

The Development of a Model for Managing ICT for School Leaders

MM Mokoena and S Simelane-Mnisi

Tshwane University of Technology, South Africa

Abstract: This paper aims to analyse literature relating to Information Communication Technology (ICT) model that is used by school leaders. Literature was derived from various data bases such as Scopus and Web of Science, and scholarly search engines. In the main, the literature review was on ICT tools to support e-leadership and communication, transformation of ICTs Schools in the Post-Pandemic Era, Managing ICTs in the school, and theoretical frameworks. In terms of ICT tools to support e-leadership and communication, literature revealed that work can now be done at any time, in any location, in real time or via technology, school principals adopt e-leadership skills. E-leadership is the effective use and combination of electronic and conventional methods of communication. In relation to the post-pandemic era, literature showed that weaknesses in available hardware were exposed. And the need to learn how to master virtual meetings became vital and key to ICT leadership and communication. Furthermore, post the pandemic, school leaders moved from face-to-face, mainly bilateral communication and adopted virtual meeting software, such as Teams and Zoom, live conferencing, groups of Facebook to the traditional ICTs tools before the pandemic such as phone calls, and e-mails. Literature review further revealed in terms of managing ICTs in the school that the management of the ICTs includes the security, and hardware and software, and that school leaders should apply ICT to daily personal and professional matters. In terms of the theoretical frameworks that support ICT enhanced school leadership, literature revealed the relevance of e-Leadership as it outlines five constructs relating to e-Leadership, Government ICT policy, ICT implementation in school, Teacher attitude towards ICT and Teachers' pedagogical change that could assist in the development an ICT model for school leaders.

Keywords: Information Communication Technology, e-leadership, Communication, School leadership, Government ICT policy

1. Introduction

This conceptual paper describes the creation of a model for ICT management by school administrators. The study assesses the body of literature that is currently accessible on the subject and draws a conclusion from it. Literature was found using a variety of databases and academic search engines such as Google Scholar, Education Resources Information Center, ResearchGate, and Google Books. The literature review focused mostly on managing ICTs in schools, using ICT tools to enhance e-leadership and communication, ICT transformation in schools in the post-pandemic period, and theoretical frameworks.

Undoubtedly, educational technology has significantly transformed schooling (Al-Faki & Khamis, 2014). Information and communication technology has been adopted because it has been successful at communicating teaching and learning procedures (Abdullaeva, Babarakhimova & Pardayev, 2020).

Information and Communication Technology (ICT) has changed and been positively accepted in education over the years, with ICT now dominating not just the instructional space of the classroom but also the administration space of education (Albugami & Ahmed, 2015; Oluoch, 2016). In this light, school administrators should be viewed as ICT pioneers in their day-to-day management responsibilities (Apsorn, Sisan & Tungkunan, 2019). Strong technological leadership is required to promote increased Internet use, technology integration, and the use of digital tools by students and instructors in classrooms (A'mar & Eleyan, 2022).

School staff members use ICTs like computers and laptops for a variety of tasks related to administrative difficulties (Gondwe, 2020). It may still be difficult for school administrators to accept ICT because of the widespread resistance to using it as a teaching and communication tool as well as the fear of external elements like pornographic content and

religious contamination (Albugami & Ahmed, 2015; Goh & Sigala, 2020). In this instance, it is essential that the school administration play a significant part in choosing the Information and Communication Technology that may be adopted and employed. The type of Information and Communication Technology (ICT) to be utilised in the school should be decided by the leadership of the institution (Mingaine, 2013). This is untrue, though, as the globalization-driven reform of the educational system has not prevented school administrators from implementing ICT in their institutions (Oluoch, 2016). According to A'mar and Eleyan (2022), administrators who can implement technology in their schools should take the lead in this area.

The role of school leadership, instructional methods, and school innovation changed in the industrial era 4.0 because of technological advancements like Artificial Intelligence and the internet (A'mar & Eleyan, 2022). These authors suggested that school administrators may affect teachers' attitudes toward technology and assist them in enhancing their ICT skills when they are ready for their new role as technology leaders and are aware of their duties. According to a study done in Malaysia (Leong, Chua & Kannan, 2017), school leaders are thought to be knowledgeable about new technologies and encourage efficient ICT-based communication and collaboration among school communities. According to this study's findings, school leaders were also thought to have advanced understanding of ICT use, but they lacked the necessary skills to take part in group decision-making.

