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Does the use of ICT by Teachers Influence Learners' Academic Performance during the COVID-19 Environment?

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ABSTRACT
Information and Communication Technology (ICT) use in the education sector has gained momentum ever since the outbreak of the COVID – 19 pandemic. This study critically analysed the use of ICT tools by secondary school teachers to ascertain if they had an influence on learner academic performance during the era of the COVID – 19 pandemic. A mixed approach which employed both the use of quantitative and qualitative research methods was used to collect data for this study. The finding of this study showed that information communication technology tools have a positive influence on improving academic performance. The study recommended that schools should be provided with enough and relevant resources needed to make a huge impact on education. Teachers and facilitators should be trained on the best use and pedagogies which involves the use of ICT in teaching and learning. In addition, the Ministry of Education and Skills Development Botswana and all the concerned education stakeholders need to make sure that ICT teaching and learning workshops are conducted in every educational sphere so that every teacher, facilitator and learner is well equipped with the appropriate use of technology to achieve the desired results. The results of this study advised on the use of ICT to improve learner academic performance.

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INTRODUCTION
Even though school closures were meant to prevent further infection and contraction of the virus by the learners, it affected their education, especially those in the remotest areas and low-income households. Before the COVID-19 pandemic developing countries were still struggling to improve their education from a 'poor to quality' level to ensure that it met the standards of the developed countries This posed a lot of pressure and challenges to the student majority because of factors such as; acceptance to use technology, which technologies to use, how to conduct personalized training because the majority were used to teachers facilitating all the time (face-to-face), data charges and an internet connection, quality of online education and how to go about it.[1]

[1] Michelle Kaffenberger, "Modeling the Long-Run Learning Impact of the COVID-19 Learning Shock: Actions to (More Than) Mitigate Loss. RISE Insight Note." *Int J Educ Dev*. 81 (2021):102326. doi:10.1016/j.ijedudev.2020.102326.

The majority of learners became frustrated because they were worried about what impact it would have on their exit years, whether they would be able to complete their education, and also whether online assessment strategies were to be used. All of these added a toll on already worried learners with no hopes to complete and continue their studies because of the pandemic.[2] In addition to the above factors, facilitators in some low-level income countries found it difficult to cope and adjust to the use of technology in teaching and learning because the routine of teaching had to change to what they were not used to.[3] All these factors led to disruption to the school routine, thus shattering the dreams of learners.

UNESCO reported that 30,086,319 cases were reported to have tested positive for the coronavirus. Out of this number, 21,833,645 recorded cases recovered and 945,962 deaths were recorded as of September 17, 2020.[4] To curb the spread of the virus, various governments across the globe were forced to close schools and adhere to health protocols as advised by the World Health Organization. School authorities, therefore, had to resort to technology as the only source or medium of instruction. This move was supported by UNESCO at the time, and it acknowledged that the coronavirus was spreading rapidly and that entreated governments to ensure that educators adhered to strict health care protocols set by the health systems in their countries.[5]

This was done so that the governments could focus on improving the health systems by; purchasing medical and personal protective equipment, setting up new hospitals, and laboratories, whilst conducting studies to identify how the virus spreads, taking care of the infected, training more health workers, development of vaccines to mitigate the virus, as well as creating global awareness on how best to take care of one's self from the disease.[6] As this was the case, and as education is and has been the pillar of the development of every nation, the education system became affected. As a result, many were forced to change the curriculum delivery and close educational institutions because the disease had taken a different toll in its widespread destruction.[7] UNESCO came up with a report which revealed that 87% of the world's student population has been affected by the closure of educational institutions due to the COVID-19 pandemic.[8] This led the research to critically analyse the use and uptake of technology in teaching and learning during the pandemic because it is and was evident that technology was the only way to deliver educational instruction. Several ICT policies were enacted and have never been carried out until the coronavirus pandemic. This will also help provide information as to why these policies were never put into implementation.

In a study by Niranjan, he concluded that COVID-19 has not only affected the economies and day-to-day living conditions but has also impacted the emotions, mental and physical well-being of countries. This has led to poor business and a lack of cash flow injections, thus causing a loss of international business relations because all international travel was locked down. Other sectors such as cultural festivities, entertainment and tourism, among many were also affected. This has led to many developing countries suffering from a big economic blow since they had to close their education and transportation systems.[9] These closures and lockdowns due to the pandemic have led to educational leaders and stakeholders having no choice but to resort to distance learning, something which developing countries have never leaned on since they have always resorted to traditional teaching

[2] Fara Elikai, and Peter William Schuhmann, "An Examination of the Impact of Grading Policies on Students' Achievement." *Issues in Accounting Education* 25 (4) (2010): 677–693. doi:10.2308/iace.2010.25.4.677.
[3] Birte Snilstveit, et. al "Interventions for improving learning outcomes and access to education in low- and middle-income countries: a systematic review," *Campbell Systematic Reviews* 13(1) (2017):1-82. DOI: 10.1002/cl2.176
[4] UNESCO. *COVID-19 Webinar: A New World for Teachers*, March 30, (2020b).
[5] UNESCO. *COVID-19 Webinar: A New World for Teachers*, March 30, (2020b).
[6] Abid Haleem , Mohd Javaid , and Raju Vaishya, "Effects of COVID 19 pandemic in daily life." *Current Medicine Research and Practice*. 10. (2020): 1016/j.cmrp.2020.03.011.
[7] UNESCO, *COVID-19 Impact on Education Data. COVID-19 Education Disruption and Response. The United Nations Educational, Scientific and Cultural Organization*, (UNESCO: Woldometer, 2020).
[8] UNESCO. *COVID-19 Webinar: A New World for Teachers*, March 30, (2020b).
[9] Haleem , et. al, "Effects of COVID 19 pandemic in daily life."

