratio might be somewhat concerning, it suggests the need to expose teachers to a wider range of digital tools and applications for the classroom.

Table 6 also indicates that a comparatively smaller proportion (28.1%) of students agreed that their school encourages and supports the use of technology when compared to those who were neutral (44.9%) or were in disagreement (27%) with the statement. Student perception of school support for ICT integration is critical for full stakeholder buy-in and should be addressed.

The data here show that a large proportion of students (64.8%) reported that technology at their school improved their learning. Only 5.5% disagreed while 29.4% of the students were neutral on this statement. This means that despite students' level of uncertainty about teachers' use of technology, they felt that once it was used, they had better learning outcomes.

A more favourable picture emerges with respect to student views on the power of ICT integration to foster greater collaboration among them, with just over 60% in agreement and about 10% disagreeing. This finding is valuable because students who perceive positive benefits of ICT integration are more likely to use and encourage their peers to use the technology in adaptive ways.

Table 6. Students' perception of technology's value

Frequency Distribution for Individual Questions: Students' Rating of the Value of Technology						
Question No.	Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Question 4	My school has reliable and good quality internet access.	6.3% (16)	27.3% (70)	36.7% (94)	19% (51)	9.8% (25)
Question 7	My teachers use a variety of technology tools in the classroom to help students complete classroom assignments.	9.8% (25)	40.6% (104)	37.5% (96)	10.2% (26)	2.0% (5)
Question 9	The use of technology at school has improved my learning.	16.4% (42)	48.4% (124)	29.7% (76)	4.7% (12)	0.8% (2)
Question 10	My school encourages and supports the use of technology	6.6% (17)	21.5% (55)	44.9% (115)	18.4% (47)	8.6% (22)
Question 12	I believe that utilizing technology in the classroom can significantly boost my academic achievement in school	25.8% (66)	46.5% (119)	25.8% (66)	1.6% (4)	0.4% (1)
Question 13	I believe that the use of technology in the classroom improves student interaction and cooperation	21.9% (56)	39.5% (101)	28.5% (73)	8.2% (21)	2.0% (5)

Inferential Statistics

Teacher

Training Differences in the perception of the value of the use of technology among teachers

H_o: There is no statistically significant difference in the teachers' perceived value of technology use based on training status

H_a: There is a statistically significant difference in the teachers' perceived value of technology use based on training status.

An Independent Samples T-Test was conducted to evaluate whether there was a significant difference in teachers' perceived value of technology use based on training status (Ques 15 16 17 19 20). This research intended to determine if educators who had access to formal ICT professional development opportunities would place a higher priority on technology integration within the classroom. This result could potentially establish the importance, level and type of technological education that should be provided to teachers.

The data, in Table 7, revealed that teachers who completed training in formal technology (M=18.93, SD=2.70) had a slightly higher positive perception of the value of the use of technology when compared to those who did not complete training (M=17.11, SD=3.28). The results revealed a statistically significant difference between the two groups t (87.11) = -2.22, p = .03. Therefore, the null hypothesis (Ho) must be rejected since the alternative hypothesis (Ha) has been accepted. These results suggest that trained teachers are more likely to put a higher value on the use of technology.

Table 7. Independent Samples T-Test Comparing the perception of the value of the use of technology Based on Training Status

	N	Mean	SD	t-cal	df	P-Value
Training in ICT not complete	53	17.77	3.28	-2.22	87.11	0.03
Training in ICT complete	110	18.93	2.70			

Age Differences in the Perception of the Value of the Use of Technology among Teachers

H_o: There is no statistically significant difference in the teachers' perceived value of technology use based on age

H_a: There is a statistically significant difference in the teaches' perceived value of technology use based on age

A One-Way ANOVA was conducted to evaluate whether there was a significant difference in the teachers' perceived value of technology use based on age. In some circumstances, younger individuals may have preferences that are distinct from older individuals. According to the findings (see Table 8), the perceived value increased marginally from the 26-40 age group (M=18.02, SD=2.88), the 18-25 (M=18.36, SD=2.80), the 41-60 (M=19.01, SD=2.98) and the over 60 (M=20.00, SD=2.82) groups in that order. The results revealed no statistically significant difference between the groups F $(3,159)$ = 1.59, p = 0.19. These results suggest that the value placed on the use of technology was approximately equal across all age groups.