As the epidemic is swiftly redefining leadership and education, leaders should lead adaptively, build organisational and individual resilience, and create distributed leadership frameworks (McLeod & Dulsky, 2021). As a result of the COVID-19, many educational institutions were caught off guard and had to quickly transition from face-to-face instruction to online learning (Ali, 2020; Arshad, 2020; König, Jäger-Biela & Glutsch, 2020). The use of technology in learning and teaching, however, has been strengthened by recent pandemic-related events, making it a necessary component of educational activities both inside and outside the classroom (Banoğlu & Gümüş, 2022). During the COVID-19 epidemic, it was crucial that the school administration engage families as equal partners in learning, keep giving students high-quality learning experiences, and make decisions that were coordinated and cohesive (McLeod & Dulsky, 2021).

ICT integration in schools has been the subject of numerous research with an emphasis on pedagogy, instructors, and students (Banoğlu & Gümüş, 2022; McLeod & Dulsky, 2021; Wu, Hu & Yu, 2019). But according to McLeod and Dulsky (2021), there is a dearth of and insufficient empirical research on the effects of main e-Leadership. Even though as a school leader, principals oversee systemic ICT transformations like the deployment of ICT infrastructure and the promotion of an innovative school culture. Few worldwide studies have examined this phenomenon (Banoğlu & Gümüş, 2022; McLeod & Dulsky, 2021; Wu, Hu & Yu, 2019).

2. Literature Review

In this section existing literature is synthesized and evaluated to gain an insight into ICT tools that support e-leadership and communication, the transformation of ICTs in schools in the post-covid pandemic period and managing ICTs in schools. The literature section will further provide an overview of the theoretical frameworks and conceptual theories that underline the development of a model for managing ICT for school leaders. The literature review aims to provide an insight on prospective approaches in developing a model for managing ICT by school managers.

2.1 ICT Tools to Support E-Leadership and Communication

School principals play a critical role in establishing the path for new technology and pedagogy when it comes to ICT-related educational transformation (Wu, Hu & Yu, 2019). In this case, ICT tools and applications can be used by leaders as a weapon to restrict or deny certain communities the opportunity to access information (Hussain, Safir, Sabie, Jahangir & Ahmed, 2020). e-Leadership support may be viewed as a new paradigm in which work can now be done at any time, in any location, in real time or via technology (DasGupta, 2011). It is noted that a strong leader is needed for effective e-leadership implementation (Yudha & Susanto, 2019). For school leaders to successfully apply ICT tools within their practices, it is imperative for them to adopt e-leadership skills. The concept of e-leadership is defined as the ability of leaders to conduct their leadership roles through digital technologies (Torre & Sarti, 2020). E-leadership is a combination of electronic and conventional methods of communication, and the effective use thereof (Van Wart, Roman, Wang

& Liu, 2019). It is further noted that e-leadership relies on virtual teams (Torre & Sarti, 2020). However, Van Wart *et al.* (2019) revealed the most common problems that could impede e-leadership relates to insufficient or poor communication, miscommunication, communication chaos, poor understanding of ICTs, weak security management, the instructor experiencing constant contact issues, and weak management of basic and auxiliary technology.

2.2 Transformation of ICTs in Schools in the Post-Pandemic Era

Among various other factors, school leadership has been identified as one of the essential stakeholder roles affecting ICT transformation in schools (Wu, Hu & Yu, 2019). Prior to the COVID-19 pandemic, different institutions – including the education sector – evaluated the quality of computer hardware and software used, and it was deemed as appropriately meeting the needs of the organizational performance at the time. However, the pandemic exposed weaknesses in available hardware, resulting in the subsequent need to learn how to master virtual meetings as a vital and key component for ICT leadership and communication (Toleikienė, Rybnikova & Juknevičienė, 2020). It is further highlighted that, before the COVID-19 lockdown pandemic, employees took advantage of available ICT opportunities once a month, while leaders and supervisors had no such opportunity, or rarely made use of such opportunities (Toleikienė *et al.*, 2020).

