



# A Descriptive Learning Analytics: An Online Learning Programmes and Load-shedding Conundrum

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## ABSTRACT

Electricity load-shedding in South Africa has become a new challenge for students pursuing online learning following the Covid-19 outbreak. This article thus investigated the way load-shedding affects students in pursuing the Advanced Certificate in Teaching (ACT) programmes. Pre-Covid-19 and during load-shedding data between 2018 and 2022 was gathered and analysed using a descriptive learning analytics tool. The research took place at a South African university where the researcher is currently employed. Learning analytics data has been available for years, but it is now being effectively harnessed to improve learning and teaching through relatively recent developments in learning analytics tools. However, the load-shedding conundrum works against this objective of harnessing learning and teaching. Research has also shown that in the least developed countries, effective e-learning practices face significant barriers, primarily stemming from insufficient infrastructure, economic challenges, low levels of computer literacy, and the added challenge of power outages. Using a constructivist paradigm, the study employed a mixed qualitative approach, which included desktop historical data and semi-structured interviews. Three participants were purposely selected because of their role in overseeing ACT students situated in both rural and urban areas. The study revealed that numerous programmes were discontinued, enrollment declined, ACT Blended shifted to e-learning, persisting load-shedding conundrum affected e-learning, a low throughput rate, and digital illiteracy contributed to an increased rate of student dropouts. This research recommends that universities should embrace the evolution of e-learning through the digitalisation of learning processes to enhance efficiency.

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## INTRODUCTION

In the 21<sup>st</sup> century society, electricity service plays a crucial role in everyone's daily life including access to e-learning platforms. Despite the courageous efforts made by universities in response to the pandemic, the concept of distance learning is still evolving because of the major challenges faced by the online way of learning.<sup>1</sup> Such challenges include electricity supply disruption known as load shedding across African States, as well as teachers' and students' unpreparedness to adapt to new ways of distance learning. The most common challenges faced by students because of the transition from conventional learning to e-learning, include accessibility to the Internet, Computers, Learning Resources, Load shedding, seating arrangements at home and noise distraction at home.

<sup>1</sup> Anwar Ali Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students," *Pakistan Journal of Medical and Health Sciences* 16, no. 5 (May 30, 2022): 1165–67, <https://doi.org/10.53350/pjmhs221651165>.

The escalating electricity conundrum has an impact on daily activities.<sup>2</sup> Research conducted in South Africa, Pakistan, and elsewhere highlights a severe electricity shortage posing a critical energy crisis. This crisis has resulted in widespread load shedding, contributing to social and economic issues, disrupting students' learning, and causing stress.<sup>3</sup> The load shedding has particularly posed significant challenges for students engaged in e-learning. Reports indicate that students struggle to submit assignments on time, impacting their academic performance, and some are compelled to drop out.<sup>4</sup>

This study applies the Learner analytics approach as a lens to understand the impact of load-shedding for ODeL students. The university under study used to conduct traditional block session venue-based classes, and the teaching materials were couriered to students across six provinces in South Africa. The ACT programmes are designed to address the requirement for a teaching and learning pathway for teachers advancing their careers.<sup>5</sup> While the university typically employs a blended learning approach for all its Open and Distance Learning (ODL) programmes, the pandemic compelled the institution to swiftly transition to entirely online methods of teaching, learning, and assessment. In response to this shift, students adjusted by reaching out to their instructors and facilitators by attending training provided by the university on the use of online learning platforms. Twenty centres across six South African provinces were used by the University of Free State pre-Covid-19. Because of the difficulties posed by load-shedding, the traditional face-to-face block contact learning in ODL had to swiftly transition to an online format. This shift required students and teachers to quickly adjust to new e-learning methods, despite being underprepared in terms of digital literacy. ODeL can cater to a large portion of students enrolled in the same programmes simultaneously. Maphosa & Bhebhe contend that approximately 30,000 students registered at one of the universities in South Africa who were practising teachers.<sup>6</sup>

Figure 1 below depicts centres used for ACT programmes before Covid-19 pandemic and electricity load-shedding conundrum in SA.

