In-Service Science Teacher's Perceptions Towards the Use of Information Communication Technology Tools in Teaching and Learning in a COVID-19 Environment

Kgalemelo Rodnie Mafa[1] & Desmond Wesley Govender[2] (iD)

[1] University of KwaZulu Natal, Edgewood Campus, Durban, South Africa.
[2] Department of Computer Science - School of Education, University of KwaZulu-Natal, South Africa.

ABSTRACT

Information and Communication Technology (ICT) have been growing incredibly for the past twenty years in most sectors; however, much needs to be achieved within the education fraternity itself. Teachers are still relying on traditional teaching methods and Botswana is currently far behind in benefiting from ICT usage in the classroom. This study critically analysed the ICT infrastructure found in Botswana's secondary schools, assesses teachers' skills, knowledge, confidence, and their perception of the integration of ICT in teaching and learning. A mixed-methods approach was used to collect data from 350 respondents. The results revealed that ICT use and integration in Botswana secondary schools during the Covid – 19 period posed some challenges even though it was beneficial to an extent where there was learner academic improvement. This has been influenced by factors such as lack of skills, lack of confidence in the use of technology by teachers, and lack of ICT equipment in schools. The study recommends that schools should be equipped with the relevant ICT infrastructures, have adequate resources, and that facilitators should be trained on the right pedagogies and use of ICT in teaching and learning. Furthermore, curriculum developers should integrate ICT teaching in subject areas. The findings of this study will contribute to the correct pedagogies and best practices of teaching, and how issues teachers found in technology use can be solved and addressed amicably for the benefit of the greater masses. The educational stakeholders can make use of these findings to improve knowledge and attitudes toward the successful adoption and implementation of information and communication technologies in teaching and learning during the pandemic.

Keywords: technology adoption, in-service teachers, perceptions towards

INTRODUCTION

This study aims to examine teachers' perceptions of the use of information communication tools in their teaching and to critically analyze the challenges of technology adoption and use. Since the outbreak of the Covid-19 pandemic, the world has been dealing with a learning crisis. This is because lockdowns enforced the closing of schools everywhere, which has shown evidence of high levels of learning poverty.[1] It was estimated by the World Bank that because of school closure during the Covid - 19 pandemic, about 1.6 billion children and youth were left out of school. Schools were closed around the world during the Covid – 19 pandemic as a precautionary measure to contain the spread and transmission of the deadly coronavirus.[2] The closure of schools forced teachers to turn to technology to continue teaching remotely during times of social distancing.[3]

During the peak time of the Covid-19 pandemic, the use of technology in teaching and learning became firmly established in almost every country, despite challenges brought about by using technology, such as lack of resources and internet access among many others.[4] Technology is changing the way things are done, and facilitators are encouraged to use technology in curriculum delivery. This ensures that learning goes beyond classroom reach 24/7 all the time.[5] Thomas, Reyes and Blumling also agreed that technology use in curriculum delivery should be assessed based on different pedagogical methods together with the expected learning outcomes.[6] This means that most countries have regarded the use of ICTs as an option to raise and improve educational standards across the board.[7] Ever since the outbreak of the Covid-19 pandemic, online learning discussions commenced, as well as the use of other technologies such as television, radio, mobile technology devices and others on how best these can be used to benefit the education sector. Many organizations started discussing how best education can continue during the pandemic. This pandemic was the driving force for instructors/teachers in utilizing ICTs in their teaching since they had no other option.

Today, most countries around the globe consider technology use as a gateway to improving their economic development in that they invest much in such technologies. For example, The United States of America (USA) spends more than $10 billion yearly on educational technology in public schools[8] and Australia spends around AUD$8 billion.[9] There are different definitions explaining information communication technologies. In this study, the researchers adopted the definition of ICT from UNESCO, which defines ICT as "forms of technology that are used to transmit, process, store, create, display, share, or exchange information by electronic means."[10] Most definitions fail to define

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[1] World Bank, Guidance Note on Remote Learning and COVID-19 (English) (2020a), 1.