pedagogies. Learning management systems were procured and set up, educational learning applications and ICT resources were sorted, and communications
were announced that these new developments aimed to help parents/ guardians, learners and facilitators. Distance learning solutions containing platforms, educational applications, and resources were aimed at helping parents, students, and teachers.[10] Thus, there was no choice for the educators but to use technology in teaching and learning. This was meant to reduce transmission and the spread of the virus.[11]

In this article, the impact of how the COVID-19 pandemic affected the education system, especially the enormous resulting repercussions on the children, learners, facilitators, and parents, was examined. The objective of this study was to assess if ICT use by teachers influences learners' academic performance during the covid-19 environment. A mixed method approach (quantitative and qualitative) was adopted in this study. All the recommended solutions on how to keep the education system running during the COVID-19 pandemic, challenges in online learning, and its opportunities, were also reviewed and discussed.

LITERATURE REVIEW

UNESCO reported that the closure of schools because of COVID-19, not only affected teachers and learners but affected parents across the world. Parents not only had to source technological gadgets but also had to pay for internet access and tutors so that they could help their children catch up with learning. This affected homesteads because most of the workforce lost their jobs, some had their salaries cut in half, and breadwinners were lost due to deaths from the virus. This, therefore, put a lot of pressure on the parents too because they had to move with the times during a difficult period.[12]

These developments were introduced to help, but due to a lack of resources such as connectivity to the internet, lower bandwidths, lack of proper ICT teaching resources, no knowledge of eLearning, how to structure content online, being technophobic, and the lack of skills on distance learning, teachers found it difficult to effectively deliver curriculum content through distance learning in developing countries.[13] Mustafa also found out that some developing countries were forced to deliver curriculum content through mediums such as radio and television, but it was difficult for the recipients in the remote areas to get the content due to a lack of network connectivity to transmit content. Additionally, some impoverished families did not have access to any such resources to make use of this learning in their respective homes. Most developing countries relied on developed nations for donations of resources such as ICT equipment, radio wave extensions, and study guides for the poorest learners.[14]

Biswas et al. in a study revealed that eighty-six percent of learners in Bangladesh have access to a television learning programme during the COVID-19 pandemic but only half engaged with the program due to a lack of access to resources in most rural areas during school closures.[15]

In a similar study in Malawi by Chikoti et al., a survey was conducted and it was found that the uptake of remote learning during the pandemic was very low because of the differences in socio-economic factors. Only about twenty-five percent participated in remote learning compared to seven percent from the poorest communities and households.[16] In Argentina, another study revealed that

[10] UNESCO, *COVID-19 Impact on Education Data.*
[11] TUAC Secretariat Briefing. "Impact and Implications of the COVID 19-Crisis on Educational Systems and Households, The Trade Union Advisory Committee (TUAC) to the OECD." (2020), 1-9.
[12] UNESCO. *COVID-19 Webinar: A New World for Teachers,* March 30, (2020b).
[13] Nasir Mustafa, "Impact of the 2019-20 Coronavirus Pandemic on Education." *International Journal of Health Preferences Research*, (2020). 1-12.
[14] Mustafa, "Impact of the 2019-20 Coronavirus Pandemic on Education."
[15] Pradipta Biswas, et. al. "COVID-19 data visualization through automatic phase detection." *Digit. Gov.: Res. Pract*. 1, (4), (2020). 1–8.
[16] Chikoti, Lizzie, et. al., Monitoring COVID-19 Impacts on Households in Malawi: Findings from the First Round of the High-Frequency Phone Survey. Washington, D.C.: World Bank Group. (2020).

learning through short message service and phone calls yielded positive results because there was randomized parental engagement in their children's learning.[17]This, therefore, helps the researchers arrive at a conclusion that the COVID-19 pandemic adversely affected low-income countries more than the high-level income ones, as the former were still struggling to cope and improve their education system.

Technology adoption in teaching and learning, including all digital media platforms, tools and resources which is also referred to as eLearning, has been the central point in the development and improvement of initiatives that support education in developing and developed countries worldwide.[18] The academic plan suffered a huge blow concerning face-to-face interaction because of the COVID-19 pandemic. Teachers and learners were forced to adapt to new ways of teaching through online learning. This left no one a choice because of the lockdowns and movement restrictions imposed by different governments around the whole world.[19] Digital technologies where learners and teachers could interact in cyberspace have existed over time, but under minimal use only in higher tertiary education systems. The secondary, primary and pre-primary schools did not rely much on technology to teach.[20]

ICT adoption in teaching and learning is of great importance to access available and up-to-date content and keep up with modern developmental trends both in the education sector and other sectors of the economy. Digital libraries and other resources are available where learners and facilitators can gain access to and share information 24/7 without any time limit, this can only be possible and realized using information communication technologies.[21] The integration of technology into teaching provides more advantages in the teaching and learning process for teachers to interact with their learners in a digitalized space.[22] According to Bai, Wang and Chai and Rana et al., studies have concluded that it is enough to use ICTs in daily lives to see how effective they can be, and when used with new and emerging technologies, how best can they enhance teaching and learning across the education sector in a country.[23] The use of ICTs in Botswana depends on who owns and can use them. In most schools, teachers are technophobic regarding the use of technology and ICTs in teaching and learning.[24] In addition to the above, Crook agrees that information communication technologies as a communication pathway and channel to enable collaboration between the facilitator and the learner.

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http://documents.worldbank.org/curated/en/591551597706342578/ Findings-from-the-First-Round-of-the-High-Frequency-Phone-Survey.