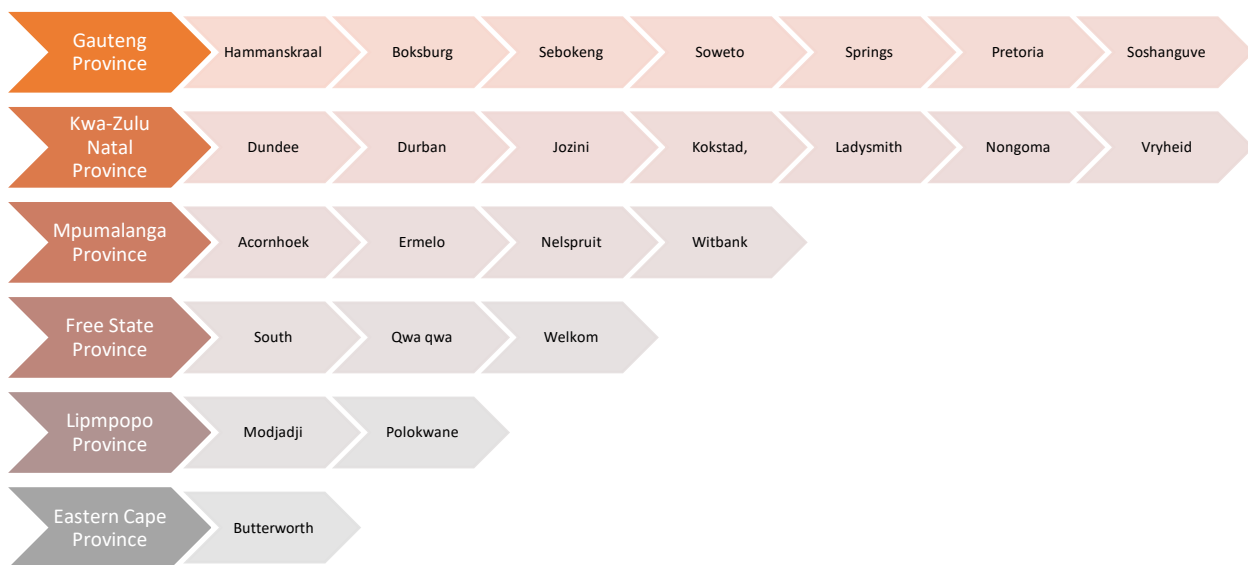


Figure 1: ACT Six Provinces across SA with its twenty-four (24) corresponding centres from 2016-2019

Due to the Covid-19 pandemic, ODL programmes across South Africa were forced to change from ODL to ODeL. However, the transfer from ODL to ODeL came with challenges including declined enrolment and absenteeism.

This manuscript is structured into seven sections: literature review, methodology, problem statement, research approach, findings and discussions, recommendations, and conclusion.

<sup>2</sup> Inayatullah Kakepotoa et al., "Exploring E-Learning Barriers of University Students during COVID 19 Pandemic," *Int J Innov Creativity Chang* 15, no. 6 (2021): 1161–74.

<sup>3</sup> Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students."

<sup>4</sup> Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students."

<sup>5</sup> ACT Blended Programme Guide, 2020.

<sup>6</sup> Cosmas Maphosa and Sithulisiwe Bhebhe, "Digital Literacy: A Must for Open Distance and e-Learning (ODEL) Students," *European Journal of Education Studies*, 2019.

## LITERATURE REVIEW

Contemporary higher education e-learning models have their origins in traditional distance education. Originally, e-learning was introduced to provide access to higher education for individuals residing in remote and rural areas.<sup>7</sup> However, e-learning has undergone significant transformations over time. These transformations are primarily driven by technological advancements. These changes began with the incorporation of radio in the 1920s, and more recently, the internet has sparked remarkable innovations in the delivery of higher education.<sup>8</sup> Nevertheless, the adoption of e-learning in higher education distance learning programmes progressed at a relatively slow pace until the emergence of the Covid-19 pandemic in 2020.<sup>9</sup> The pandemic forced universities to swiftly transition from traditional in-person teaching to online modalities. ODL institutions were not spared from this switch from ODL to ODeL. Online learning offers various opportunities like the flexibility to access educational content anytime and accessible to a broader audience. As ODL switched from ODL to ODeL, it came with some advantages and disadvantages. One benefit for the university is that ODeL can cater for a significant number of students enrolled in the same programme simultaneously. There are numerous challenges in accessing e-learning, but this study discusses three major challenges. These are the electricity load-shedding conundrum, the state of Load-shedding in Southern African countries, and the digital divide. This study explores the four primary obstacles to accessing online learning in the study context.