As referred to in literature, students were of the opinion that e-learning contributed positively to their learning experience during the COVID-19 pandemic lockdown. However, students also perceived that it increased their workload (Maatuk, Elberkawi, Aljarwarneh, Rashaideh & Alharbi, 2021). In a study conducted in Libya during COVID-19, it was found that poor-quality internet connections were the main barrier in achieving the effective integration of ICT into education (Maatuk *et al.*, 2021). It is further believed that due to COVID-19, e-learning could be the future of education (Kim, 2020). In a study conducted in Russia to explore the level of university teachers' readiness to employ e-learning during the COVID-19 pandemic as well as the challenges they faced, the following challenges were identified: the electronic environment and support, academic staff readiness and student readiness for online learning, and the level of computer literacy (Almazova, Krylova, Rubtsova & Odinkaya, 2020).

Post-pandemic it was observed that various institutions, including the education sector, has moved away from face-to-face (mainly bilateral) communication, and adopted virtual meeting software such as Teams, Zoom, live conferencing, and Facebook Groups. Pre-pandemic, more traditional ICT tools such as phone calls, e-mails, and Messenger were employed (Toleikienė *et al.*, 2020). In the post-pandemic era, school principals should be more proactive in providing resources to teachers, as well as technical and emotional support (Banoğlu & Gümüş, 2022).

2.3 Managing ICTs in School

The management of ICTs in schools includes security, hardware and software, copyright, intellectual property and privacy, data usage, cleaning, and repairs thereof (GDE, 2011). In a study conducted in Nigeria, it was reported that inadequate funding of ICT education, inadequate ICT facilities in secondary schools, unstable power supplies, the high cost of ICT facilities, poor implementation of government policies on ICT, poor network service and coverage, as well as poor ICT literacy were the challenges experienced preventing the effective administration of ICT in secondary schools (Jacob, Jegede & Musa, 2020). For the successful pedagogical implementation of ICT in schools, it is essential for school principals and management teams to encourage and support the use of role modelling, teachers share best practices, teacher attend professional development as well as emphasis collaboration and network within the school (Banoğlu & Gümüş, 2022). In support of the idea Apsorn *et al.* (2019) further state that school leaders should act as a role model in applying ICT to their daily personal and professional matters. It is critical for school leaders to share knowledge, create opportunities, and render an ICT culture in schools whereby an e-learning community can be fully developed.

Apsorn *et al.* (2019) opined that school leaders should make concessions for developing a vision and formulating administrative plans for the use of ICT in schools. School leaders should establish safety and security measures relevant to the acquired ICT. They should establish strategies for promoting teachers' and students' use of technology in learning and teaching. It is critical that plans are developed to improve and support teachers' technological skills. It is also critical that school leaders manage, support and facilitate an atmosphere conducive to the use of ICT, and provide Information

Technology resources. School leaders should learn about meeting any ICT related challenges with prudence and care. They should oversee and follow-up on data storage as well as data updates for the benefit of decision-making and problem-solving (Apsorn *et al.*, 2019). The identified aspect by Apsorn *et al.* is reported to be hindered by the absence of professional development for principals, as well as documented research (A'mar & Eleyan, 2022).

3. Theoretical Framework

In this paper, two theories and a model will assume the rationale for the investigation of the model for managing ICT. These theories include constructivism (Piaget & Vygotsky), connectivism (Siemens) and e-Leadership (Wu, Yu & Hu). These theoretical frameworks will be discussed to draw and generate a suitable model for school leaders. Henning, Van Rensburg and Smith (2004) define a theoretical framework as a frame or design which guides and allows the researcher to consider his or her attitudes to study and places the researcher's investigation in the subject discipline within which he or she is engaged. Merriam (1998) stated that a theoretical framework is the viewpoint concerning the work of others that the researcher brings into his or her study, to inform him or her regarding the known and the unknown. The goal of this paper's exploration of several theories is to make an argument about their theoretical and practical implications for the current post-pandemic school management practise. The purpose of this article is also to identify the source of information about how school leaders use ICT.

3.1 Constructivism

Constructivism is a method of instruction that encourages students to create their own information by combining it with existing knowledge to create novel experiences (Akpomi & Kayii, 2022). In this context, the individuals' ability to generate knowledge independently rather than from the instructor is the focus of training (Suhendi, Purwarno & Chairani, 2021). These authors go on to elaborate that constructivism is a philosophy that contends that each person produces knowledge on an individual and social level. Krishnamoorthy, Prelatha, David and Manikam (2021) posits that constructivism recognises an individual's active role in the process of creating their own knowledge, the value of experience in this process, and the fact that the degree

to which the information developed is correct in representing reality will vary.

