



## Adoption of e-learning in Zimbabwe's higher education: Opportunities and challenges

Pinias Chikuvadze<sup>1\*</sup>, Joseph Zuva<sup>2</sup>, Samuel Mugijima<sup>3</sup> & Patrick C. Rusike<sup>4</sup>

<sup>1</sup>Office for International Affairs, University of the Free State, South Africa

Email: chikuvadzepinias@gmail.com

<sup>2</sup>Department of Business Management & Information Technology, Catholic University in Zimbabwe

Email: shumbanyamuzihwa54@gmail.com

<sup>3</sup>Department of Information Systems, Women's University of Africa, Zimbabwe

Email: samuel.mugijima@gmail.com

<sup>4</sup>Department of Quality Assurance & Standards, Ministry of Higher & Tertiary Education, Innovation, Science & Technology Development, Zimbabwe

Email: rusikep64@gmail.com

### Article Info

#### Article history:

Received: 05-01-2025

Revised: 19-02-2025

Accepted: 20-03-2025

Publish: 23-03-2025

#### DOI:

[doi.org/10.31960/ijol](https://doi.org/10.31960/ijol)

ec. V7i2.2955

**Abstract.** This paper explores the adoption of e-learning in Zimbabwe's higher education, examining the opportunities and challenges associated with its implementation in the teaching and learning process. The paper was grounded in a systematic review approach, which provides a holistic view of the issue under investigation. In this regard, the PRISMA 2020 checklist ensured transparency and consistency in selecting the 60 papers from databases (Scopus, DOAJ, DHTE, WoS, Scielo SA, and IBSS). In addition, this approach ensured that all the crucial aspects of the issue under investigation were included in the analysis and discussion. The paper highlights e-learning as a concept and its process in the context of higher education. It also articulated a multifaceted approach that can be employed to enhance the adoption of e-learning in higher education. This led to the interrogation of the potential of e-learning to enhance accessibility, reduce costs, and improve educational outcomes. However, it also identifies significant barriers, including limited internet connectivity, inadequate technological infrastructure and resistance to change from both lecturers and students. In conclusion the adoption of e-learning in Zimbabwe's higher education presents both significant opportunities and notable challenges. To unlock the full potential of e-learning, policymakers, educational institutions and stakeholders need to collaborate in addressing these challenges. Ultimately, with the right approach, e-learning can play a transformative role in improving the quality and accessibility of higher education in Zimbabwe, contributing to broader educational socio-economic development targets.

#### Keywords:

*Adoption;  
Challenges;  
E-learning;  
Higher Education;  
Opportunities.*

#### Corresponden author:

**Pinias Chikuvadze**

Street: University Rd, Park West, Bloemfontein, 9301, South Africa

Email: chikuvadzepinias@gmail.com



Open access article under CC BY-NC-4.0 license. @2025 by author

## INTRODUCTION

The rapid evolution of technology has marked a turning point in numerous sectors of the economy, including education (Jan, 2023; Hayati & Zaim, 2024). Furthermore, with the Industrial Revolution 4.0, higher education needs to integrate all technologies into 21st-century teaching and learning following current developments (Mahat et al., 2020). In other words, it has become a vital element inseparable from education (Daniel, 2023). It is in this regard that in Zimbabwe, the adoption of electronic learning (e-learning) in higher education institutions as a means to enhance the teaching and learning experience has become a priority. This means that technology in education is not only about tools, applications, and software but also about how teachers implement technology in the teaching and learning process (Thy et al., 2023). This has been accelerated by the COVID-19 pandemic, which forced educational institutions to find alternative platforms and tools to facilitate teaching and learning (Heng, 2021). The integration of Information and Communication Technologies into the learning environment creates opportunities for broader education initiatives, thus bringing students into the information age (Pondiwa et al., 2022).

The shift towards e-learning, however, is not without challenges, especially in developing countries such as Zimbabwe. E-learning has gradually replaced traditional teaching methods, with computer and interactive board-aided learning becoming more accepted, especially among younger learners (Dube et al., 2021). Even though some countries are doing well in implementing e-learning, others are facing challenges, which prompted the researcher to conduct this type of study. Addressing these challenges is critical to ensure that the adoption of e-learning contributes meaningfully to the improvement of higher education in Zimbabwe and also bridging the digital divide.

In the context of higher education, the alternative methods of delivering education were centred mainly on e-learning (i.e., online courses, virtual classrooms, digital resources and interactive learning modules). The

integration of e-learning in Zimbabwe's higher education aims to provide flexible and accessible education to a diverse student population. In this sense, a considerable number of studies (Kafai et al., 2020; Kassem, 2018; Li et al., 2020) have outlined the potential promises and potential pitfalls concerning the adoption of e-learning in higher education. However, there remains notable concern regarding the seamless adoption of e-learning by higher education institutions in Zimbabwe.