### Electricity Load-shedding Conundrum

Load-shedding is characterised as a method of dispersing the demand for electrical power among various power sources to alleviate pressure on the main energy source when the electricity demand surpasses what the primary power source can provide.<sup>10</sup> The South African energy crisis is a persistent period of widespread and nationwide electricity supply interruptions. It commenced in the latter part of 2007 and persists up to the present day.<sup>11</sup> In 2023, South Africa is facing unprecedented levels of load-shedding, and the power utility has faced difficulties in meeting the electricity demand, resulting in some parts of the country, especially specific areas and rural regions experiencing up to 12 hours of darkness daily.<sup>12</sup> Research has indicated that although the likelihood of a complete grid system collapse is low, it remains a possibility.<sup>13</sup>

There are several theories about the alleged causes of load-shedding in South Africa. It could have been orchestrated to intentionally damage the coal mill, allowing a corrupt repair company to step in and carry repairs at an inflated price.<sup>14</sup> Alternatively, it might have been a component of a broader political plot aimed at undermining South Africa's energy infrastructure and weakening the ruling government.<sup>15</sup>

Historical data indicates that since 2007, Eskom has faced capacity shortages in both electricity generation and distribution. Consequently, in the initial quarter of 2008, power outages became a common occurrence in the country, leading to detrimental effects on South Africa's economy. Economic growth in the first quarter of 2008 dropped to 1.57% from 5.4% in the last quarter of 2007.<sup>16</sup> Eskom attributed the crisis primarily to the government's refusal to fund the expansion of electricity capacity in the country, prompting Eskom to request a multi-billion Rand budget to enhance capacity and prevent similar issues in the future. As a result, in October 2004, the government agreed to finance the construction of a new power plant. However, due to insufficient time for completion, it could not be used to address the deficit experienced in 2007-2008.<sup>17</sup> In January 2023, energy analyst Mallinson argued that the anticipated actual output from the impaired coal-fired power stations, combined with output from other sources, is likely to reach 198 terawatt hours in 2023.<sup>18</sup> The

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<sup>7</sup> Moeketsi Letseka, Matsephe Martha Letseka, and Victor Pitsoe, "The Challenges of E-Learning in South Africa," in *Trends in E-Learning* (InTech, 2018), <https://doi.org/10.5772/intechopen.74843>.

<sup>8</sup> Khaled Mahmud, "E-Learning for Tertiary Level Education in Least Developed Countries: Implementation Obstacles and Way Out for Bangladesh," *International Journal of Computer Theory and Engineering*, 2010, 150–55, <https://doi.org/10.7763/IJCTE.2010.V2.132>.

<sup>9</sup> Maphosa and Bhebhe, "Digital Literacy: A Must for Open Distance and e-Learning (ODEL) Students."

<sup>10</sup> Sympower, "What Are Energy Markets?," 2023, <https://sympower.net/what-are-energy-markets/>.

<sup>11</sup> Merve Lopus, "Digital Literacy and Citizenship Is Part of Equitable Access," *Common Sense*, 2022, <https://www.commonssensemedia.org/kids-action/articles/digital-literacy-and-citizenship-is-part-of-equitable-access>.

<sup>12</sup> Lopus, "Digital Literacy and Citizenship Is Part of Equitable Access."

<sup>13</sup> SABC News Channel 405, 20 May 2023.

<sup>14</sup> Andrew Harding, "South Africa Load-Shedding: The Roots of Eskom's Power Problem," *BBC News*, 2023, <https://www.bbc.com/news/world-africa-65671718>; Lopus, "Digital Literacy and Citizenship Is Part of Equitable Access."

<sup>15</sup> Harding, "South Africa Load-Shedding: The Roots of Eskom's Power Problem."

<sup>16</sup> Sympower, "What Are Energy Markets?"

<sup>17</sup> Roula Inglesi and Anastassios Pouris, "Forecasting Electricity Demand in South Africa: A Critique of Eskom's Projections," *South African Journal of Science* 106, no. 1 (2010): 50–53.