Some of the proponents of the constructivism theory include the likes of Jerome Bruner, Jean Piaget, Lev Vygotsky, and John Dewey (Adom, Yeboah & Ankrah, 2016). The construction of knowledge is achieved either by way of accommodation or assimilation. This implies that an individual can learn new information by accommodating the new knowledge in their mind, or they can assimilate new information. This means that the individual retains the old knowledge and may choose to use or ignore new information (Adom *et al.*, 2016). The relevance of the constructivism philosophical paradigm to this study is based on the core meaning and purpose of this philosophical paradigm; the assertion that knowledge is constructed through interactions with a phenomenon, and meanings are concluded after the experience (Adom *et al.*, 2016). Here, the relevance of the constructivism theory is because this study seeks to establish the influence of ICT and the practices of leaders within the management space. The subsequent findings should allow the researcher to construct an ICT approach or conclusion for school leaders. The view of the researcher is supported by Wang, Chen, & Anderson (2014), who argue that in social constructivism, a network is a social media for interaction. This assertion implies that ICT in schools could be utilised as a means of communicating between different stakeholders.

3.2 Connectivism

Literature reveals that the connectivism paradigm is suggested to be a more acceptable theory for this digital age (Mattar, 2018). The argument here lies in the understanding that information is no longer held by an individual, but that other people or databases can spread the information by means of more efficient devices (Mattar, 2018). Connectivism posits that knowledge can be inherent in non-human objects and in networks. It distinctly identifies the existence of groups and networks (Bell, 2011). Within the school environment, groups exist among different levels of stakeholders, school leaders, teachers, learners, parents, and other external groups. Consequently, these groups are linked through the ICT networks available in schools. Furthermore, connectivism assumes that knowledge is a structured network (AlDahdouh, Osório & Caires, 2015). This network is based on sets of nodes connected through relationships with each other. Thus, technology has actors and connectors. In this case,

smart phone devices, electronic books and websites are the actors, while social networks, the internet and intranet are as the connectors (AlDahdouh *et al.*, 2015). In a school situation, a school would be placed as a node or network consisting of different stakeholders such as teachers, students, administrators, and parents. Connectivism places emphasis on the interaction with and between people, media, and places, distributing knowledge across networks. Therefore, a network is viewed as an extension of the mind (Wang *et al.*, 2014).

3.3 E-Leadership

Adaptive Structural Theory (AST) serves as the foundation for the E-leadership paradigm (DeSanctis & Poole, 1994). AST was conceived to assist in describing the way people incorporate AIT into their work (Avolio *et al.*, 2000). Through its interaction with organisations, AST highlights that AIT may influence leadership, and such interactions could lead to transformation (Avolio *et al.*, 2000).

DeSanctis and Poole (1994) define AIT 'as tools, techniques, and knowledge that enable multiparty participation in organizational and inter-organizational activities through sophisticated collection, processing, management, retrieval, transmission, and display of data and knowledge. These include e-mail systems, message boards, groupware, Group Support Systems, knowledge management systems, executive information systems, and collaborative customer relationship management and supply-chain management systems. These technologies can help leaders scan, plan, decide, disseminate, and control information'. This definition of AIT will assist the researcher in this study to ascertain the foundation of and subsequent link to e-Leadership. According to Avolio *et al.* (2000), e-leadership refers to a social influence process interceded by AIT to produce a shift in attitudes, feelings, thinking, behaviour and/or performance with individuals, groups, and/or organizations. Wu, Yu and Hu (2019) identify e-leadership of school principals as the basis of ICT transformation in a school setting.

The deployment of ICT in schools, e-leadership, and teacher attitudes toward ICT are significant drivers of ICT transformation in schools, according to recent literature (Wu, Yu & Hu, 2019). Aspects of e-leadership, which are leadership strategies and practises aimed at achieving the vision and

objectives of e-learning, have also been studied (Chen, Ho & Ng, 2013; Tan, 2010). As a result, the National Educational Technology Standards for Educational Leaders (NETS-EL) were published by the International Society for Technology in Education (ISTE, 2018). They include the following attributes: advocate for equity and citizenship, visionary planner, empowering leader, systems designer, and connected learner. Even though several studies have examined the leadership styles and traits of school principals in relation to ICT use in schools (Chen *et al.*, 2013), research into the effects of e-leadership on lagging factors like school level ICT application and variations in teaching and learning is still lacking.