[2] World Bank Guidance Note on Remote Learning and COVID-19 (English) (2020a), 1.

[3] Syed Noor-Ul-Amin, "An Effective Use of ICT for Education and Learning by Drawing on Worldwide Knowledge, Research and Experience: ICT as a Change Agent for Education". *Scholarly Journal of Education*, 2, (4), (2013): 38-54.

[4] Noor-Ul-Amin, "An Effective Use of ICT For Education and Learning…." 38-54.

[5] Tami L. Thomas, Imelda Reyes, Amy Blumling, "Technology and Teaching: Avoiding the Pitfalls, Increasing Student Engagement, and Improving Outcomes." *Journal of Nursing Education and Practice*, 5(3), (2014): 33–35.

[6] Thomas, Reyes and Blumling, "Technology and Teaching," 33-35.

[7]Noor-Ul-Amin, "An Effective Use of ICT For Education and Learning…." 38-54.

[8] Jason Dan Brunk, Factors Affecting the Level of Technology Implementation by Teachers in Elementary Schools (Doctoral Dissertation, The University Of Oklahoma. Awarded 2008), accessed June 22, 2020. https://www.proquest.com/openview/6a3c33159a30bff77a9fd376839684ab/1?pq-origsite=gscholar&cbl=18750

[9] Jeniffer M. Lane, "Developing the Vision: Preparing Teachers to Deliver a Digital World-Class Education System." *Australian Journal of Teacher Education*, 37(4), (2012): 59-74.

[10] UNESCO, COVID-19 Webinar: A New World for Teachers, Education's Frontline Workers, accessed April 2020, https://en.unesco.org/news/covid-19-webinar-new-world-teachers-educations-frontline-workers-covid-19-education-webinar-2

and contextualize the true meaning of ICTs because they create the impression that ICTs are merely computers and computer systems in use. This study adopted a quantitative research approach in order to answer the research questions. The research questions of this study were: (1) What are the perceptions of in-service secondary school teachers towards the use of ICT tools in teaching and learning during the Covid-19 pandemic? (2) What are perceived as challenges towards the use of ICTs in teaching and learning during this era where Covid – 19 is still prevalent?

LITERATURE REVIEW

Studies on the use of ICT in education have concluded that it is important for one to learn about ICT use and how effective can they be, and when used together with new technology, how it can enhance teaching and learning.[11] This assertion is similar to the views of Crook who agrees that ICT can be used effectively as a vehicle to deliver course content materials in an environment where the instructor collaborates with the learners, whether synchronously or asynchronously.[12] Almost every learner across the globe has access to a mobile technology device, some own and majority have access to a computer or technology devices from their parents. Since this is the case, the use of these gadgets to the advantage of the learners is minimal, even though governments have put ICT policies and infrastructure in place.

Albayrak and Yildirim stress that the use of ICT in teaching and learning aids lifelong and distance learning skills, thus this promotes collaborative learning and supports skills development. They further emphasize the use of technology, which can help in the professional development of both the learner and the teacher.[13] In these respects, ICT is a source of both teaching and learning.[14] If properly used, ICT can significantly benefit curriculum delivery; this can also instill new ways of using these ICTs in teaching by facilitators and instructors. Several studies conducted in developing countries showed that the introduction of ICT policy and plan in curriculum delivery is influenced by the lack of fundamental ICT resources and infrastructure, lack of funds to purchase adequate ICT resources, and an unskilled workforce in the education fraternity.[15]

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[11] Barry Bai, Jing Wang, C. Chai. "Understanding Hong Kong Primary School English Teachers' Continuance Intention to Teach With ICT." *Computer Assisted Language Learning*, (2019). 1-23; Celia Hoyles, "Transforming the Mathematical Practices of Learners and Teachers through Digital Technology," *Research In Mathematics Education*, 20(3), (2018): 209-228; Karna Rana, Janinka Greenwood, Wendy Fox-Turnbull, and S. Wise, A Shift from Traditional Pedagogy in Nepali Rural Primary Schools? Rural Teachers' Capacity to Reflect ICT Policy in their Practice. *International Journal of Education and Development Using ICT,* 14(3), (2018); 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.