<sup>18</sup> Anne H Charity Hudley, Christine Mallinson, and Mary Bucholtz, "Toward Racial Justice in Linguistics: Interdisciplinary Insights into Theorizing Race in the Discipline and Diversifying the Profession," *Language* 96, no. 4 (2020): e200–235.

projected demand stands at 230TWh, resulting in a 32TWh deficit, which translates to ongoing stage four load-shedding throughout 2023. The current state of load-shedding in SA with daily power outages has proven the predictions provided by Mallison.

### **The States of Load-shedding in Southern African Countries**

The escalating electricity problem and widespread load-shedding in countries like Pakistan have profound implications for students engaged in e-learning programs.<sup>19</sup> Additionally, their study reveals a severe electricity shortage, classifying it as a critical issue in the broader energy crisis. The resultant extensive load-shedding not only gives rise to social and economic challenges but also disrupts the learning experiences of students, leading to heightened stress levels. For e-learning students, the challenges posed by electricity load-shedding are particularly pronounced. The study by Malik, *et al.*, underscores that students struggle to meet assignment deadlines and attend online classes due to power outages, significantly impacting their academic performance.<sup>20</sup> The report highlights the difficulty faced by educational institutions in conducting seamless classes, diminishing students' enthusiasm for their studies within the e-learning framework. Moreover, the impact of power outages extends beyond the realm of academics. Load-shedding affects students' access to ACT e-learning programmes and this disrupts the continuity of education and hinders the effectiveness of ODeL. Additionally, the connection between power outages and water availability further compounds the challenges for students and impacts their ability to maintain personal hygiene and leading to mental and physical discomfort.

In the ODeL context, which heavily relies on technology and digital resources, disruptions in power supply not only interrupt online classes and access to educational materials but also impede communication between students and instructors. The study emphasises the need to address infrastructure challenges to ensure the resilience of online learning platforms and enhance the overall learning experience for students engaged in ODeL amidst electricity shortages and load-shedding. When power outages extend to affect water availability, students may encounter difficulties in managing basic personal hygiene practices. This, in turn, can contribute to mental and physical discomfort, potentially hindering their ability to fully engage in and benefit from ODeL. Lack of access to water for hygiene purposes can lead to health concerns, affect concentration, and create an overall challenging learning environment for students engaged in remote education. Load-shedding not only disrupts the flow of online classes and access to educational materials but also contributes to significant health concerns for students. The resulting irritability, boredom, and stress can lead to decreased academic performance and wasted study time, directly affecting the effectiveness of ODeL.<sup>21</sup> In the context of ODeL, the impact of load-shedding on students' daily routines and health becomes particularly significant. ODeL relies heavily on consistent access to electricity and digital resources, making interruptions due to power outages more detrimental to the learning process. Given the digital nature of ODeL, employing effective coping strategies becomes crucial for students to navigate these challenges. Strategies such as engaging in physical activity, reducing caffeine intake, sharing thoughts with supportive peers, listening to music, and fostering a positive mindset are not only essential for managing anxiety but also for maintaining a conducive learning environment within the ODeL framework.<sup>22</sup> Conversely, inadequate coping mechanisms may lead to unhealthy behaviours, impacting not only students' well-being but also their ability to fully participate in and benefit from ODeL.

The increasing electricity crisis and widespread load-shedding in countries like Pakistan have significant consequences for students enrolled in e-learning programs.<sup>23</sup> The severity of the electricity shortage, as revealed in their study, is classified as a critical issue within the broader energy crisis. The resultant extensive load-shedding not only gives rise to social and economic challenges but also disrupts the learning experiences of students, leading to heightened stress levels.

For e-learning students, the challenges posed by electricity load-shedding are particularly pronounced, as highlighted by the study conducted by Malik, Memon, Ali, Mallah, Bux, & Ul Haq.<sup>24</sup> This research underscores that students struggle to meet assignment deadlines and attend online classes due to power outages, significantly impacting their academic performance. The report emphasizes the difficulty faced by educational institutions in conducting seamless classes, diminishing students' enthusiasm for their studies within the e-learning framework.