[17] Noam Angrist, Peter Bergman, David K. Evans, Susannah Hares, Matthew CH Jukes, and Thato Letsomo. "Principles for Phone-Based Assessments of Learning." *BMJ Global Health*, (2020). Forthcoming Approaches: Pearson New International Edition. Pearson Education Limited.

[18] United Nations Children's Fund, 2017

[19] A. De-Vincenzi, "From the face-to-face classroom to the virtual University classroom in the context of the COVID-19 pandemic. Advances of a university experience in face-to-face careers adapted to the virtual modality." *College Debate*, 8(16), (2020): 67-71.

[20] Gonzalo Almerich, Natividad Orellana, Jesús Suárez-Rodríguez and Isabel Díaz-García "Teachers' information and communication technology competences: A Structural Approach." *Computers and Education*, 100, (2016): 110-125.

[21] Gerald Knezek, and Rhonda Christensen, "Extending the will, skill, tool model of technology integration: Adding pedagogy as a new model construct." *Journal of Computing in Higher Education*, 28(3), (2016): 307-325.

[22] Japhet Lawrence, and Usman Tar, "Factors that influence teachers' adoption and integration of ICT in teaching/learning process." *Educational Media International*, 55(1), (2018): 79-105. https://doi.org/10.1080/09523987.2018.1439712.

[23] Barry Bai, Jing Wang, and C.-S.Chai, "Understanding Hong Kong primary school English teachers' continuance intention to teach with ICT." *Computer Assisted Language Learning*, (2019). 1-23; Karna Rana, Janinka Greenwood, and Wendy Fox-Turnbull, "Implementation of Nepal's education policy in ICT: Examining current practice through an ecological model." *The Electronic Journal of Information Systems in Developing Countries.* (2019). 10.1002/isd2.12118.

[24] K. Rodnie Mafa, and Desmond W. Govender, "Perceptions of students towards the use of mobile devices in improving academic performance: A case of a senior secondary school in a developing country." *International Journal of Sciences and Research, 73*(4), (2016): 220-233.

Collaboration can be either synchronous or asynchronous.[25] In this study, the research is keen to find out and critically analyse how these devices and other technologies were adopted and used during the COVID-19 pandemic. This is also supported by the policies the Botswanan government has enacted and put in place, such policies to support and encourage technology use in teaching and learning. [26]

Albayrak and Yildirim agree that technology integration in teaching and learning helps to realize lifelong learning skills and promotes collaboration between the facilitator and learner and enables the realization of new skill sets and professional development in both parties.[27] This is supported by Dysthe et al.and Kirkwood, who noted that ICT integration in teaching and learning if used and implemented properly, can yield positive results, especially in curriculum delivery.[28] Thus the motivation of this study is to find the extent of how it impacted teaching, learning, and what new and developmental trends it influenced, and what emerged as a result.

Studies carried out in developing countries showed that ICT policies introduction and execution in curriculum delivery were necessitated by the lack of important ICT resources and setups, lack of funds to purchase adequate ICT resources, and an unskilled workforce in the education sector.[29] The purpose of this study was to unveil and analyse how these factors affected effective teaching and learning during the pandemic, as well as analyse academic performance during the previous years before the pandemic. This will assist the researcher in revealing if the COVID-19 pandemic had an impact on teaching and learning in ICT use compared to other years before the pandemic. This will also help disclose whether there was an impact regarding professional development and training on the use of ICT as this is widely regarded as the ticket to facilitators' effectiveness in the use of technology to influence its use.[30] Adoption is not only the choice to accept innovation, but also the extent to which that innovation is integrated into the appropriate context. Teachers had no choice but to adopt the use of technology. This adoption added to their professionalism because it led to the professional development of their teaching. Social adoption became part of teaching since teachers had to adapt to the use of technology with their peers during peer teaching and their online classes.

The digital divide and access to technology between developing and developed countries is a major worry for facilitators who want to adapt and use technology in teaching and learning. Facilitators who managed to attend technology teaching lessons are in a better position to use it effectively in their curriculum delivery than those who cannot.[31] Even though that is the case, many facilitators and concerned stakeholders have succumbed to pressure that COVID-19 has affected learning and feared

[25] Charles Crook, Versions of computer supported collaborating in higher education. In S. Ludvigsen, A. Lund, I. Rasmussen & R. Säljö (Eds.), *Learning across sites: New tools, infrastructures and practices* (USA and Canada: Routledge, 2011), 156- 171.
[26] Statistics Botswana Annual Report, Government of Botswana, (2008).
[27] Duygu Albayrak, and Zahide Yildirim, "Using social networking sites for teaching and learning: Students' involvement in and acceptance of Facebook® as a course management system." *Journal of Educational Computing Research*, 52(2), (2015): 155-179.
[28] Olga Dysthe, S. Lillejord, B. Wasson, and A. Vines, Productive e-feedback in higher education: Two models and some critical issues. In S. Ludvigsen, A. Lund, I. Rasmussen and R. Säljö (Eds.), *Learning across sites. New tools infrastructures and practices,* USA and Canada: Routledge. (2010). 243-258 *education's frontline workers.* Accessed April 2020 https://en.unesco.org/news/COVID-19-webinar-new-world-teachers-educations-frontline-workers; Adrian Kirkwood, "Teaching and learning with technology in higher education: Blended and distance education needs 'joined-up thinking'rather than technological determinism." *Open Learning:The Journal of Open, Distance and e-Learning,* 29(3), (2014): 206-221.
[29] Md. Shahadat Hossain Khan, Mahbub, Hasan and Che Kum Clement, "Barriers to the Introduction of ICT into Education in Developing Countries: The Example of Bangladesh." *Online Submission*, 5(2), (2012): 61-80.
[30] Sarah Hennessy and Laura London, "Learning from International Experiences with Interactive Whiteboards: The Role of Professional Development in Integrating the Technology," *OECD Education Working Papers*, 89, (2013). OECD Publishing, Paris, https://doi.org/10.1787/5k49chbsnmls-en.
[31] L. Johnson, S. Adams, and K. Haywood, *NMC Horizon Report: 2011 K-12 Edition*. Austin, Texas: The New Media Consortium. Accessed June 21, 2022 https://www.learntechlib.org/p/182017/.