[12] 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.

[13] 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.

[14] 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 & R. Säljö (Eds.), *Learning Across Sites. New Tools Infrastructures and Practices*, (USA and Canada: Routledge, 2010), 243-258; 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.

[15] M.D. Khan, Hossain Shahadat, Mahbub Hasan, Che Kum Clement, "Barriers to the Introduction of ICT into Education in Developing Countries: The Example of Bangladesh." *International Journal of Instruction*, 5(2), (2012): 61-80; R.B. Kozma, and W.S. Vota, *ICT In Developing Countries: Policies, Implementation, And Impact. Handbook of Research on Educational Communications and Technology* (New York: Springer, 2014). 885-894.

Some researchers suggest that with the rapid development of computer technology, digital learning materials offer additional affordances over traditional print materials. For example, Karagiannidis et al. and Laurillard emphasise the use of technology in teaching and learning can improve learning and student academic performance.[16] Karagiannidis et al. also argue that acceptance of the use of technologies for different roles around the globe has promoted the adoption and acute development of these technologies and their use in teaching and learning.[17] Extant literature indicated a gap in understanding the best pedagogical approach and issues teachers might have found during the Covid-19 pandemic.

METHODOLOGY

A quantitative research approach was adopted to gather the data required using a quantitative questionnaire. The sample consisted of three hundred and fifty (350) in-service secondary school science teachers around the country and only three hundred and forty-nine (349) questionnaires were retrieved and used. Teachers were chosen because they are they were using ICTs in teaching and learning since the outbreak of the Covid – 19 pandemic. These teachers were from different schools across the education regions in Botswana and were teaching all the subjects (Computer studies, Mathematics, English, Sciences, History, Religious education, physical education, Moral education, Home economics, Geography and Setswana) taught in Botswana. Descriptive statistics were used to make the analysis easier to understand.

Quantitative research examines the relationships between variables and can establish the cause and effect in highly controlled circumstances. Quantitative research is a numerical representation and manipulation of observations to describe and explain the phenomena that those observations reflect. In addition, according to Cohen and Manion, quantitative research is defined as a form of social research that employs empirical methods and statements.[18] A descriptive design was adopted for the analysis. It reported other summaries of data such as variation, percentage, and correlation between variables. Borg & Gall agree that descriptive research can include multiple variables for analysis since it requires only one variable, for example, a descriptive study might employ methods of analyzing correlations between multiple variables by using tests such as Pearson's Product Moment correlation, and regression, or multiple regression analysis.[19]

The sample of this study focused on in-service secondary school teachers using the convenience sampling method. The purpose of choosing this sample is that these teachers go back to tertiary educational institutions to increase their qualifications and attain degrees at the undergraduate and master's levels. A convenience sample is one of the main types of nonprobability sampling method, where the sample is taken from a group of people easy to contact or reach. According to Cohen and Manion, a convenience sample is fast, easy to use, has limited costs and is very attractive. These attributes make it the most preferred by the majority of researchers.[20]

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[16] Charalampos Karagiannidis, Panagiotis Politis and Ilias Karasavvidis, *Research on E-Learning and ICT In Education: Technological, Pedagogical and Instructional Perspectives.* (New York: Springer, 2014); Diana Laurillard, Effective Use of Technology in Teaching and Learning in HE. In P. Peterson, E. Baker & B. Mcgaw (Eds.), *International Encyclopedia of Education* (Third Edition), (Oxford: Elsevier, 2010), 419-426.

[17] Karagiannidis, Politis, and Karasavvidis, *Research On E-Learning And ICT In Education*, 419-426.

[18] Louis Cohen, and Lawrence Manion, *Research Methods in Education* (2nd Ed.) (New York:, 1980).

[19] Walter R. Borg, and Meredith D. Gall, *Educational Research: An Introduction* (5th Ed.). (White Plains, NY: Longman, 1989).