Table 8. One-Way ANOVA Comparing the perception of the value of the use of technology based on Age Group

Age Group	N	Mean	SD	t-cal	df	P-Value
18 to 25 Years	11	18.36	2.80	1.59	(3,159)	0.19
26 to 40 Years	71	18.02	2.88			
41 to 60 Years	79	19.01	2.98			
Over 60 Years	2	20.00	2.82			

Principals' Involvement /Support and Teachers' Value of Technology Use

H_o: There is no statistically significant relationship between the teachers' rating of principals' involvement/support for use of technology and the teachers' perceived value of technology

H_a: There is a statistically significant relationship between the teachers' rating of principals' involvement/ support for use of technology and the teachers' perceived value of technology

A Spearman's Rank Correlation revealed a statistically significant moderate positive correlation between Principals' involvement and support for the use of technology and teachers' perceived value r_s =.52, p=.00 (Table 9). This suggests that higher levels of principal involvement and support may lead to a stronger positive perception among teachers. Although this correlation analysis does not establish causality, it indicates the extent to which school leaders' technological behaviors positively relates to educators' interest in becoming more involved in the utilization of ICT for educational purposes. Educational administrators who assume the lead in this technology inclusion initiative may inspire teachers to become more active in the process.

Table 9. Spearman's Correlations between Principals' Involvement and Support for the Use of Technology and Teacher's Perceived Value

	N	Spearman's Rho	P-Value
Perceived Value	163	0.52	0.00**

**P<.001

Student

IT Subject Participation Differences in Student Perception of Benefits Derived from Technology

H_o: There is no statistically significant difference in the perception of benefits derived from technology based on students' participation in an IT subject

H_a: There is no statistically significant difference in the perception of benefits derived from technology based on students' participation in an IT subject

An Independent Samples T-Test was conducted to evaluate whether there was a significant difference in the perception of benefits derived from technology based on whether or not the student has done or is presently doing information technology as a subject in school. There are several IT related subjects offered in secondary schools in Antigua, such as Information Technology and Electronic Document Preparation Management. This research, through this analysis, wanted to discover whether students' exposure to an IT course influenced their impression of the benefits of technology. Students not involved in IT reported a similar benefit (M=17.88, SD=3.57) when compared to those involved in IT (M=18.01, SD=2.68). The results revealed no statistically significant difference between the two groups t (253) = -0.33, p = .77. These results suggest that students, whether or not involved in IT subjects perceive technology as equally important (see Table 10).

Table 10. Independent Samples t-test Results Comparing IT Students to Non-IT Students on Perception of Benefits of Technology (Quest 9-13)

	N	Mean	SD	t-cal	df	P-Value	Decision
No IT Subject	72	17.88	3.57	-0.33	253	0.77	Do Not Reject Ho:
IT Subject	183	18.01	2.68				

The range (Min =11, Max24) of scores for students not involved in technology were also in close proximity to that of the students involved (Min =10, Max25). These results also show that the median score is 18 for both groups suggesting that 50% of persons from each group reported favourable benefits which was above average.

5. Discussion and Conclusion

While a number of quantitative analyses were conducted, the main ones germane to answering the research questions are extrapolated below. Less important results were included to give an overall picture of all the analyses that were done.

5.1 Research Question #1

What are teachers' and students' views of the principal led ICT rollout at their schools?

Online questionnaires were distributed to teachers and students using Google Forms as part of this quantitative study. Teachers were surveyed regarding the ways in which school principals were incorporating technology. The study's findings indicate that although school administrators implemented a number of ICT integration leadership tactics, many educators seemed doubtful of the advantages or effectiveness of those approaches, which can be concerning. Interestingly, 23.9% of respondents were neutral indicating that perhaps it was not clearly evident to them that school administrators embraced and encouraged ICT integration. On the other hand, 6.7% stated clear disagreement.

The data showed that approximately 25% of educators were not confident that their school administration was ready to meet the demands of integrating technology into the classroom, while 30% remain neutral. This neutrality probably meant that they could not say for certain or were not aware of their school leaders readiness to lead in technology integration. Either way, this neutral position could be interpreted as leaning more to a negative rather than a positive perspective which suggests that school leaders technology integration initiatives need to be more visible and impactful. Reduced teacher and student enthusiasm for technology use may arise from staff views of school leaders' lack of technological expertise (Keane et al., 2020; Shyr, 2017). These methods seemed to have been executed either insufficiently or revealed the necessity of implementing additional techniques to support these approaches.