Five concepts related to e-Leadership, including teacher attitudes toward ICT, ICT implementation in schools, government ICT policy, and teachers' pedagogical transformation, make up e-leadership. In this study, an ICT culture management model for school leaders was established and developed using an adaptation of the e-leadership paradigm to fit the South African setting.

4. Results and Discussion

The aim of this conceptual paper was to analyse literature relating to ICT tools to support e-leadership and communication, transformation of ICTs in schools in the post-pandemic era and managing ICTs in schools. The findings and discussions in this paper are based on literature reviewed. In terms of ICT tools to support e-leadership and communication, literature findings revealed that the successful deployment of e-leadership requires a strong leader (Yudha & Susanto, 2019). Furthermore, research revealed that the most frequent problems that could obstruct e-leadership were inadequate and poor communication, miscommunication, communication chaos, a lack of understanding of ICTs, poor security management, issues with the instructor's constant contact, and poor management of the basic and auxiliary technology, according to Van Wart *et al.* (2019).

Findings relating to the post-pandemic age, revealed that hardware flaws were uncovered, necessitating the need to master virtual meetings, which became crucial to ICT leadership and communication (Toliekienė *et al.*, 2020). The typical ICTs methods used by school leaders prior to the pandemic, such as phone calls and emails, were replaced with virtual

meeting software, such as Teams and Zoom, live conferencing, and groups on Facebook after the pandemic (Toleikienė *et al.*, 2020). Hardware defects were discovered in the post-pandemic era, according to literature, necessitating the mastery of virtual meetings, which became essential to ICT leadership and communication. Prior to the pandemic, school administrators often communicated by phone calls and emails. After the pandemic, they switched to live conferencing, Facebook groups, and virtual meeting tools like Teams and Zoom (Toleikienė *et al.*, 2020).

The literature findings on managing ICTs in schools demonstrated that maintaining ICT entails several concerns, including upkeep, cleaning, and software and hardware repairs, among others (GDE, 2011). The management of ICT in schools presents additional obstacles, according to the literature. The most frequent issues are a lack of money for ICT education, inadequate ICT infrastructure, unstable power sources, excessive ICT facility expenses, inadequate ICT facility implementation, poor network service and coverage, and low ICT literacy. Additionally, the literature offered potential approaches to manage ICTs in schools, such as promoting and supporting role modelling, exchanging best practises, and participating in professional development (Banoğlu & Gümüş, 2022; A'mar & Eleyan, 2022).

In terms of the theoretical framework, literature findings has shown that both connectivism and constructivism theories serve as a foundation for the adoption and creation of an ICT model that school administrators may use. Constructivism emphasises how new knowledge must be integrated or adjusted to fit into a person's conceptual framework. It also argues that ICT in schools could be used as a channel for communication between diverse parties (Wang *et al.*, 2014). Furthermore, literature findings show that knowledge is no longer the sole property of a single individual because it can now be shared via databases or other users of more advanced technology. In this way, networks and non-human objects can both contain knowledge (Bell, 2011; Mattar, 2018).

5. Conclusion and Recommendations

In conclusion, it is vital to unequivocally acknowledge the presence of networks and groups as knowledge hubs. The e-leadership model discussed in this paper is further highlighted as essential and as having the potential to support the creation of a

model for school leaders to manage ICT. Teachers' pedagogical reform, government ICT policies, school ICT implementation, and teacher attitudes toward ICT are among the five themes in e-leaderships that literature highlighted has been related to e-Leadership. It is recommended that an ICT model relevant to the South African context be developed to assist school leaders in their communication and management roles. It is further recommended that ICT professional development should be provided to stakeholders involved in the education sector.