[20] Cohen, and Manion, *Research Methods in Education*.

Instrument and Procedures

The purpose of the questionnaire was to gather information which will help address the research questions under study. The participants responded by filling out a questionnaire. This was done with careful attention to the social distancing measures imposed because of the outbreak of the Corvid-19 pandemic and different health protocols shaped by responsible bodies to minimize infections. During the time of filling in the questionnaires, the social distancing measures had been eased and people could move around. This method was used because it facilitated the collection of structured data from the large sample size as compared to conducting interviews.

The responses from the questionnaire were grouped according to the type of questions and answers were entered into a Microsoft Excel document which was later exported to Statistical Package for the Social Science (SPSS) for analysis. The data was analyzed using descriptive statistics to answer the research questions of the study.

RESULTS /FINDINGS

Table 1 shows all the participants according to Gender, involved in data collection in this study using the quantitative questionnaire.

Table 1. Study participants

Gender	Frequency	Percentage
Female	188	54%
Male	161	46%

The findings reveal that they were more female teachers (54%) as compared to male teachers (46%). This shows that the teaching fraternity in Botswana is dominated by more females than males.[21]

Table 2: Perception of the use of technology in teaching and learning

Percentage scores					
Construct	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Technology use in my job helped me to accomplish tasks more quickly during the covid-19 pandemic.	9.2	17.2	20.3	20.9	31.8
Using the technology would improve my job performance	10.6	11.7	16.3	24.9	35.5
Using the technology would enhance my effectiveness on the job.	8.3	11.7	14.3	33	33.2
Using the technology would make it easier to do my job.	7.4	14.3	22.3	25.5	29.5

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[21] Julie O'Neil and Marianne Eisenmann, "An Examination of How Source Classification Impacts Credibility and Consumer Behavior." *Public Relations Review.* 43. (2017). 10.1016/J.Pubrev.2017.02.011.

Using the technology improves the quality of the work I do.	9.5	15.5	19.8	27.2	27.2
Using the technology increases my productivity	7.4	18.6	21.5	30.7	20.9
If I use the technology…					
I will spend less time on routine job tasks.	7.7	16	20.1	27.2	27.5
I will increase the quality of output of my job	7.4	17.2	22.6	22.6	27.5
I will increase the quantity of output for the same amount of effort.	7.7	19.8	26.6	23.6	21.8
My co-workers will perceive me as competent	10.3	16	18.9	31.8	22.1

The results report that 66.2% agreed that using the technology would enhance effectiveness on their job. This is followed by 60.4% who also agreed that using technology would improve their work performance and 54.4% that technology use would improve the quality of the work they do. 27.5% disagreed that if they use technology, it will increase the quality of output for the same amount of effort. Only 26% also disagreed that if they use technology in their teaching would improve their productivity.

Table 3: ICT-related challenges

ICT Related challenges	Percentage scores				
	Not a challenge at all	Slightly a challenge	A minor challenge	A challenge	A major challenge
Insufficient number of computers	15.2	15.2	17.2	26.6	25.2
Inadequate lack of skills on ICTs	9.5	18.9	16	22.9	32.7
Not enough copies of software for specific subjects	8.6	16.6	21.2	22.9	30.1
Lack of interest in teachers on the use of ICT in teaching and learning	13.8	21.5	18.6	19.5	26.4
Insufficient teacher time	17.2	24.1	18.3	19.8	20.3
Lack of adequate technical assistance	13.5	30.9	16.3	20.1	18.1
Slow speed of the internet	9.5	17.8	18.3	23.8	30.4
Lack of administrative assistance	12	21.2	16.9	21.5	27.9
Lack of adequate computer lab	7.2	17.8	16.3	23.5	35
Lack of proper policy and strategy on ICT usage in schools by the Ministry	15.8	19.8	19.5	22.3	22.3

Technophobia (fear to use ICT in teaching)	9.2	14.9	14.3	24.6	36.1
Computer Virus attacks	15.5	25.2	16.6	21.8	20.6

The results show that 60.7% reported that technophobia (fear to use ICT in teaching) is a challenge, followed by 58.5% who reported a lack of adequate computer labs and 51.8% on insufficient numbers of computers as challenges respectively. 47.2% reported that lack of technical assistance is a minor challenge followed by 41.8% on computer virus attacks also as a minor challenge.