Although many appear to lack sufficient experience in this area, the study's findings suggest that a positive way for school administrators to promote technology use is for them to become proficient and informed technology users themselves (Garcia et al., 2019; Waxman et al., 2013). In the short term, school principals should find the right staff members who are proficient in ICT if they are not. Teachers' quantitative data revealed that many of the respondents did not believe the plans and initiatives that school leaders had put in place to integrate technology were working well. Furthermore, some educators felt that some principals lacked the necessary skill-set to handle the demands of technological integration, regardless of the approaches that were used.

According to the results of the study, 27% of students did not think that their school promoted and supported technology use, whereas 44% were neutral. The students' perceptions indicated above may not indicate an encouraging sign for educational establishments. If students do not feel that their school actively encourages technology use, their enthusiasm for using it in class may decline. School leadership is responsible for all technology-related classroom activities, including decisions, policies, and technology implementation (A'mar & Eleyan, 2022). To guarantee that students employ technology tools to a greater level, effective technology leadership is required when discussing school technology (A'mar & Eleyan, 2022). School administrators play a crucial role as technology leaders, directly influencing the success of ICT integration. Ultimately, reevaluating the efficacy of these approaches employed by school administrators will require constructive input from all stakeholders.

5.2 Research Question # 2

What is the relationship between teachers' value for ICT integration and perceived administrative support for ICT Integration in Antiguan Secondary Schools?

Another important finding was that, according to a Spearman's Rank Correlation, there was a somewhat favorable and statistically significant relationship between teachers' perceptions of the value of ICT integration and the involvement and encouragement of their principals in the use of technology. This result indicates that school administrators who were more involved, setting an example and giving teachers the support they needed added value to ICT integration ecosystem in the school. This further demonstrates the power of effective leadership in this critical area of school life where teachers must feel and know that they have the backing of school administration as they progress in the new digital stratosphere.

Educators are more likely to include technology into their classes when they believe that their school administrators support its use in the classroom (Samancıoğlu et al., 2015). It has been shown that school administrators can greatly influence and motivate teachers and students to embrace ICT integration if they are prepared to undertake their duties as technology leaders (Leong et al., 2016). However, many administrators are not proficient in technology integration approaches (Hero, 2020). How teachers use technology in their daily tasks is influenced by the mindset of school administration (Krawchuk, 2022). In a similar manner, research shows that administrators' favorable attitudes toward the use of technology in the classroom has an impact on teachers' increasing use of it (Waxman et al., 2013). Accordingly, a supportive organizational climate is necessary for meaningful ICT integration in schools (Samancıoğlu et al., 2015). Additionally, administrators who demonstrate their ability to utilize technology are crucial to expanding its use in the classroom (Shyr, 2017).

The results of this study further demonstrated that the manner in which teachers and students use technology in their daily tasks is significantly influenced by the support offered by school administration. Principals must take the initiative, show enthusiasm, offer support, and develop the necessary digital skillsets. It is not enough for them to just have expectations for their teachers and students' tech-related behaviors. It may negatively affect other students who wish to use technology in the classroom if school administrators do not offer this kind of guidance and assistance. For students and teachers to fully support this teaching tool, they must see how school principals are utilizing ICT. The reality is, until school principals are prepared for their duties as technology leaders, educators and students are unlikely to receive effective support in adopting technology (Wei et al., 2017).

5.3 Research Question #3

What are the teachers and students perceived benefits of ICT integration?

The study's findings showed that integrating technology into instruction gave teachers the ability to present students with a variety of specialized learning opportunities. Teachers at all levels can now reach children with different learning requirements by employing technology. Data from the online survey showed that over 80 percent of teachers said they used ICTs in their classrooms. Furthermore, over half of the students concurred that their teachers enhanced their learning by utilizing a range of technological resources in the classroom. Likewise, this research indicated that more than 70% of teachers believed that technology played a significant role in raising their student's academic performance. More than 80% of respondents agreed that integrating technology into their lessons can significantly increase students' chances of finishing the assigned content.