attending lessons physically because of fear of contracting the disease. This left them no choice but to choose which technologies and applications to use to reach their learners.[32]

In a study by Lawrence and Tar, ICTs are of paramount importance in the education system. Since the emergence of COVID-19, it should be noted that there is a growing need to use ICTs in teaching and learning to impart skills and knowledge that learners should acquire during this digital age.[33] The adoption of ICT and integration in teaching and learning has gained momentum in most countries around the world.[34]

METHODOLOGY

This section discussed the methodology that was used in the collection of data. Data collection from the study was obtained using a quantitative questionnaire and an interview guide (qualitative data). The use of mixed methods research in data collection enabled the researcher to enquire and compare the strengths of both methods of data collection methods.[35] Quantitative data was analyzed using descriptive statistics (mean, median, mode, standard deviation, frequencies, and percentages), while qualitative data was analyzed and presented as descriptive using verbatim statements. Similar responses were grouped together to eliminate data duplication and redundancy.[36] All the data collected was analyzed as was collected from the subjects. This study took place in Botswana secondary schools using 350 participants who responded to the questionnaire and six groups of five (30) who responded to the focus group interviews.

RESULTS /FINDINGS

Table 1: Gender of the respondents

Gender		Frequency	Percentage
	Female	188	54%
	Male	161	46%
	Total	349	100.0 %

Table 1 presents the gender of the participants in this study. In this study, the findings reveal that they were more female teachers (54%) than compared to male teachers with (46%). This shows that the teaching fraternity in Botswana is dominated by females than males. This is confirmed by the Education Policy Institute report 2020 that only 35.5% of secondary school teachers were males and 64.5% constituted females.

[32] Gregg Lemke, and Gregg J. Silverman, "Blood clots and TAM receptor signalling in COVID-19 pathogenesis." *Nature Reviews Immunology*, 20, (2020):1– 2. https://doi.org/10.1038/s41577-020-0354-x.
[33] Lawrence, and Tar, "Factors that influence teachers' adoption and integration of ICT in teaching/learning process."
[34] Knezek, and Christensen, "Extending the will, skill, tool model of technology integration: Adding pedagogy as a new model construct."
[35] Fernando Almeida, Daniel Faria, and André Queirós, "Strengths and Limitations of Qualitative and Quantitative Research Methods." *European Journal of Education Studies*. 3. (2017): 369-387. 10.5281/zenodo.887089.
[36] W. Lawrence Neuman, *Social Research Methods: Qualitative and Quantitative* Approaches (Boston; Allyn & Bacon, 2014) ISBN-13: 978-0205615964

Table 2: Age groups of the respondents

Age		Frequency	Percentage
1	18-25	41	12%
2	26-36	131	36%
3	37-51	119	34%
4	52+	57	16%
	Total	349	100%
Missing	NA	1	.3%

The age of the respondents in ranges is presented in table 2. The findings reveal that out of 349 respondents, 348 answered the questions and 1(0.3%) participant did not answer the question. The age range 26 – 30 reported the highest percentage (36%). It shows that the majority of secondary school teachers are in 51 years and younger.

Table 3: Descriptive statistics for class X1

	marks for June 2019	marks for June 2020	marks for June 2021	marks for August 2019	marks for August 2020	marks for August 2021	marks for September 2019	marks for September 2020	marks for September 2021	marks for October 2019	marks for October 2020	marks for October 2021
N Valid	17	17	17	17	17	17	17	17	17	17	17	17
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Mean	65.18	50.24	46.88	41.53	43.00	42.82	37.24	39.47	44.06	40.000	33.35	54.41
Std. Error of Mean	2.5281	4.3879	3.7748	2.7827	3.9733	2.4528	3.2148	3.7023	3.1077	3.5115	3.9304	2.6913
Std. Deviation	10.4237	18.0919	15.5639	11.4734	16.3822	10.1133	13.2549	15.2648	12.8134	14.4784	16.2055	11.0965
Minimum	51.0	21.0	22.0	19.0	15.0	22.0	14.0	12.0	23.0	20.0	10.0	35.0
Maximum	86.0	81.0	74.0	65.0	68.0	63.0	62.0	62.0	66.0	67.0	62.0	72.0

The results for class X1 show a mean mark of 65.18 for June 2019, 50.24 for June 2020 and 46.88 for June 2021 the result shows a decline in performance. The results for August for the three years are not that different as the recorded means were 41.53 for the year 2019, 43 for 2020 and 42.82 for the year 2021. The results for the month of September for the three years shows an improvement in performance with recorded mean marks being 37.24, 39.47 and 44.06 for the year 2019, 2020 and 2021 respectively. The mean marks for the months of October for the three years are 40, 33.35 and 54.41 this shows a decline and an improvement in performance. The data is summarized in table 4.