References

- Abdullaeva, B., Babarakhimova, B. & Pardayev, B.P. 2020. Using information and communication technologies in teaching process of various primary school subjects. *European Journal of Research and Reflection in Educational Sciences*, 8(10).
- Adom, D., Akwasi Yeboah, A. & Ankrah, A.K. 2016. Constructivism philosophical paradigm: Implication for research, teaching and learning. *Global Journal of Arts Humanities and Social Sciences*, 4(10):1-9.
- Akpomi, M.E. & Kayii, N.E. 2022. Constructivist Approaches: A Budding Paradigm for Teaching and Learning Entrepreneurship Education. *International Journal of Education, Teaching, and Social Science*, 2(1):2809-0489. Accessed 11 October 2022.
- Albugami, S. & Ahmed, V. 2015. 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 ICT*, 11(1):36-54.
- AlDahdouh, A.A., Osório A.J. & Caires, S. 2015. Understanding knowledge network, learning and connectivism. *International Journal of Instructional Technology and Distance Learning*, 12(10).
- Al-Faki, I.M. & Khamis, A.H.A. 2014. Difficulties facing teachers in using interactive whiteboards in their classes. *American International Journal of Social Science*, 3(2).
- Ali, W. 2020. Online and Remote Learning in Higher Education Institutes: A Necessity in Light of Covid-19 Pandemic. *Higher Education Studies*, 10(3).
- Almazova, N., Krylova, E., Rubtsova, A. & Odinkaya, M. 2020. Challenges and Opportunities for Russian Higher Education Amid Covid-19. *Teachers' Perspective, Education Sciences*, 10(368).
- Apsorn, A., Sisan, B. & Tungkunanan, P. 2019. Information and Communication Technology Leadership of School Administrators in Thailand. *International Journal of Instruction*, 12(2): 639-650.
- Arshad, M. 2020. Covid-19: It's time to be Thankful to our ICT Professionals. *International Journal of Information Technology and Electrical Engineering*, 9(2):23-31.