DISCUSSION

The finding from the data presented and analyzed revealed that there are more females than males in the teaching fraternity. This is attributed to the popular belief that females are more patient than males when handling matters.[22] Hence, they can take all the time in disseminating and imparting knowledge to learners. The finding also revealed that teachers have positive and negative perceptions towards the use of ICTs in teaching and learning. The positive perceptions included among others that using technologies in teaching and learning would improve effectiveness in their jobs, would improve their work performance and the quality of work that they do, and it will also increase the quality of output of the work that they do. The negative perceptions included among others that using the technology will not improve the quality of work for the same amount of effort and will not increase their productivity.

A literature review by Ertmer and Ottenbreit-Leftwich indicated that teachers' attitudes towards technology use are the indicator predictor for actual use.[23] A study by Pittman and Gaines also showed that teachers who are ICT competent and have been using ICTs have enough confidence to use technology in their teaching since they can use it well to plan, execute and deliver their job mandate.[24] This agrees with Instefjord and Munthe who concluded in their study that perceived use of technology is important in technology adoption and use and explained perceived usefulness as the extent to which teachers perceive or believe that using technology will have an impact on their teaching and student learning.[25] The findings from the data analysis also revealed that there are many challenges attributed to the integration and use of information communication technologies in teaching and learning. These challenges among others are that majority of the teachers are technophobic or they fear using technologies in their day-to-day job.

There is a lack of adequate infrastructures such as computer lab facilities that support the use of technology in teaching. It is also revealed that there are insufficient computers and technology gadgets to use. Poor internet connection and slow bandwidth are also factors that are contributing to the challenge. However, some revealed and noted minor challenges such as lack of technical assistance, computer virus attacks and lack of administrative support from the authorities at school. Challenges such as internet access were also a problem because teachers could not effectively

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[22] O'Neil and Eisenmann, "An Examination of How Source Classification Impacts Credibility and Consumer Behavior."

[23] Peggy Ertmer and Anne Ottenbreit-Leftwich, "Teacher Technology Change: How Knowledge, Beliefs, and Culture Intersect." *Journal of Research on Technology in Education*. 42. (2010): 55-284. 10.1080/15391523.2010.10782551.

[24] Tiffani Pittman and Trudi Gaines, "Technology Integration in Third, Fourth and Fifth-Grade Classrooms in A Florida School District" *Educational Technology Research & Development*, 63(4), (2015): 539-554.

[25] Elen Instefjord and Elaine Munthe, "Preparing Pre-Service Teachers to Integrate Technology: An Analysis of the Emphasis on Digital Competence in Teacher Education Curricula." *European Journal of Teacher Education*, 39(1), (2016): 77–93.

collaborate and interact with their learners online but rather resorted to asynchronous communication. It also proved to be ineffective for those who did not have any access to the internet as they could not meet online in any way. Barriers could be external or internal. External barriers can be associated with lack of access or limited resources, limited training and support while some may face the challenge of trying to overcome intrinsic barriers linked to facilitator confidence, beliefs and perceived ease of use of technology. This is supported by a model from Christensen and Knezek in which three major elements were distinguished.[26]

These elements include technology integration, willingness to use technology in instruction delivery, and access to appropriate technology to use.[27] For schools to adopt and be prepared for the digital era, teachers should be challenged and prepared to use digital technologies in their teaching.[28] Several studies have revealed that only a select few teachers have shown a positive attitude towards technology use in their classrooms while the majority were not enticed to adopt the use of technology in their teaching. This was because of issues related to lack of ICT skills, the digital divide and lack of professional development programmes on technology use. They further noted that the use of digital technologies in the classroom was limited as most teachers are not competent in using technology. Digital technology competence in this study is defined as, the competence and ability to use information communication technologies to the best of the learner and the facilitator.[29] Ilomäki et al. divided digital competence into four areas; technological skills to operate the technologies, competence, and ability to apply and use digital technologies in different workplaces, one's capability to evaluate digital technology use in a context, and participation in the digital space. All these four areas are investigated in this study, so they can assess the Botswanan context.[30]