Utilizing technology has provided learners with an array of tailored educational possibilities. (McKnight et al., 2016). ICT integration offers options for autonomous learning and specialized instruction that cater to each student's specific needs (Ruloff & Petko, 2022). According to research, ICT integration can help educators in offering a variety of pedagogical options to a more diverse student population (Rabah, 2015). Furthermore, integrating ICT is highly desired in today's educational setting; as a result, instructional practices must change from employing conventional approaches such as chalk and talk modalities to utilizing contemporary technologies in order to deliver high-level, effective instruction (Omar & Ismail, 2020).

Additionally, teachers stimulate students' interest whenever they incorporate technology into their classrooms (Rabah, 2015). Constructivist education, defined as the active exploration of knowledge through an examination of our experiences with the world around us, the relationship of novel information to previous knowledge, and connection to other people, is one of the potential benefits of technology integration (Schindler et al., 2017). This research found that numerous educational technologies are designed to promote interpersonal relationships and teamwork. Consequently, research indicates that effective integration of digital learning materials requires pedagogical strategies that encourage increased student participation (Henrie et al., 2015).

5.4 Research Question #4

What are the teachers and students perceived challenges of ICT integration?

This study found that more than 60% of students said that using technology in the classroom improved their learning. Concomitantly, about half of the students concurred that their teachers utilized a variety of technological

resources in the classroom to assist them in meeting learning goals. On the other hand, it was found that even though students acknowledged that technology was regularly used in the classroom, approximately 27% of them did not believe that their school encouraged and supported its use. Moreover, the study's findings revealed that as many as 35% of teachers had never taken an ICT course. Despite this, the results of the current study showed that educators who received formal technology training had a marginally more positive opinion of the benefits of using technology than teachers who did not.

Lack of ICT training and educator ICT competency are two weaknesses that can deter educational leaders and educators from effectively incorporating ICTs in educational institutions (Raman & Thannimalai, 2019). When incorporating ICT into the classroom, teachers face many obstacles, including a lack of expertise and confidence (Chen, 2015). One obstacle that lowers the possibility of educators utilizing technology is inadequate training (Chua & Chua, 2017). Consequently, research suggest that teachers who have taken an ICT course are more adept at incorporating digital technologies into the classroom than those who have not (Ghavifekr et al., 2015),

This study also brought attention to the issue of schools offering dependable, high-quality internet. Up to 30% of teachers and students said they did not think their schools offered reliable, high-quality internet. According to the participants, there has to be a major improvement made to the internet's coverage and quality on school grounds. The survey found that teachers were frequently and for prolonged periods of time disappointed by the internet's unavailability. It is probable that unreliable internet access had a detrimental effect on the use of technology in teaching, administration, and communication. Since most digital devices need steady internet access to work, inadequate internet connectivity in schools can seriously impair teachers' ability to successfully integrate technology. According to research, access issues in public schools included delayed or erratic wireless connectivity and insufficient network infrastructure (Chen, 2015). Research also indicates that many school principals believe that because educational institutions do not possess sufficient bandwidth to support internet usage, they are falling behind (Chen, 2015).

5.5 Conclusion

The results of this quantitative study were valuable and included favorable correlations between higher levels of principal engagement and endorsement for ICT integration, as well as significant T-Tests pertaining to ICT training and teachers' and students' perceptions of the usefulness of technology. Compared to educators who did not receive formal training, it was found that those who did had a more positive opinion of the benefits of integrating ICTs. Additionally, the findings of a Spearman's Rank Correlation showed that greater principal involvement and support for technology integration in secondary schools may result in teachers having a more positive view of the benefits of integrating technology. Therefore, among the suggestions are the development of a modernized ICT use policy and the implementation of pre-service and in-service training on ICT integration to both principals and teachers. Additionally, "special technology days" that heavily emphasize technology integration can be added to the school calendar as a way to motivate and inspire students' use of ICT for learning. Regarding the creation of innovative technology policies that address the particular needs of our contemporary society, this study may have implications for education officials in Antigua and other developing countries in the region. It should be noted that, while this study provides valuable insights, it is limited by its focus on quantitative data. Future research should incorporate qualitative perspectives to better understand teachers' and students' experiences with ICT.