The adoption of e-learning in Zimbabwe presents several opportunities for both students and institutions. One primary advantage lies in the increased accessibility to educational resources (Mufeti, 2020). E-learning platforms enable students from diverse geographical locations to access higher education (McColgan, 2012). E-learning provides flexibility, allowing students to learn at their own pace and convenience (Marumo et al., 2009). This is particularly beneficial for students who may have work or family commitments, enabling them to balance their education with other responsibilities. E-learning can facilitate personalized learning experiences. The integration of multimedia resources, interactive simulations, and adaptive assessments can cater to different learning styles and needs, thus enhancing student engagement and knowledge retention.

While the potential benefits of e-learning are substantial, several challenges hinder its effective adoption in Zimbabwe's higher education sector. One of the most significant barriers is the lack of adequate infrastructure. Many students, especially those in rural areas, lack reliable access to computers, smartphones, and the internet (Ntshwarang et al., 2021). The cost of data and internet access can also be a barrier for many students. Furthermore, many educators in developing countries face the challenge of providing content such as videos and advanced applications, even at the higher education level (Maatuk et al., 2021). Without proper infrastructure, the promise of e-learning cannot be fully realized. In addition to infrastructural limitations, there is a need for comprehensive training and support for both educators and students.

It is against this background that this paper sought to provide a comprehensive

analysis of the adoption of e-learning in higher education institutions with specific reference to opportunities and challenges. The paper begins with a theoretical framework, followed by an account of the research methodology. Then, the findings are presented and discussed, leading to the crafting of the conclusion.

The systematic review approach guided the process of creating a solid base for interrogating the issue at the centre of this paper. This enabled an exhaustive search and guaranteed the identification of papers (Vergara et al., 2024) on the topic and keywords from databases (i.e., Scopus, DOAJ, DHTE, WoS, Scielo SA and IBSS).

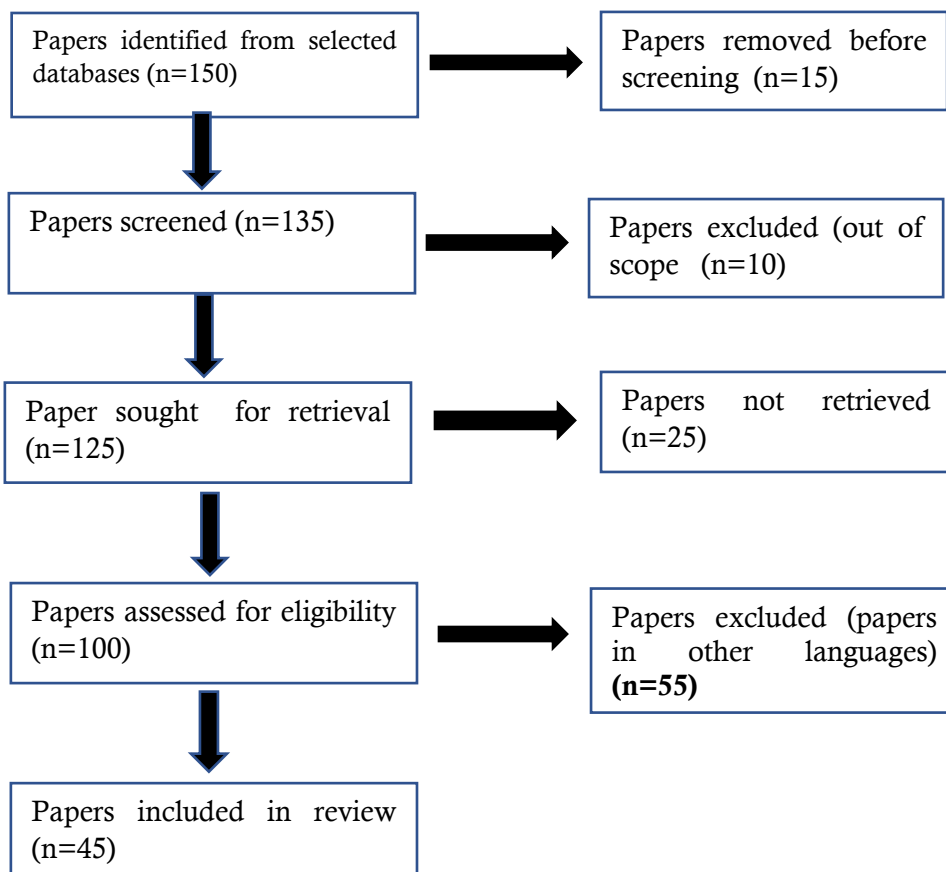
**METHOD**

**Table 1.** Database search string

Search string
((“Adoption” OR “integration”) AND (“higher education” OR “tertiary education”) AND (“e-learning” OR “electronic learning”) AND (“opportunities”) AND (“challenges”) AND (“Zimbabwe”))

The preliminary keywords search availed 150 published papers. In a bid to increase the accuracy of the sample, the PRISMA 2020 checklist (David et al., 2023)

was followed as a framework. Figure 1 below shows the identification and screening processes that guided the selection of the papers that were reviewed.