Table 4: Descriptive statistics for class Z4

	marks for June 2019	marks for June 2020	marks for June 2021	marks for August 2019	marks for August 2020	marks for August 2021	marks for September 2019	marks for September 2020	marks for September 2021	marks for October 2019	marks for October 2020	marks for October 2021
N Valid	23	23	23	23	23	23	23	23	23	23	23	23
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Mean	73.61	50.30	50.48	62.22	37.57	51.57	61.26	56.96	46.17	52.96	44.09	41.61
Std. Error of Mean	2.8128	2.9073	3.9960	2.9728	3.2739	2.7953	3.3711	2.1325	2.1675	2.1352	2.7897	2.9339
Std. Deviation	13.4899	13.9429	19.1641	14.2572	15.7013	13.4057	16.1674	10.2269	10.3952	10.2402	13.3788	14.0704
Minimum	45.0	24.0	11.0	25.0	6.0	15.0	36.0	42.0	25.0	31.0	6.0	15.0
Maximum	98.0	74.0	86.0	82.0	65.0	78.0	88.0	85.0	63.0	77.0	62.0	65.0

The results for class Z4 show a mean mark of 73.61 for June 2019, 50.30 for June 2020 and 50.48 for June 2021 the result shows a steep decline in performance from the year 2019 to the year 2020. The results for August for the three years are 62.22 for the year 2019, then a decline to 37.57 for 2020 and an improvement to 51.57 for the year 2021. The results for the month of September for the three years show a decline in performance as recorded mean marks declined from 61.25 in 2019, then 56.96 in 2020, and a further decline to 46.17 in 2021. The mean marks for the months of October for the three years also showed a decline in performance from 52.96 in 2019 to 44.09 in 2020 and a further decline to 41.61 in 2021. The data is summarized in table 5.

Table 5: Descriptive statistics for class X1 and Z4 combined

	marks for June 2019	marks for June 2020	marks for June 2021	marks for August 2019	marks for August 2020	marks for August 2021	marks for September 2019	marks for September 2020	marks for September 2021	marks for October 2019	marks for October 2020	marks for October 2021
N	40	40	40	40	40	40	40	40	40	40	40	40
Mean	70.03	50.28	48.95	53.43	39.88	47.85	51.05	49.53	45.28	47.45	39.53	47.05
Std. Error of Mean	2.0313	2.4696	2.7829	2.6265	2.5327	2.0155	3.0175	2.4043	1.7989	2.1635	2.4372	2.2543
Std. Deviation	12.8472	15.6188	17.6009	16.6115	16.0179	12.7471	19.0841	15.2063	11.3770	13.6831	15.4139	14.2576
Minimum	45.0	21.0	11.0	19.0	6.0	15.0	14.0	12.0	23.0	20.0	6.0	15.0
Maximum	98.0	81.0	86.0	82.0	68.0	78.0	88.0	85.0	66.0	77.0	62.0	72.0

The overall performance calculated the descriptive statistics for the two data sets combined. The results for the month of June and September for the three years shows a decline in performance as the mean marks recorded were 70.03, 50.28 and 48.95 for the month of June and 51.05, 49.53 and 45.28 for the month of September. The mean marks for the month of August are 53.43, 39.88 and 47.85 and for the month of October are 47.45, 39.53 and 47.05. The results for the month of August and October show a decline in performance for the year 2020 and an improvement in performance for the year 2021 for both months. The results are summarized in table 6.

Table 6: Marks comparisons for the years 2019 to 2021 for class X1

	marks for June 2019	marks for August 2019	marks for September 2019	marks for October 2019	marks for June 2020	marks for August 2020	marks for September 2020	marks for October 2020	marks for June 2021	marks for August 2021	marks for September 2021	marks for October 2021
N	17	17	17	17	17	17	17	17	17	17	17	17
Mean	65.18	41.53	37.24	40.00	50.24	43.00	39.47	33.35	46.88	42.82	44.06	54.41
Std. Error of Mean	2.5281	2.7827	3.2148	3.5115	4.3879	3.9733	3.7023	3.9304	3.7748	2.4528	3.1077	2.6913
Std. Deviation	10.4237	11.4734	13.2549	14.4784	18.0919	16.3822	15.2648	16.2055	15.5639	10.1133	12.8134	11.0965
Minimum	51.0	19.0	14.0	20.0	21.0	15.0	12.0	10.0	22.0	22.0	23.0	35.0
Maximum	86.0	65.0	62.0	67.0	81.0	68.0	62.0	62.0	74.0	63.0	66.0	72.0

The researcher further proceeded to make comparisons within a year and results show that for the year 2019, mean performance for class X1 declined from 65.18% in June to 41.53% in August and further declined to 37.245 in September and slightly improved in October to 40%. The results for the year 2020 showed a decline in performance with recorded mean marks being 50.24, 43.00, 39.47 and 33.35 for the months of June, August, September and October respectively while for the year 2021, the average performance for June was 46.88 then it dropped to 42.88 in August and performance improved to 44.06 and further improved to 54.41% for the months of September and October respectively. The data is summarized in table 7.