References

A'mar, F., & Eleyan, D. (2022). Effect of principal's technology leadership on teacher's technology integration. *International Journal of Instruction, 15*(1), 781–798. https://doi.org/10.29333/iji.2022.15145a

Brown, B., & Jacobsen, M. (2016). Principals' technology leadership: How a conceptual framework shaped a mixed-methods study. *Journal of School Leadership, 26*(5), 811-836. https://doi.org/10.1177/105268461602600504

Chan, C. K. Y. (2023). A comprehensive AI policy education framework for university teaching and learning. *International Journal of Educational Technology in Higher Education, 20*(1), 38. https://doi.org/10.1186/s41239-023-00408-3

Chen, B. (2015). Exploring the digital divide: The use of digital technologies in Ontario public schools. *Canadian Journal of Learning and Technology, 41*(3). https://doi.org/10.21432/t2kp6f

Chua, Y. P., & Chua, Y. P. (2017). Developing a grounded model for educational technology leadership practices. *Education and Science, 42*(189), 1-13. https://doi.org/10.15390/EB.2016.6705

Etikan, I., & Bala, K. (2017). Sampling and sampling methods. *Biometrics & Biostatistics International Journal,*

5(6), 215-217. https://doi.org/10.15406/bbij.2017.05.00149

Garcia, A., Abrego, J., & Jauregui, J. (2019). Technologies frequently used by elementary principals. *Universal Journal of Educational Research, 7*(1), 95–105. https://doi.org/10.13189/ujer.2019.070113

Ghavifekr, S., Kunjappan, T., Ramasamy, L., & Anthony, A. (2016). Teaching and learning with ICT tools: Issues and challenges from teachers' perceptions. *Malaysia Online Journal of Educational Technology, 4*(2), 38–57. http://files.eric.ed.gov/fulltext/EJ1096028.pdf

Hamzah, M. I. M., Juraime, F., & Mansor, A. N. (2016). Malaysian principals' technology leadership practices and curriculum management. *Creative Education, 07*(07), 922–930. https://doi.org/10.4236/ce.2016.77096

Harrell, S., & Bynum, Y. (2018). Factors affecting technology integration in the classroom. *Alabama Journal of Educational Leadership, 5*, 12-18. http://files.eric.ed.gov/fulltext/EJ1194723.pdf

Henderson, M., Selwyn, N., & Aston, R. (2015). What works and why? Student perceptions of useful digital technology in university teaching and learning. *Studies in Higher Education, 42*(8), 1567-1579. http://dx.doi.org/10.1080/03075079.2015.1007946

Henrie, C. R., Halverson, L. R., & Graham, C. R. (2015). Measuring student engagement in technology-mediated learning: A review. *Computers & Education, 90*, 36-53. https://dl.acm.org/doi/10.1016/j.compedu.2015.09.005

Hero, J. L. (2020). Exploring the principal's technology leadership: Its influence on teachers' technological proficiency. *International Journal of Academic Pedagogical Research, 4*(6), 4–10. http://files.eric.ed.gov/fulltext/ED606393.pdf

Keane, T., Boden, M., Chalmers, C., & Williams, M. (2020). Effective principal leadership influencing technology innovation in the classroom. *Education and Information Technologies, 25*(6), 5321–5338. https://doi.org/10.1007/s10639-020-10217-0

Krawchuk, J. S. (2022). Relationships between school principals' perceived technology self-efficacy and the perceived ability to lead technological innovation in the Covid-19 pandemic era. (Doctoral dissertation, St. John's University). Retrieved from https://scholar.stjohns.edu/cgi/viewcontent.cgi?article=1389&context=theses_dissertations

Leong, M. W., Kannan, S., & Maulo, S. B. A. (2016). Principal technology leadership practices and teacher acceptance of School Management System (SMS). *Educational Leader (Pemimpin Pendidikan), 4*, 89-103. file:///C:/Users/Nyeim%20T%20Archibald/Downloads/10590%20(2).pdf

McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Teaching in a digital age: How educators use technology to improve student learning. *Journal of Research on Technology in Education, 48*(3), 194-211. https://doi.org/10.1080/15391523.2016.1175856

Omar, M. N., & Ismail, S. N. (2020). Mobile Technology Integration in the 2020s: The impact of Technology leadership in the Malaysian context. *Universal Journal of Educational Research, 8*(5), 1874–1883. https://doi.org/10.13189/ujer.2020.080524