**Figure 1.** Prisma checklist developed in the review

Through the identification and screening phases, 105 papers were excluded as they were out of the scope of the issue at the

centre of this paper. The exclusion criteria indicated that papers should be in the highlighted databases and written in English

language (Snyder, 2019). Upon defining the exclusion criteria 45 papers were considered for review.

## **RESULT AND DISCUSSION**

This section centres on gaining a deeper of the following aspects: conceptualisation of e-learning in higher education, articulating the process of e-learning in higher education, and opportunities brought about by the adoption of e-learning in higher education. The challenges to the effective adoption of e-learning in higher education are interrogated with the view to advance strategies that can improve the quality of higher education.

### **Conceptualisation of e-learning in the context of higher education**

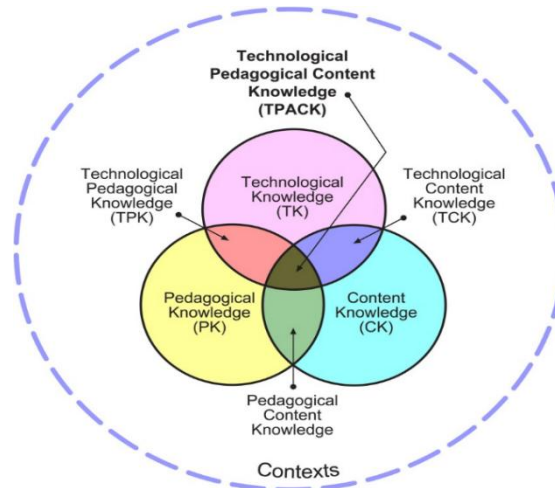
In this paper, e-learning is considered as the delivery of instructional content through electronic means among them are the following: CD-ROMs, satellite broadcasts, internet, videotapes and conferencing, intranets, audio tapes, virtual classrooms, and digital collaboration (Gabriel, 2000; Klein & Ware, 2003). It is viewed as a blanket term for its predecessor's computer-based learning, web-based learning, online learning, and other buzz terms of the 1980s and 1990s in the sense that it covers both onsite and offsite technologically-mediated interactions. Moll et al (2007) defined e-learning as 'flexible learning using ICT resources, tools and applications, focusing on accessing information, interaction among teachers, learners, and the online environment collaborative learning, and production of materials, resources and learning experiences.

E-learning also provides access to a vast array of resources, including multimedia content, interactive simulations, and digital libraries. In the context of higher education, it encompasses a variety of tools and methods, such as online courses, virtual classrooms, digital resources, and interactive modules. Furthermore, e-learning fosters collaboration and communication through virtual

discussions, group projects, and real-time feedback. This diversity caters to different learning styles and preferences, enriching the educational experience. eLearning is the use of technological interventions for teaching, learning and assessment (Mlitwa & van Belle, 2011), enabling learners to improve problem-solving skills and empowering educators to disseminate and impart knowledge effectively. The goal is to enhance the educational experience by making it more flexible, accessible, and engaging.

### **The theoretical framework underpinning e-learning in Zimbabwe's higher education**

We based our argument within the confines of the Technological Pedagogical Content Knowledge (TPACK) and the Social Learning Theory, particularly the connectivism-constructivism learning theory to cross-examine the opportunities and challenges brought about by the adoption of e-learning in Zimbabwe's higher education. There is a significant higher education shift from principal suppliers of prestigious conventional learning to organizers of unstructured and online learning settings (Dacholfany et al., 2022). Liu and Li (2021) further viewed higher education as a lively, complicated structure contained in a flexible, complicated super system - a modern civilization. In this context, TPACK framework provided a theoretical basis for comprehending the complex interplay between technology, pedagogy, and content knowledge in higher education teaching and learning (Karaduman & Akman, 2024; Zou et al., 2024). Arslan (2020) argued that TPACK is a fusion of three main knowledge domains, which include content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). In other words, lecturers are expected to combine TK with PCK in their teaching and learning activities (Aunzo, 2025). Figure 1 is a diagrammatical illustration of the TPACK framework.



**Figure 1: TPACK Framework** (Source: Farhadi & Öztürk, 2023)

TPACK take into cognisance three fundamental bodies of knowledge that intersect into Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Content Knowledge (TPACK) (Tseng et al., 2019). In this discussion, the TPACK framework is intertwined with the Connectivism-Constructivism learning theory to unpack E-learning in higher education learning activities. The theory of Connectivism-Constructivism holds that the essence of knowledge is the connection between the subject and the environment (Liu and Li, 2021). Watkins et al, (2020) put forward two forms in the name of physical form and logical form. The only logical form can be realized and utilized by people. Hence learning can be divided into two stages: connection and construction (Liu and Li, 2021). In this regard, connection is the premise while construction is considered to be the core, and the network action generated in the connection stage as a raw material is pruned, and processed by various systems in the construction stage to become a psychological representation. When the psychological representation is used, the relevant network shaping is finished, and the meaningful network is formed, which completes the change of knowledge from physical form to logical form and from logical form to physical form (Kropf, 2013).