Table 7: Marks comparisons for the years 2019 to 2021 for class Z4

	marks for June 2019	marks for August 2019	marks for September 2019	marks for October 2019	marks for June 2020	marks for August 2020	marks for September 2020	marks for October 2020	marks for June 2021	marks for August 2021	marks for September 2021	marks for October 2021
N	23	23	23	23	23	23	23	23	23	23	23	23
Mean	73.61	62.22	61.26	52.96	50.30	37.57	56.96	44.09	50.48	51.57	46.17	41.61
Std. Error of Mean	2.8128	2.9728	3.3711	2.1352	2.9073	3.2739	2.1325	2.7897	3.9960	2.7953	2.1675	2.9339
Std. Deviation	13.4899	14.2572	16.1674	10.2402	13.9429	15.7013	10.2269	13.3788	19.1641	13.4057	10.3952	14.0704
Minimum	45.0	25.0	36.0	31.0	24.0	6.0	42.0	6.0	11.0	15.0	25.0	15.0
Maximum	98.0	82.0	88.0	77.0	74.0	65.0	85.0	62.0	86.0	78.0	63.0	65.0

Results for Class Z4 show that for the year 2019 mean performance for class Z4 declined from 73.61% in June to 62.22% in August and further declined to 61.26 in September and further declined in October to 52.96%. The results for the year 2020 showed both a decline and an improvement in recorded mean marks being 50.30 in June then declined to 37.57 in August then an improvement to 56.96 in September and a decline to 44.09 in October. The year 2021 average performance for June was 50.48 then it improved to 51.57 in August and performance declined to 46.17 and further declined to 41.61% for the months of September and October respectively. The data is summarized in table 8.

Table 8: Overall comparisons with a year

	marks for June 2019	marks for August 2019	marks for September 2019	marks for October 2019	marks for June 2020	marks for August 2020	marks for September 2020	marks for October 2020	marks for June 2021	marks for August 2021	marks for September 2021	marks for October 2021
N	40	40	40	40	40	40	40	40	40	40	40	40
Mean	70.03	53.43	51.05	47.45	50.28	39.88	49.53	39.53	48.95	47.85	45.28	47.05
Std. Error of Mean	2.0313	2.6265	3.0175	2.1635	2.4696	2.5327	2.4043	2.4372	2.7829	2.0155	1.7989	2.2543
Std. Deviation	12.8472	16.6115	19.0841	13.6831	15.6188	16.0179	15.2063	15.4139	17.6009	12.7471	11.3770	14.2576
Minimum	45.0	19.0	14.0	20.0	21.0	6.0	12.0	6.0	11.0	15.0	23.0	15.0
Maximum	98.0	82.0	88.0	77.0	81.0	68.0	85.0	62.0	86.0	78.0	66.0	72.0

The overall comparison of performance within a year shows that for the year 2019, a decline in performance was recorded as the mean averages were 70.03, 53.43, 51.05 and 47.45 for the months of June, August, September, and October respectively. The results for the year 2020 showed both a decline and an improvement in performance as the mean mark for June was 50.28 and it declined to 39.88 in August, then improved to 49.53 in September before declining to 39.53 in October. Performance for the year 2021 saw a decline in performance for the months of June, August and September with mean averages being 48.95%, 47.85% and 45.28% respectively and improved for the month of October to 47.05%.

The following section reports the overall performance of the Botswana general certificate of secondary education (BGCSE) and the Botswana junior certificate education (JCE) results looking at the years 2019 to 2021. This will help to see how the national results were in the secondary schools BGCSE & JC respectively which was an area of interest in this study.

Table 9: BGCSE Number of Grades awarded at key grades A, C, E and G

Year		G or better	E or better	C or better	A or better	Total grades awarded
2021	Number of grades awarded	224255	173543	70254	6595	231721
	% of grades awarded	96.78	74.89	30.32	2.85	
2020	Number of grades awarded	217820	169528	68508	6345	226813
	% of grades awarded	96.04	74.74	30.20	2.80	
2019	Number of grades awarded	210197	161159	63284	5497	218094
	% of grades awarded	96.38	73.89	29.02	2.52	

Source: Botswana Examinations Council Report (2021)

The results depict the grades which were awarded at G, E, C and A or better. This indicates that 96.78% were grades G or better, 74.89% were grades E or better and 30.32% were grades C or better, while grades A or better (A and A*) scored 2.85% in 2021, as compared to 96.04%, 74.74%, 30.20% and 2.80%, respectively in 2020.

Table 10: BGCSE Number of Grades which are C or better

Year	2019	2020	2021
Total grades awarded	218094	226318	231721
Number of grades C or better	63284	68508	70254
% of grades C or better	29.02	30.20	30.32

Source: Botswana Examinations Council Report (2021)

The results show that in 2019, the percentage of grades C or better was 29.02% in 2019, 30.20% in 2020 and 30.32% in 2021 respectively. It is shown in table 11 that the total grades awarded have increased significantly from 2019 through 2020 to 2022.

Table 11: BGCSE Number of grades which are A or better

Year	**2019**	**2020**	**2021**
Total grades awarded	218094	226813	231721
Number of grades A or better	5497	6345	6595
% of grades A or better	2.52	2.80	2.85

Source: Botswana Examinations Council Report (2021)

The results show that the percentage of grades A or better for the Botswana general certificate of secondary education was 2.52% for 2019, 2.80% for 2020 and 2.85% for 2021 respectively. It is shown that the total grades awarded which are A or better increased from 2019 through 2020 to 2021 respectively.

Table 12 & 13: BGCSE Grades Awarded to Candidates in Government and Government Aided Schools and Private Candidates (including those from private schools), all syllabi

	Grades awarded	**Grade A***		**Grade A**		**Grade B**		**Grade C**		**Grade D**	
		No.	Cum %	No.	Cum %	No.	Cum %	No.	Cum %	No.	Cum %
GOV Schools	2021 190066	1496	0.79	4191	2.99	17690	12.30	37675	32.12	46870	56.78
PVT Candidate	2021 41655	267	0.64	591	2.06	2173	7.28	6114	21.95	11023	48.42

	Grades awarded	**Grade E**		**Grade F**		**Grade G**		**U**	
		No.	Cum %	No.	Cum %	No.	Cum %	No.	Cum %
GOV Schools	2021 190066	36807	76.15	23696	88.61	16724	97.41	4917	100.00
PVT Candidate	2021 41655	8621	69.11	5890	83.25	4306	93.59	2670	100.00

Source: Botswana Examinations Council Report (2021)

The results in table 12 & 13 for the Botswana general certificate of secondary education awarded to candidates and government, government aided and private schools in all syllabi show a cumulative percent of 0.79% for grade A in 2021 for government and government-aided schools and a slight decrease with a cumulative percent of 0.64% for the private schools. A cumulative percentage of grade F for government schools was 88.61% and 83.25% for private schools respectively in the 2021 academic year.