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<sup>19</sup> Umair Javed, Aiza Hussain, and Hassan Aziz, "Demanding Power: Contentious Politics and Electricity in Pakistan," June 3, 2021, <https://doi.org/10.19088/IDS.2021.047>.

<sup>20</sup> Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students."

<sup>21</sup> Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students."

<sup>22</sup> Junaid Ahmed Khan, Anwar Ayub, and Usman Farooq, "Effects of Electric Load Shedding on Academic Performance of Students in Khyber Pakhtunkhwa," *Advances in Gender and Development Studies* 1, no. 1 (2022): 32–41.

<sup>23</sup> Javed, Hussain, and Aziz, "Demanding Power: Contentious Politics and Electricity in Pakistan."

<sup>24</sup> Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students."

Moreover, the impact of power outages extends beyond the realm of academics. Load-shedding affects students' access to ACT e-learning programs, disrupting the continuity of education and hindering the effectiveness of ODeL. Additionally, the connection between power outages and water availability further compounds the challenges for students, impacting their ability to maintain personal hygiene and leading to mental and physical discomfort.

In the ODeL context, which heavily relies on technology and digital resources, disruptions in power supply not only interrupt online classes and access to educational materials but also impede communication between students and instructors. The study emphasizes the need to address infrastructure challenges to ensure the resilience of online learning platforms and enhance the overall learning experience for students engaged in ODeL amidst electricity shortages and load-shedding.

When power outages extend to affect water availability, students may encounter difficulties in managing basic personal hygiene practices. This, in turn, can contribute to mental and physical discomfort, potentially hindering their ability to fully engage in and benefit from ODeL. Lack of access to water for hygiene purposes can lead to health concerns, affect concentration, and create an overall challenging learning environment for students engaged in remote education.

Load-shedding not only disrupts the flow of online classes and access to educational materials but also contributes to significant health concerns for students. The resulting irritability, boredom, and stress can lead to decreased academic performance and wasted study time, directly affecting the effectiveness of ODeL.<sup>25</sup> In the context of ODeL, the impact of load-shedding on students' daily routines and health becomes particularly significant, given its heavy reliance on consistent access to electricity and digital resources, making interruptions due to power outages more detrimental to the learning process.

The initiation of electricity load shedding in the latter part of 2007,<sup>26</sup> has persisted to the present day. Beginning in November 2021, the occurrence of load shedding has had far-reaching consequences and notable amongst them is the decline in mobile network connectivity, as highlighted by Harding.<sup>27</sup> This decline can be attributed to the theft of backup batteries and vandalism of cellphone towers, incidents that often occur during power outages. Such disruptions impact both large and small corporations, with estimated losses in sales due to load shedding reaching R13.72 billion in 2015.<sup>28</sup> The study posits that the ramifications extend beyond business, directly affecting the teaching and learning environment for online studies. In addition, proficiency in digital skills becomes crucial in ODeL institutions. Particularly in remote teaching within the ODeL context, both lecturers and students need to be proficient at utilising ICT tools for distance education. The efficacy of these tools is heavily dependent on internet accessibility.<sup>29</sup> The study argues that the availability of power and internet connectivity are closely intertwined. However, a substantial number of Southern African countries grapple with high levels of electricity load shedding, directly impacting internet availability and, consequently, the ability of ODeL students to access e-learning platforms. Metivier highlighted that among the eleven countries in Southern Africa, only Angola and Botswana currently do not face an immediate risk of power shortages.<sup>30</sup> Zimbabwe is particularly severely affected, with a possible need for 24-hour rolling power cuts starting in 2023, translating to electricity availability only every other day.<sup>31</sup>

Malawi and, until February, Zambia experienced daily power cuts lasting over 12 hours due to low water levels in their dams, affecting the production capacity of their power stations. However, recent indications suggest an improvement in Zambia's risk of power cuts, with less than 12 hours of load shedding per day.<sup>32</sup> Eswatini has intermittently implemented load shedding since 2015 and currently imposes four-hour daily cuts but maintaining continuous coverage in the evenings.<sup>33</sup> While load shedding is not currently in effect, Lesotho, Madagascar, Mozambique, and Namibia have also experienced power shortages, with the most recent instances occurring as recently as 2022.