In addition, the Internet has become the core of connectivism, which is potentially dynamic in innovative educational e-learning

platforms. Through the implementation of e-learning, learners are now considered as 'do-it-yourself' learners (Aderson, 2016). Connectivism envisages learning as an unstructured chance and it converts individual learners into 'networks' themselves, equally skilled in exchanging their skills and experience among learners and the society at large after gaining knowledge from a sequence of learning curves (Albert & Steve, 2013) cited in (Dacholfany et al., 2022). However, this discussion does not only promote the students' connection stage but also helps the students' construction stage, therefore, constructivist learning theory provides a theoretical underpinning for conceptualizing how students in higher education construct knowledge and meaning through active interaction with their environment (Roushan et al., 2025).

In the same vein, this calls for student-centred and inquiry-based instruction in higher education through the adoption of e-learning. This brought to the fore the need for digital environments to facilitate the creation of networked learning in higher education (Chandrappa, 2018; Leow & Neo, 2023; Ukpe, 2023). Hence, the Connectivism-Constructivism learning theory is successfully integrated into a rather complete and effective theoretical framework to reconstruct the Connectivism-Constructivism learning theory in a way that unpacks e-learning in institutions of higher learning (Liu & Li, 2021). Therefore, the integration of the TPACK framework together with the social learning theory with specific reference to

connectivism-constructivism learning theory created a theoretical lens that facilitates the methodology for developing professional pedagogical competence in understanding the opportunities and challenges experienced in the adoption of e-learning by Zimbabwe's higher education.

### **E-learning adoption in higher education in Zimbabwe**

E-learning is transforming higher education by making it more accessible, flexible and aligned with the needs of modern students (Baig et al., 2022). It's an exciting aspect of teaching and learning with continuous developments, which promises to enhance students' experience in higher education. It is in this regard that this section centres on the process of e-learning in higher education institutions in Zimbabwe (Maune, 2023). Rolling out the e-learning platform and content to students and faculty. This involves setting up user accounts, providing access to course materials, and ensuring that all participants are comfortable with the new system. Implementing e-learning in higher education requires a strategic and comprehensive approach to ensure its success (Mahlangu & Makwasha, 2023). According to Babirye et al (2024); Mataruka et al (2023); Maphosa et al (2020); the following are some of the key steps to consider when adopting e-learning in higher education:

1. **Planning and strategy:** Develop a clear and detailed plan that outlines the goals, objectives, and desired outcomes of the e-learning initiative. This should include a timeline, budget, and resource allocation.
2. **Stakeholder engagement:** Engage all relevant stakeholders, including faculty, students, administrative staff, and IT professionals, to ensure their support and collaboration. This helps in addressing any concerns and ensuring a smooth implementation process.
3. **Infrastructure setup:** Establish the necessary technological infrastructure, such as high-speed internet, servers, and learning management systems (LMS). Ensure that the infrastructure can support the anticipated user load and is scalable for future growth.
4. **Content development:** Create high-quality, engaging, and interactive digital content that aligns with the learning

objectives. This includes multimedia elements such as videos, animations, and simulations to enhance the learning experience.

5. **Training and support:** Provide comprehensive training programs for faculty and students to familiarize them with the e-learning platform and tools. Establish a technical support team to assist with any issues that may arise.
6. **Pilot testing:** Conduct a pilot test of the e-learning platform with a small group of users to identify any potential issues and gather feedback. Use this feedback to make necessary adjustments before a full-scale rollout.
7. **Implementation:** Launch the e-learning platform and make it available to all users. Ensure that there is ongoing support and communication to address any challenges that may arise during the initial implementation phase.
8. **Monitoring and valuation:** Continuously monitor the performance and effectiveness of the e-learning platform. Collect feedback from users and use data analytics to assess the impact on learning outcomes. Make necessary improvements based on this evaluation.
9. **Continuous improvement:** E-learning is an ongoing process that requires regular updates and enhancements. Stay informed about the latest trends and technologies in e-learning and incorporate them into your platform to ensure its continued success.

### **Opportunities for adopting e-learning in Zimbabwe's higher education**

Adopting e-learning in higher education in Zimbabwe presents numerous opportunities that can significantly enhance the educational landscape (Nherera & Mukora, 2024). In this regard, Dube and Scott (2017); Mutale (2025); Murandu (2019) indicated the following opportunities associated with the adoption e-learning in higher education:

1. **Increased access to education:** E-learning can bridge the gap for students in remote and underserved areas, providing them with access to quality education. This is particularly important in Zimbabwe, where geographical barriers often limit educational opportunities.