Table 14: National JCE summary of overall grades from 2019 to 2021

	2019			**2020**			**2021**		
Grade	Count	%	Cum	Count	%	Cum	Count	%	Cum
Merit	3	0.01	0.01	11	0.03	0.03	13	0.03	0.03

A	484	1.18	1.19	485	1.11	1.14	543	1.17	1.20
B	4205	10.24	11.43	4187	9.54	10.68	4176	9.03	10.23
C	9833	23.95	35.38	9865	22.48	33.16	10322	22.33	32.56
D	14181	34.55	69.93	14924	34.01	67.17	15367	33.24	65.80
E	6088	14.83	84.76	5947	13.55	80.72	6112	13.22	79.02
U	5920	14.42	99.18	6626	15.10	95.82	6744	14.59	93.61
X	334	0.81	100.00	1838	4.19	100.00	2955	6.39	100.00
Total	**41048**			**43883**			**46232**		

***NB**: X means failure to meet the grading requirements to be awarded a qualification while U denotes a failure for one to meet the minimum requirements at grade E.*

The results show that the cumulative pass rate (grade E or better), stood at 79.02% in 2021 to that of 80.72% in 2020 which showed a slight decline in percentage while the credit pass rate (grade C or better) is 32.56% compared to 33.16% in 2020 respectively which has also scored a decline in percentile. The total number of candidates set for the examination who were assigned X were as follows 2019 (334), 2020 (1838) and 2021 (2955) respectively.

DISCUSSION

The finding of this study which addressed this research was based on the results of the learners in the years 2019, 2020 and 2021 respectively. The results for the year 2019 were those when there was no COVID – 19 which lead to the closure of schools in the years 2020 and 2021. This was when lockdowns were being imposed all over the world, yet schools were forced to close which left teachers and learners with no choice but to resort to online learning. It is shown from the results in table 3 that in 2019 that the average mean of the results from June, July, August, September and October was 3.59, it increased for the same month to 38.61 and further increased to 47.1 in 2021 respectively for class XI. The results for class XI were compared to those of class Z4 for the same month because that was the time the schools were closed. It is evident in table 4 that the results for class Z4 for the same months (June, August, September and October) average mean was 62.51 in 2019, 47.23 in 2020 and 47.46 in 2021 respectively.

The above results show that there was a significant improvement in the results from the year 2019 when teachers were using traditional methods of teaching before COVID to the time when ICT tools were used in teaching and learning. Class XI improved results as seen above. Class Z4 dropped from 62.51 in 2019 to 47.23 in 2020 and further improved by 0.23 to make an average mean of 47.23. This shows that in the year 2020, both teachers and learners were getting used to the use of technologies in teaching and learning, thus an improvement in learner academic performance. In the year 2021, the results improved which shows that they now were getting used to technology adoption and integration in teaching and learning. This really shows that the use of technology in teaching and learning during the COVID – 19 influenced learners' academic performance in a positive way.

The results above are also supported by table 5 when both results for the respective years were combined to further explore the influence and academic learner performance. It is evident that results for class XI and Z4 combined show that in the year 2019 the average mean mark was 55.49, 44.81 in 2020 and 47.28 in 2021. This shows that learner academic performance improved positively between the years 2020 and 2021 when technology was now the center of teaching and learning. Technology use in teaching and learning is key to better academic results as shown by the results above. This is evident in the national Botswana general certificate of secondary education (BGCSE) results for the years 2019, 2020 and 2021 in table 9. It is shown that the national results for grades A, C, E and G was 50.45% in 2019; it improved in 2020 to 50.94% and further improved in 2021 to 51.21%. Table 10 shows that the number of grades C or better for the year 2019 was 29.02%, 30.20% in 2020 and 30.32%

in 2021. This has shown a positive improvement and that technology used in teaching and learning influence learner academic performance better compared to the traditional methods of teaching.

It is further shown and supported in table 12 & 13 that the BGCSE results for the number of grades A or better was 2.52% in 2019, 2.80% in 2020 and a further improvement to 2.85% in 2021. The national results from government and private schools were also compared to access how technology influenced teaching and learning during the COVID – 19. It is evident that government schools performed better than private schools during the COVID -19 pandemic. Table 12 shows the results for government and private schools' grades on all syllabi for the year 2021, it shows that for the grades A*, A, B, C, D, E, F, G, U, government schools performed better than private schools with an average percentage of 51.91% to 47.37% that of private schools. This is supposedly so because there is support for the use of technology by the government as compared to private schools and private schools mostly focus on profit-making compared to the government which is doing it for the benefit of all. This is backed by the following qualitative comments from chapter six;

We have two computer labs in our school. The government-built one was refurbished with new computers and appropriate technology for teaching and learning. The software is up to date and new software were installed on all the machines. We have another smart computer laboratory. These were donations from the local mine in our locality. This has made technology integration in teaching and learning very easy. [Participant 3]

We have tablets for use by both learners at our computer labs in my school. These were donations from one of the churches in the localities. [Participant 16]

In our school, there is an internet connection in both the computer laboratories and the administration area. The government has improved internet connectivity in our school. This will be done in other schools. [Participant 27]

The national Botswana junior certificate examination (JCE) results were also compared to see the differences in the results summary. Table 14 shows that for the results grades of Merit, A, B, C, D, E, U and X the average percentage for JCE results for the years 2019, 2020 and 2021 was 12.5% respectively for all the years. It however shows that there was an improvement in learner academic performance for the grade Merit which was 1.18% in 2019, 1.11% in 2020 and an improvement to 1.17% in 2021. This shows that the Merit results improved between 2020 and 2021 when technology was adopted in teaching and learning.