- 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.
- Avolio, B.J., Kahai, S. & Dodge, G.E. 2000. E-Leadership: Implications for Theory, Research, and Practice. *Leadership Quarterly*, 11(4):615-668.
- Banoğlu, K. & Gümüş, S. 2022. Supporting Technology Integration in Schools. *Managing Today's Schools: New Skills for School Leaders in the 21st Century*, 37.
- Bell, F. 2011. Connectivism: Its place in theory-informed research and innovation in technology-enabled learning. *The International Review of Research in Open and Distance Learning*, 12(3):98-118.
- Chen, W., Ho, J.M. & Ng, D.F.S. 2013. School leadership in ICT implementation: Perspectives from Singapore. *The Asia-Pacific Education Researcher*, 22(3):301-311.
- Dasgupta, P. 2011. Literature review: e-Leadership. *Emerging Leadership Journeys*, 4(1):1-36.
- DeSanctis, G. & Poole, M.S. 1994. Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science*, 5(2):121-147.
- Gauteng Department of Education. 2011. *Guidelines on the management and usage of ICTs in public schools*. Gauteng, South Africa: eLearning Directorate, Gauteng Department of Education. Pretoria: Government Printers.
- Goh, E. & Sigala, M. 2020 Integrating Information & Communication Technologies (ICT) into classroom instruction: Teaching tips for hospitality educators from a diffusion of innovation approach. *Journal of Teaching in Travel & Tourism*, DOI: 10.1080/15313220.2020.1740636. Accessed 21 April 2022.
- Gondwe, F. 2020. ICT Integration into Teacher Education: Teacher Educators' Experiences of Policy at Two Teacher Education Institutions in Malawi. *Journal of International Development Studies*, 29(1).
- Henning, E., Van Rensburg, W. & Smit, B. 2004. *Finding your way in qualitative research*. Pretoria: JL van Schaik.
- Hussain, F., Safir, A.H., Sabie, D., Jahangir, Z. & Ahmed, S.I. 2020. Infrastructuring Hope: Solidarity, Leadership, Negotiation, and ICT among the Rohingya Refugees in Bangladesh. *In Information and Communication Technologies and Development (ICTD '20)*. Available at: <https://doi.org/10.1145/3392561.3394640>. Accessed 24 March 2022.
- Jacob, O.N., Jegede, D. & Musa, A. 2020. Administration of Information Communication Technology (ICT) in Nigerian secondary schools: Challenges and the ways forward. *Electronic Research Journal of Engineering, Computer and Applied Sciences*, 2. Available at: www.erjsciencenews.info. Accessed 21 April 2022.
- Kim, J. 2020. Learning and Teaching Online During Covid-19: Experiences of Student Teachers in an Early Childhood Education Practicum. *International Journal of Early Childhood*, 145-158. Available at: <https://doi.org/10.1007/s13158-020-00272-6>. Accessed 21 April 2022.
- König, J., Jäger-Biela, D.J. & Glutsch, N. 2020. Adapting to online teaching during Covid-19 school closure: Teacher education and teacher competence effects among early career teachers in Germany. *European Journal of Teacher Education*, 43(4):608-622.
- Krishnamoorthy, R., Prelatha, R., David, T. & Manikam, M. 2021. The Implementation of Behaviorism, Constructivism and Information Processing Theory in Instructional Design Practice Activities – A Review. *International Journal of Education and Pedagogy*, 3(2):37-44.
- Leong, M.W., Chua, Y.P. & Kannan, S. 2017. Relationship between principal technology leadership practices and teacher ICT competency. *Malaysian Online Journal of Educational Management*, 4(3):13-36.
- Maatuk, A.M., Elberkawi, E.K., Aljawarneh, S., Rashaideh, H. & Alharbi, H. 2021. The Covid-19 pandemic and E-learning: Challenges and opportunities from the perspective of students and instructors. *Journal of Computing in Higher Education*. Available at: <https://doi.org/10.1007/s12528-021-09274-2>. Accessed 14 March 2022.
- Mattar, J. 2018. Constructivism and connectivism in education technology: Active, situated, authentic, experiential, and anchored learning. *RIED: Revista iberoamericana de educación a distancia*, 21(2). Available at: <http://www.redalyc.org/articulo.oa?id=331455826012>. Accessed 10 March 2022.
- Mcleod, S. & Dulsky, S. 2021. March. Resilience, Reorientation, and Reinvention: School Leadership During the Early Months of the Covid-19 Pandemic. *In Frontiers in Education*, 6:70.
- Merriam, S.B. 1998. *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.
- Mingaine, L. 2013. Leadership Challenges in the Implementation of ICT in Public Secondary Schools, Kenya. *Journal of Education and Learning*, 2(1). Available at: <http://dx.doi.org/10.5539/jel.v2n1p32>. Accessed 9 July 2019.
- Oluoch, D. 2016. Strategies of Enhancing ICT Use in the Delivery of Management Services in Public Secondary Schools in Siaya County in Kenya. *European Scientific Journal*, 12(28).
- Siemens, G. 2005. Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(1). Available at: <http://www.elearnspace.org/Articles/connectivism.htm>. Accessed 10 March 2022.
- Suhendi, A., Purwarno, P. & Chairani, S. 2021. Constructivism-Based Teaching and Learning in Indonesian Education. *Annual International Conference on Language and Literature (AICLL), KnE Social Sciences*, 76-89. DOI 10.18502/kss.v5i4.8668.
- Tan, S.C. 2010. School technology leadership: Lessons from empirical research. In C.H. Steel, M.J. Keppell, P. Gerbic & S. Housego (Eds.). *Curriculum, technology & transformation for an unknown future. Proceedings Ascilite Sydney 2010*, 896-906. Available at: <http://ascilite.org.au/conferences/sydney10/procs/Seng-chee-tan-full.pdf>. Accessed 24 June 2021.
- Toleikienė, R., Rybnikova, I. & Juknevičienė, V. 2020. Whether and how does the crisis-induced situation change e-leadership

- in the public sector? Evidence from Lithuanian public administration. *Transylvanian Review of Administration Services*, 149-166.
- Torre, T. & Sarti, D. 2020. The "Way" Toward E-leadership: Some evidence from the field. *Frontier Psychology*, 11(554253). DOI: 10.3389/fpsyg.2020.554253. Accessed 19 January 2022.
- Van Wart, M., Roman, A., Wang, X.H. & Liu, C. 2019. Operationalizing the definition of e-leadership: Identifying the elements of e-leadership. *International Review of Administrative Sciences*, 85(1):80-97.
- Wang, Z., Chen, L. & Anderson, T. 2014. A Framework for Interaction and Cognitive Engagement in Connectivist Learning Contexts. *International Review of Research in Open and Distributed Learning*, 15(2):121-141.
- Wu, B., Yu, X. & Hu, Y. 2019. How does principal e-leadership affect ICT transformation across different school stages in K-12 education: Perspectives from teachers in Shanghai. *British Journal of Educational Technology*, 50(3):1210-1225.
- Yudha, H.C.P. & Susanto, T.S. 2019. E-Leadership: The Effect of E-Government Success in Indonesia. *Journal of Physics*, 1201. 012025. DOI:10.1088/1742-6596/1201/1/012025. Accessed 3 March 2021.