2. Flexibility and convenience: E-learning offers flexibility in terms of time and location, allowing students to learn at their own pace and convenience. This can be especially beneficial for working students or those with other commitments.
  3. Cost-Effectiveness: Implementing e-learning can reduce the costs associated with traditional classroom-based education, such as transportation, accommodation, and physical infrastructure. This can make higher education more affordable for a larger number of students.
  4. Enhanced learning experience: E-learning platforms can incorporate multimedia elements, interactive simulations, and virtual laboratories, making the learning experience more engaging and effective. This can lead to better retention and understanding of complex concepts.
  5. Continuous professional development: E-learning provides opportunities for continuous professional development for both students and faculty. Online courses and certifications can help individuals stay updated with the latest trends and advancements in their fields.
  6. Collaboration and networking: E-learning platforms can facilitate collaboration and networking among students and faculty from different institutions and regions. This can lead to the exchange of ideas, knowledge, and best practices, fostering a more collaborative academic environment.
  7. Scalability: E-learning platforms can easily scale to accommodate a growing number of students and courses. This scalability is essential for meeting the increasing demand for higher education in Zimbabwe.
  8. Resilience to disruptions: E-learning can ensure continuity of education during disruptions such as pandemics, natural disasters, or political instability. This resilience is crucial for maintaining the educational process in challenging times.
  9. Data-Driven Insights: E-learning platforms can provide valuable data and insights into student performance and engagement. This data can be used to personalize learning experiences, identify areas for improvement, and enhance overall educational outcomes.
- By leveraging these opportunities, higher education institutions in Zimbabwe can create a more inclusive, flexible, and effective educational environment that meets the needs of a diverse student population and positions them for success in an increasingly digital world.

**Challenges faced when adopting e-learning in higher education**

Adopting e-learning in higher education, particularly in Zimbabwe, comes with several challenges that need to be addressed to ensure effective implementation.

**Table 2.** Challenges of adopting e-learning in Zimbabwe's higher education

Author(s)	Challenges
Chitanana et al (2008); Mupfiga et al (2017)	<ol style="list-style-type: none"> <li>a. Reliability: Many regions in Zimbabwe suffer from unreliable internet connections that disrupt the continuity of online learning.</li> <li>b. Speed: Slow internet speeds hinder the access to multimedia content and live streaming of lectures.</li> </ol>
Maune (2023); Sambo et al (2021)	<ol style="list-style-type: none"> <li>a. Affordability: The cost of internet data is high for the students, limiting their ability to engage in e-learning.</li> <li>b. Sustainability: Even if students can afford data initially, sustaining these costs over a long period can be challenging.</li> </ol>



Nherera and Mukora (2024)	Access to hardware	<ol style="list-style-type: none"> <li>Availability: Not all students have access to the necessary hardware, such as computers, tablets, or smartphones.</li> <li>Quality: Even when devices are available, they may not be of sufficient quality to support advanced e-learning applications.</li> </ol>
Chitanana (2024), Mpofu and Mpofu (2023)	Digital literacy	<ol style="list-style-type: none"> <li>Skills gap: Both students and educators may lack the necessary digital skills to effectively use e-learning tools and platforms.</li> <li>Training: There is a need for ongoing training and support to help users become proficient in using e-learning technologies.</li> </ol>
Chiome and Chindanya (2015); Sibanda (2022)	Pedagogical challenges	<ol style="list-style-type: none"> <li>Adapting teaching methods: Educators need to adapt their traditional teaching methods to suit the online environment, which can be difficult.</li> <li>Engagement: Keeping students engaged and motivated in an online setting can be more challenging compared to a physical classroom.</li> </ol>
Mahlangu and Makwasha (2023); Maramba and Mazongoda (2020)	Assessment and evaluation	<ol style="list-style-type: none"> <li>Fairness: Developing fair and effective assessment methods for online learning is complex.</li> <li>Academic integrity: Ensuring academic integrity and preventing cheating in an online environment is a significant concern.</li> </ol>
Chikuvadze et al (2024); Chinamasa and Ncube (2023)	Infrastructure development	<ol style="list-style-type: none"> <li>Electricity supply: Reliable electricity is crucial for e-learning, but power outages are common in many areas.</li> <li>Support services: Establishing dedicated support services to address technical issues is essential for smooth operation.</li> </ol>

From the table 2, we note several similar challenges mainly, infrastructural constraints, demographic divides, staffing issues, organisational issues, learner issues, and pedagogical issues. However, some institutions have unique challenges like lack of time and resources, inadequate curriculum design, and training, shortage of ICT skills and user penetration. By addressing these challenges through strategic investments, policy adjustments, and continuous support,

Zimbabwe's higher education institutions can enhance the adoption and effectiveness of e-learning.