Facilitators lack the skills to conduct an online class let alone to operate a computer. Research has shown that technical skills for setting and conducting an online class, depend on the availability of resources and the technical skills of the operator.[31] Effective training on technology use in teaching is a further challenge in that without it they cannot effectively use ICTs in teaching. Lower internet speeds and bandwidth are also challenges because if one does not have enough connection and access to the internet they cannot effectively participate in an online class. Several studies were conducted on the challenges of using ICTs in teaching and learning, for example, Ertmer and Ottenbreit-Leftwich noted some challenges relating to poor internet connection and low bandwidths.[32] In another study in Kenya, Taurus et al. identified challenges related to using an eLearning system, these were lack of infrastructure development, lack of technical skills and purchasing power to procure required resources.[33] A similar study by Spante et al. attributed factors such as the poor and un-interactive

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[26]Gerald Knezek and Rhonda Christensen, The Importance of Information Technology Attitudes and Competencies in Primary and Secondary Education. In: Voogt, J., Knezek, G. (Eds) *International Handbook of Information Technology in Primary and Secondary Education. Springer International Handbook of Information Technology in Primary and Secondary Education*, Vol 20. (Boston Ma. Springer, 2018), Https://Doi.Org/10.1007/978-0-387-73315-9_19.

[27] Instefjord and Munthe, "Preparing Pre-Service Teachers To Integrate Technology," 77-93.

[28] Ministry Of Communications and Technology Botswana, 2007.

[29] Maria Spante, Sylvana Sofkova Hashemi, Mona Lundin, Anne Algers and Shuyan Wang (Reviewing Editor) "Digital Competence and Digital Literacy in Higher Education Research" *Systematic Review of Concept Use, Cogent Education*, 5 (1), (2018), DOI: 10.1080/2331186X.2018.1519143.

[30] Liisa Ilomäki, Sami Paavola, Minna Lakkala, and Anna Kantosalo, "Digital Competence – An Emergent Boundary Concept for Policy and Educational Research" *Education and Information Technologies*, 21(3), (2016): 655–679.

[31] Ertmer and Ottenbreit-Leftwich, "Teacher Technology Change..." 55-284.

[32] Ertmer and Ottenbreit-Leftwich, "Teacher Technology Change..." 55-284.

[33] J.K. Taurus, D. Gichoya, and A. Muumbo, "Challenges of Implementing E-Learning in Kenya: A Case of Kenyan Public Universities," *International Review Of Research In Open And Distributed Learning*, 16 (1), (2015).

design of the interface and lack of information and technology skills as primary causes in hindering successful implementation and use of e-learning management systems.[34] Kenan et al. in Lybia claimed that issues relating to culture, politics, and socio-economic factors are the main reasons for failure.[35] In the same way, challenges relating to management, technical know-how, culture, and implementation are key to the unsuccessful implementation and use of eLearning.[36]

These findings are also similar to the views of a study by Gupta and Dharamveer who found that most of the respondents agreed and strongly agree that ICTs and enough resources enabled them to improve their teaching coupled with relevant updated course content materials.[37] In support of this, investors in other countries in the education fraternity have helped the adoption and use of ICT in teaching and learning growth and consequently, ICT was considered to be the catalyst for enhancing the quality and effectiveness of teaching. [38] Buabeng-Andoh & Totimeh also support that ICT integration has brought remarkable changes and improvements in teaching and learning.[39] Technology use and support are very important in teaching and learning as evidenced in the results of this study. This is supported by Albugarni and Ahmed who stressed that successful implementation of ICT-based learning needs the presence of technical support personnel so that both the teachers and learner can be supported on the use of ICT in teaching. ICT resources must be always available to enable the process of teaching and learning.[40] Lim and Khine posit that without technical support, it will be difficult to integrate ICTs in the classroom.[41]