The above results are supported by Charaya, Bana and Malhotra and Akinoso who concluded that ICT impacted positively terms of academic achievement of those learners who used ICT in their teaching and learning which is also found in this study.[37] Positive influence on learner academic improvement was also noted and seen to be similar to a study by Basri et al. who showed that learner academic performance improved their information and capabilities which was attributed to GPA and character.[38] Several studies showed that the use of ICTs by learners improves their academic performance. This quantifies and validates the results in this study that the use of ICT in teaching and learning has a positive influence on teaching and learning.[39] Information communication technology

[37] Anureet Charaya, Veena Bana, and R. Malhotra, "Impact of ICT on Creativity and Achievement Ability of Perspective Teachers and Students of Technical Education." *International Journal on Arts, Management and Humanities.* 6(2), (2017): 15-22. ISSN No. (Online): 2319–5231; Sabainah Oyebola Akinoso, *Information Communication Technology and Collaborative Skills on Students with Learning Difficulties in Mathematics*. Lambert Academic Publishing, 2017, 1-65.
[38] Wael Sh Basri, Jehan A. Alandejani, and Feras M. Almadani, "ICT adoption impact on students' academic performance: evidence from Saudi universities." *Education Research International*, 9. (2018) https://doi.org/10.1155/2018/1240197.
[39] Charaya, Bana, and Malhotra, "Impact of ICT on Creativity and Achievement Ability of Perspective Teachers and Students of Technical Education."; Tabassum Rashid and Hanan Muhammad Asghar, "Technology use, self-directed

tools are being used to modernize the education systems and new settings and strategies for achieving better academic performance results are being done so that no learner is left behind and that the intended academic targets are achieved.[40]

Covid – 19 pandemic has seen learners also adopting ICT in their learning and yielded positive results as shown above. Perceived ease of use has also been seen to have influenced behavioral intention on the use of ICTs in teaching and learning since no one had a choice but to resort to the use of technology integration in teaching and learning.[41] With continuity in the use of ICTs in schools and children growing up with ICTs, this has made teachers' use of ICTs in teaching and learning less of a concern than in the olden days.

RECOMMENDATIONS

1. The Ministry of education and skills development should organise ICT training courses for both primary and secondary schools so that teachers are taught how to effectively use and integrate technology in teaching and learning.
2. The curriculum developers should include technology use in teaching and learning (digital curriculum) when they are developing school curriculums. This must be piloted to make sure that teachers have adopted, understand and appreciate change.
3. All teachers before they graduate from colleges of education and universities, must enrol in an ICT course so that they are well aware and knowledgeable about how to use technologies in their teaching.
4. The government of Botswana through the Ministry of education must avail ICT resources for teaching and learning in all government schools so that access to these resources must be easy and available to all learners.
5. The school management should make sure that the utilization of technology in teaching is done in an appropriate way so that the benefits intended are achieved.
6. The Ministry of education through the department of communication, information and technology must ensure that all three network service providers in the country are available in all parts of the country even in the remotest villages so that there can be access to full network and internet resources.
7. Regular professional development workshops should be conducted during schools closure so that teachers are equipped with ICT special skills in technology integration in teaching.
8. All the school level grades from reception to form five should have access to a technology device so that they get used to technology use.
9. The ministry of education is requested to liaise with the faculty of education at the University of Botswana whenever there are changes to be made in the schools' curriculums. This makes sure that experts from the faculty are engaged in teaching and learning development.
10. Proper communication channels should be used to communicate to stakeholders in matters that concern education.
11. There should be partnerships between the ministry of education Botswana and other education ministries in the region and beyond so that the calibre in Botswana is competitive globally.
12. Countries need to level up and prepare for situations not catered for, this will ensure resistance to pressure from pandemics in the future.

learning, student engagement and academic performance: Examining the interrelations." *Computers in Human Behavior*, 63, (2016): 604–612. https://doi.org/10.1016/j.chb.2016.05.084.

[40] Kashif Ishaq, Nor Azan Mat Zin, Fadhilah Rosdi, Adnan Abid, Mustansar Ijaz "The impact of ICT on students' academic performance in public private sector universities of Pakistan." *International Journal of Innovative Technology and Exploring Engineering (IJITEE*), 9(3), (2020): 1117-1121.

[41] Ishaq, et. al. "The impact of ICT on students' academic performance in public private sector universities of Pakistan."

CONCLUSION

This study critically analyzed the adoption and use of information communication technologies by in-service secondary school teachers during the COVID – 19 pandemic. It emerged from this study that there are barriers associated with technology use and integration into teaching. It became evident that the use of ICTs in teaching and learning has a positive influence on learners academic results. This study revealed that there are different technologies used in government and private schools and showed that government schools are doing well in terms of learners' academic performance than private schools. The study further made recommendations to the concerned stakeholders on how best to promote and support technology use in teaching and learning so that the intended purpose could be achieved easily. The findings of this study also showed and affirmed that the COVID – 19 pandemic significantly influenced the use of technology in teaching as it left no one with a choice.

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