## CONCLUSION AND SUGGESTION

The adoption of e-learning in Zimbabwe's higher education is driven by the



need to adapt to global trends and the unprecedented advancement in industry and commerce. This is seen as a transformative step towards making higher education accessible and modernized. In this regard, the adoption of e-learning has brought about numerous opportunities such as flexibility in learning schedules, access to a wide range of digital resources, and the potential for personalized learning experiences. In addition, it facilitates collaboration and communication among students and lecturers, fostering a supportive and interactive learning environment. However, several challenges, such as improving internet connectivity, reducing data costs, ensuring the availability of necessary hardware, and providing adequate training for lecturers are faced in the attempt to adopt e-learning in higher education. In conclusion, while the journey towards widespread e-learning adoption in Zimbabwe's higher education is apprehensive with challenges, it also holds immense opportunities. Therefore, by addressing the encountered challenges and leveraging the opportunities presented by the adoption of e-learning, Zimbabwe's higher education can create a more inclusive, flexible, and effective learning system, which meets the needs of its diverse student population and remains competitive in an increasingly technologically charged environment.

## REFERENCES

- Anderson, T. (2016). Theories for learning with emerging technologies. In G. Veletsianos (Ed.). *Emergence and innovation in digital learning: Foundations and applications* (35-64). Edmonton: Athabasca University Press.
- Arslan, A. (2020). Reliability and Validity of Instruments Measuring English Teachers' TPACK. *International Journal of Assessment Tools in Education*, 7(3), 343-360. <https://doi.org/10.21449/ijate.679876>
- Aunzo Jr, R.T. (2025). Advancing sustainable development goals with educational technology: supporting stem education and fostering innovation through educational technology. In *Advancing sustainable development goals with educational technology* (pp. 65-98). IGI Global Scientific Publishing.
- Babirye, L. N., Jjagwe, G., & Turihohabwe, J. (2024). Suitability of eLearning Adoption Frameworks and Models for Higher Education Institutions in Uganda. In *Rethinking ICT adoption theories in the developing world: Information and Communication Technologies* (pp. 249-268). Cham: Springer Nature Switzerland.
- Chandrappa, P.K. (2018). Connectivism as a learning theory for the digital age. *Adhyayan: A Journal of Management Sciences*, 8(01), 37-47. <https://smsjournals.com/index.php/Adhyayan/article/view/2092>
- Chikuvadze, P., Mugijima, S., & Mujere, N. (2024). Digital technology-enhanced pedagogy and its influence on sustainable pre-service educators' development in Zimbabwe. *International Journal of Education, Technology and Science*, 4(2), 1861-1872.
- Chiome, C., & Chindanya, A. (2015). An analysis of academia perceptions of effects of mainstreaming e-learning on gender/socio-cultural minorities in Zimbabwean universities. *Journal of Scientific Research & Reports*, 7(3), 218-227.
- Chinamasa, E., & Ncube, M. (2023). Factors influencing e-learning acceptance in teacher education institutions: students' and lecturers' views. *International Journal of Education Humanities & Social Science*, 6(01), 80-93.
- Chitanana, L. (2024). The suitability of blended learning in Zimbabwean state universities in the post-COVID-19 era. *E-Learning & Digital Media*, 0(0). <https://doi.org/10.1177/20427530241277913>
- Chitanana, L., Makaza, D., & Madzima, K. (2008). The current state of e-learning