Prasojo, L. D., Habibi, A., Yaakob, M. F. M., Mukminin, A., Haswindy, S., & Sofwan, M. (2019). An explanatory sequential study on Indonesian principals' perceptions on ICT integration barriers. *Electronic Journal of e-Learning, 17*(1), 1–10. https://files.eric.ed.gov/fulltext/EJ1213053.pdf

Rabah, J. (2015). Benefits and challenges of Information and Communication Technologies (ICT) integration in Québec English Schools. *The Turkish Online Journal of Educational Technology, 14*(2), 24–31. http://files.eric.ed.gov/fulltext/EJ1057526.pdf

Raman, A., & Thannimalai, R. (2019). Importance of technology leadership for technology integration: Gender and professional development perspective. *SAGE Open, 9*(4). https://doi.org/10.1177/2158244019893707

Raman, A., Thannimalai, R., & Ismail, S. N. (2019). Principals' technology leadership and its effect on teachers' technology integration in 21st century classrooms. *International Journal of Instruction, 12*(4), 423–442. https://doi.org/10.29333/iji.2019.12428a

Ruloff, M., & Petko, D. (2022). School principals' educational goals and leadership styles for digital transformation: results from case studies in upper secondary schools. *International Journal of Leadership in Education,* 1-19. https://doi.org/10.1080/13603124.2021.2014979

Samancıoğlu, M., Bağlıbel, M., Kalman, M., & Sincar, M. (2015). The relationship between technology leadership

roles and profiles of school principals and technology integration in primary school classrooms. *Journal of Educational Sciences Research, 5*(2), 77-96. https://www.researchgate.net/profile/Murat-Baglibel/publication/327892139_The_Relationship_between_Technology_Leadership_Roles_and_Profiles_of_School_Principals_and_Technology_Integration_in_Primary_School_Classrooms/links/5babb23d4585 1574f7e9580a/The-Relationship-between-Technology-Leadership-Roles-and-Profiles-of-School-Principals-and-Technology-Integration-in-Primary-School-Classrooms.pdf

Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2017). Computer-based technology and student engagement: A critical review of the literature. *International Journal of Educational Technology in Higher Education, 14*(1). https://doi.org/10.1186/s41239-017-0063-0

Shyr, W. J. (2017). Developing the principal technology leadership competency indicators for Technical High Schools in K-12 in Taiwan. *Eurasia Journal of Mathematics, Science and Technology Education, 13*(6), 2085-2093. https://www.ejmste.com/download/developing-the-principal-technology-leadership-competency-indicators-for-technical-high-schools-in-4760.pdf

Singh, A. S., & Masuku, M. B. (2014). Sampling techniques & determination of sample size in applied statistics research: An overview. *International Journal of Economics, Commerce and Management, 2*(11), 1-22. http://ijecm.co.uk/wp-content/uploads/2014/11/21131.pdf

Uygur, M., Ayçiçek, B., Doğrul, H., & Yelken, T. Y. (2020). Investigating stakeholders' views on technology integration: The role of educational leadership for sustainable inclusive education. *Sustainability, 12*(24), 10354. https://doi.org/10.3390/su122410354

Vishwakarma, A. (2015). Benefits and challenges of mobile learning in education. In J. Keengwe (Ed.), *Promoting active learning through the integration of mobile and ubiquitous technologies* (pp. 24-36). IGI Global. https://www.irmainternational.org/viewtitle/115466/?isxn=9781466663435

Waxman, H. C., Boriack, A. W., Lee, Y., & MacNeil, A. (2013). Principals' perceptions of the importance of technology in schools. *Contemporary Educational Technology, 4*(3), 187-196. https://dergipark.org.tr/en/pub/cet/issue/25733/271487

Wei, L. M., Piaw, C. Y., & Kannan, S. (2017). Relationship between principal technology leadership practices and teacher ICT competency. *Malaysian Online Journal of Educational Management, 4*(3), 13–36. https://doi.org/10.22452/mojem.vol4no3.2

Yarbro, J., McKnight, K., Elliott, S., Kurz, A., & Wardlow, L. (2016). Digital instructional strategies and their role in classroom learning. *Journal of Research on Technology in Education, 48*(4), 274-289. https://doi.org/10.1080/15391523.2016.1212632