RECOMMENDATIONS

The study recommends that schools should be equipped with appropriate ICT supporting infrastructures, and teachers should be trained on the pedagogy of ICT in teaching. Furthermore, the curriculum should be designed in such a way that it includes ICT integration in subject areas. The results of this study will help the concerned teachers, curriculum developers and parents on which is the best and correct pedagogy to use. It will also inform what is required to appropriately use technology to get the benefits required, thus improvement of education in the country and meeting new learning outcomes and better performance. They will also encourage teaching and learning using ICTs.

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[34] Spante et. al, "Digital Competence and Digital Literacyin Higher Education Research."

[35] T. Kenan, C. Pislaru and A. Elzawi, "Novel SWOT Analysis of E-Learning Implementation in HE Institutions In Libya." *International Journal on E-Learning* (IJEL): Association for the Advancement of Computing In Education (AACE). (2018). (To Be Published).

[36] Amal Rhema and Iwona Miliszewska, "Towards E-Learning in Higher Education in Libya." *Issues in Informing Science and Information Technology*. 7(2010): 423-437.

[37] Manmohan Gupta and Dharamveer. "Prospective Teacher's Attitude towards the Use of ICT: A Comparative Study between C.C.S. University, Meerut & Kurukshetra University, Kurukshetra." *Educational Quest: An International Journal of Education and Applied Social Sciences* 8 (2017): 81.

[38] Shaheeda Jaffer, Dick Ng'ambi and Laura Czerniewicz, "The Role Of ICTS In Higher Education In South Africa: One Strategy for Addressing Teaching and Learning Challenges", *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)*, 3(4), (2007): 131-142.

[39] Charles Buabeng-Andoh, and Fred Totimeh. "Teachers' Innovative Use of Computer Technologies in Classroom: A Case of Selected Ghanaian Schools." *International Journal of Education and Development Using Information and Communication Technology* 8 (2012): 22-34.

[40] S.Albugarni, and V.Ahmed, "Success Factors For ICT Implementation in Saudi Secondary Schools: From the Perspective of ICT Directors, Head Teachers, Teachers, and Students." *International Journal of Education and Development Using Information and Communication Technology*, *11*(1), (2015): 36.

[41] Cher Ping Lim and Myint Swe Khine, "Managing Teachers' Barriers to ICT Integration in Singapore Schools." *Journal of Technology and Teacher Education*, 14(1), (2006): 97-125.

CONCLUSION

This study has found that factors that contribute to challenges are associated with developing competent ICT teachers. Most teachers only do an introduction to ICT as a minor subject when they are at tertiary institutions. They are not taught how to integrate it into their teaching because education systems are centralized to the syllabuses dictated by the education ministries. Teachers are also technophobic; they fear technology use as it is unfamiliar to them and therefore rather resort to what is known to them. The issue of insufficient funds is also a concern and the main factor that hinders the tutelage of teachers to be ICT competent. Teachers often have little time to finish a demanding syllabus which ends up taking all the time and overlooking the use of ICT let alone the benefits that surface with its use. There are no proper ICT resources for use at the disposal of teachers. The findings of this study provide the correct pedagogies and best practices of teaching, and how issues teachers found in technology use can be solved and addressed amicably for the benefit of the greater masses. All stakeholders in the educational sector in Botswana can make use of these findings to improve knowledge and attitudes toward the successful adoption and implementation of information and communication technologies in teaching and learning during challenging periods.

ACKNOWLEDGEMENTS

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ABOUT AUTHOR(S)

Kgalemelo Rodnie Mafa's research interest spans from technology teaching, teacher education, mobile learning, teaching and information communication technologies use in teaching and learning.

Professor Desmond Wesley Govender is the Discipline Coordinator: Computer Science Education at the University of KwaZulu Natal South Africa.