- at universities in Zimbabwe: Opportunities and challenges. *International Journal of Education and Development using ICT*, 4(2), 5-15.
- Dube, A., Chenjerai, B., & Zimbabwe, C. (2021). Challenges Militating against Primary School Learners' Maximum Access to E-Education Programmes in Goromonzi District of Zimbabwe. In *International journal of research studies in computer science and engineering* (Vol. 8, Issue 1). <https://doi.org/10.20431/2349-4859.0801004>
- Dacholfany. M.I, Saifi, I.L & Sulaiman. S, (2022). Connectivism and constructivism approaches to social learning theory, *International Journal of Education, Vocational and Social Science*, Volume 01 issue 01, 2022, E-ISSN: 2963 4954
- Daniel, S. (2023). Work and meaning in the age of AI-brookings. Brookings, available at: [www.brookings.edu/wp-content/uploads/2023/01/Work-and-meaning-in-the-age-of-AI\\_Final.pdf](http://www.brookings.edu/wp-content/uploads/2023/01/Work-and-meaning-in-the-age-of-AI_Final.pdf)-Md
- Dube, S., & Scott, E. (2017). The use of e-learning systems for pedagogy: What Zimbabwean Educators say. *International Journal of Advances in Computer Science & Its Applications*, 7(1), 67-71.
- Farhadi. S & Öztürk. G, (2023), Technological Pedagogical Content Knowledge (TPACK) Level and Needs of Pre-service English as a Foreign Language (EFL) Teachers: Evidence from Turkey. *Revista Educación*. [Dhttps://doi.org/10.15517/revedu.v47i1.51920](https://doi.org/10.15517/revedu.v47i1.51920)
- Goldie, J. G. S. (2016). Connectivism: A knowledge learning theory for the digital age? *Medical Teacher*, 38(10), 1064–1069. <https://doi.org/10.3109/0142159X.2016.1173661>
- Hayati, A., & Zaim, M. (2024). Students' perception toward teachers' implementation of Technological Pedagogical and Content Knowledge in EFL classroom at Madrasah Aliyah. *Al-Ishlah: Jurnal Pendidikan*, 16(1), 328-335. <https://doi.org/10.35445/alishlah.v16i1.4529>
- Heng, K. (2021). COVID-19: A catalyst for the digital transformation of Cambodian education, 87(2021).
- Jan, S. (2023). Meaning-thinking-AI. *AI & Society*. Available at: <https://link.springer.com/article/10.1007/s00146-023-01709-x>
- Kafai, Y.B., Proctor, C., & Lui, D. (2020). From theory bias to theory dialogue: embracing cognitive, situated, and critical framings of computational thinking in K-12 CS education. *ACM Inroads*, 11(1), 44-53.
- Karaduman, T., & Akman, B. (2024). A comprehensive review of technological Pedagogical Content Knowledge (TPACK). *e-Kafkas Journal of Educational Research*, 11(1), 141-159. <https://doi.org/10.30900/kafkasegt.1282126>
- Kassem, M.A.M. (2018). Balancing technology with pedagogy in English language classroom: Teachers' perspective. *International Journal of English Language Teaching*, 6(9), 1–19. <https://www.researchgate.net/publication/329248065>
- Kropf, D. C. (2013). Connectivism: 21st century's new learning theory. *European Journal of Open, Distance and E-Learning*, 16(2), 13–24. <https://eric.ed.gov/?id=EJ1017519>
- Leow, F.T., & Neo, M. (2023). Critical factors for enhancing students' collaborative learning experiences in a project-based connectivism learning environment. *International Journal of Learning, Teaching and Educational Research*, 22(7), 388-410.

- <https://doi.org/10.26803/ijlter.22.7.21>
- <https://doi.org/10.2304/elea.2009.6.4.351>
- Liu, X., & Li, H.L. (2021) A preliminary study on connectivism-constructivism learning theory based on developmental cognitive neuroscience and spiking neural network. *Open Journal of Applied Sciences*, 11, 874-884.  
<https://doi.org/10.4236/ojapps.2021.118064>
- Li, Y., Wang, K., Xiao, Y., & Friday, J. (2020). Research and trends in STEM education: A Systematic review of journal publications. *International Journal of STEM Education* 7, 11. doi:10.1186/s40594-020-00207-6
- Mahat, H., Arshad, S., Saleh, Y., Aiyub, K., Hashim, M., & Nayan, N. (2020). Penggunaan dan penerimaan bahan bantu mengajar multimedia terhadap keberkesanan pembelajaran Geografi. *Malaysian Journal of Society and Space*, 16(3), 219–234. <https://doi.org/10.17576/geo-2020-1603-16>
- Mahlangu, G., & Makwasha, L. (2023). Factors affecting the adoption and use of online assessment for learning at polytechnics in Zimbabwe. *Cogent Education*, 10(10), 2177475. <https://doi.org/10.1080/2331186X.2023.2177475>
- 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. In *Journal of Computing in Higher Education* (Vol. 34, Issue 1, p. 21). Springer Science+Business Media. <https://doi.org/10.1007/s12528-021-09274-2>
- Marumo, R., Sehurutshi, R., & Wangombe, K. (2009). E-Learning Platform for Education Innovation: A Case for Botswana. In *E-Learning and Digital Media* (Vol. 6, Issue 4, p. 351). SAGE Publishing.
- McColgan, K. (2012). Development of a multi-media book for clinical supervision training in an undergraduate nursing programme. In *Journal of Nursing Education and Practice* (Vol. 3, Issue 5). Sciedu Press. <https://doi.org/10.5430/jnep.v3n5p31>
- Mufeti, T. K. (2020). Learning in Namibia: an opportune solution or an impediment to learning? – The case at the University of Namibia. In *المجلة الدولية للتعليم بالانترنت* (Vol. 19, Issue 1, p. 16). <https://doi.org/10.21608/ijie.2020.148712>
- Maphosa, V., Jita, T., & Dube, B. (2020, June). Students' perception and use of Moodle as the E-Learning system implemented at a rural University in Zimbabwe. In *EdMedia+ Innovate Learning* (pp. 175-182). Association for the Advancement of Computing in Education (AACE).
- Maramba, P., & Mazongoda, S.S. (2020). Formative evaluation on acceptance and usage of e-learning platforms in developing countries: A case of Zimbabwe. *African Evaluation Journal*, 1(8), a375. <https://doi.org/10.4102/aej.v8i1.375>
- Marandu, E. E., Makudza, F., & Ngwenya, S. N. (2019). Predicting students' intention and actual use of E-learning using the technology acceptance model: A case from Zimbabwe. *International Journal of Learning, Teaching and Educational Research*, 18(6), 110-127.
- Mataruka, L. T., Muzurura, J., & Nyoni, J. (2021). The adoption of E-learning systems in Zimbabwe's universities: An integration of theory of planned behaviour and technology acceptance model.
- Maune, A. (2023). Adoption and use of e-learning platforms by universities in developing countries: Evidence from Zimbabwe. *Cogent Education*, 10(2),

2287905.  
<https://doi.org/101080/20231186X.2023.2287905>
- Mpofu F.Y., & Mpofu, A. (2023). The COVID-19 pandemic and digital transformation in Zimbabwean universities: Opportunities and challenges and implications for transition to online learning. *International Journal of Social Science Research & Review*, 6(3), 64-88. <https://doi.org/10.47814/ijssrr.v6i3.957>
- Mupfiga, P., Mupfiga, M.C., & Zhou, T.G. (2017). Enhancing teaching and learning through the use of mobile technologies in Zimbabwean universities. *Journal of Systems Integration*, 8(2), 43-49. <https://doi.org/10.20470/jsi.v8i2.298>
- Ntshwarang, P. N., Malinga, T., & Losike-Sedimo, N. (2021). eLearning Tools at the University of Botswana: Relevance and Use Under COVID-19 Crisis. In *Higher Education for the Future* (Vol. 8, Issue 1, p. 142). SAGE Publishing. <https://doi.org/10.1177/2347631120986281>
- Nherera, C.M., & Mukora, F.N. (2024). Digitalisation of higher education in Zimbabwe: A challenging necessity and emerging solutions. *Journal of Comparative & International Education*, 16(2), 25-34. <https://ojed.org/jcibe>
- Pondiwa, S., Nabahany, U. E., & Phiri, M. (2022). Integration of ICT into Education: Lessons Learnt at the State University of Zanzibar and the Midlands State University in Zimbabwe. In *IntechOpen eBooks*. IntechOpen. <https://doi.org/10.5772/intechopen.98441>
- Roushan, G., Polkinghorne, M., & Patel, U. (2025). Teaching and learning with innovative technologies in higher education: Real-World Case Studies. <https://doi.org/10.4324/9781032635248>
- Sambo, P., Hapanyengwi, G.T., & Zengeya, T. (2021). The adoption of e-learning by students in Zimbabwean universities in the wake of COVID-19. *Journal of Electronic & Information Systems*, 3(2), 20-27. <https://doi.org/10.30564/jeisr.v3i2.3722>
- Sibanda, N. (2022). E-learning at a Zimbabwean university during the COVID-19 pandemic: Challenges and opportunities. *Alternation*, 29(1), 317-336. [https://hdl.handle.net/10520/ejc.alt\\_v29\\_n1\\_a14](https://hdl.handle.net/10520/ejc.alt_v29_n1_a14)
- Synder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333-339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- Thy, S., Ly, T., & Ean, S. (2023). Cambodian upper secondary school education amid COVID-19 pandemic: challenges and opportunities. Cambodia Development Resource Institute.
- Tseng, J. J., Cheng, Y. S., & Yeh, H. N. (2019). How pre-service English teachers enact TPACK in the context of web- conferencing teaching: A design thinking approach. *Computers & Education*, 128, 171-182. <https://doi.org/10.1016/j.compedu.2018.09.022/>
- Ukpe, E. (2023). Information and Communication Technologies for e-Learning in tertiary education. *Open Journal of Social Sciences*, 11(12), 666-680. <https://doi.org/10.4236/jss.2023.1112044>
- Watkins, Y., Kim, E., Sornborger, A., Kenyon, G.T., et al. (2020) Using sinusoidally-modulated noise as a surrogate for slow-wave sleep to accomplish stable unsupervised dictionary learning in a spike-based sparse coding model. 2020 IEEE/CVF Conference on Computer

Vision and Pattern Recognition  
Workshops  
Seattle, 14-19 June, 1482-1487.  
<https://doi.org/10.1109/CVPRW50498.2020.00188>

Zou, R., Jiang, L., Cao, Y., Muthukrishnan,  
P., Fauzi, M. A., & Zhang, H. (2024).

Mapping Fifteen Years of  
Technological Pedagogical and  
Content Knowledge (TPACK) Model  
Applications in Higher Education.  
<https://doi.org/10.21203/rs.3.rs-5400076/v1>