Despite having the largest grid, the highest level of electrification, and the highest per capita consumption in the region, South Africa is facing worsening energy circumstances. Continuous rolling of load shedding since November 2022 has led to decreased reliability, making South Africa the only country in the

<sup>25</sup> Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students."

<sup>26</sup> Lopus, "Digital Literacy and Citizenship Is Part of Equitable Access."

<sup>27</sup> Harding, "South Africa Load-Shedding: The Roots of Eskom's Power Problem."

<sup>28</sup> Lopus, "Digital Literacy and Citizenship Is Part of Equitable Access."

<sup>29</sup> Maphosa and Bhebhe, "Digital Literacy: A Must for Open Distance and e-Learning (ODEL) Students."

<sup>30</sup> Matthieu Metivier, "Alternating Current: Southern Africa's Issue with Load Shedding," *Crisis24*, March 27, 2023, <https://crisis24.garda.com/insights-intelligence/insights/articles/alternating-current-southern-africas-issue-with-load-shedding>.

<sup>31</sup> Metivier, "Alternating Current: Southern Africa's Issue with Load Shedding."

<sup>32</sup> Fred Kanjelesa et al., "Improving Stability Through Adaptive Under-Frequency Load Shedding: The Zambian Scenario," in *2023 31st Southern African Universities Power Engineering Conference (SAUPEC)* (IEEE, 2023), 1–6.

<sup>33</sup> Kakepotoa et al., "Exploring E-Learning Barriers of University Students during COVID 19 Pandemic."

region experiencing a decline in electrification levels.<sup>34</sup> The year 2023 is projected to be the worst on record, with South Africa likely to endure some form of load shedding every day.

In summary, the impact of load shedding on ODeL students is substantial, affecting not only their access to e-learning platforms but also disrupting the digital teaching and learning environment. The challenges posed by power cuts and reduced internet connectivity have far-reaching consequences for educational institutions relying on online modalities.

Figure 1 below provides a picture of Southern African countries' levels of electricity load-shedding which impacts economies, as a barrier to e-learning education systems.

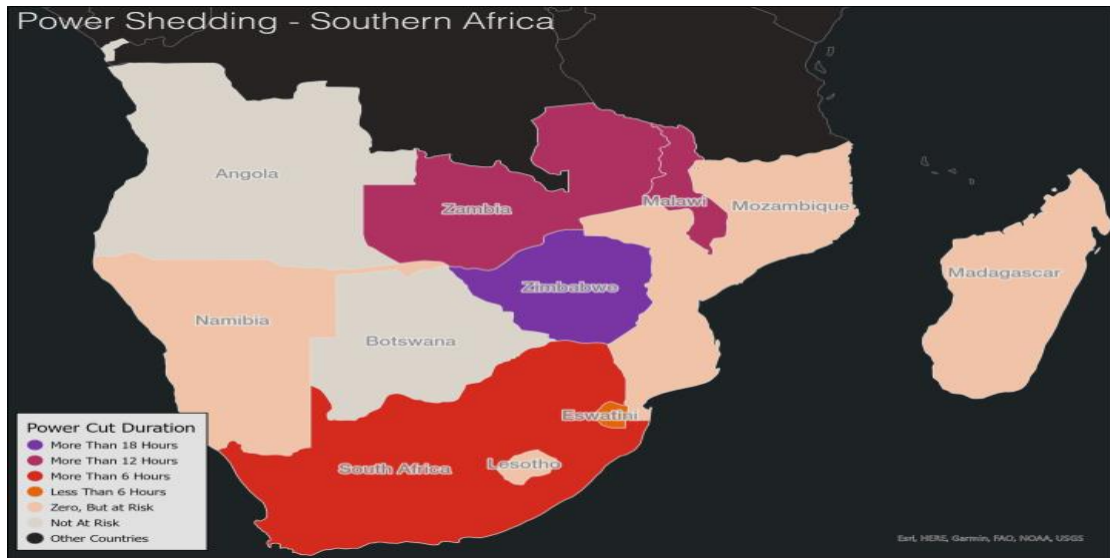


Figure 2 - The longest daily power outage durations during the period from January to March 2023 (Crisis24, 2023)

Finally, Figure 3 below revealed that 8% of respondents had varying opinions on the impact of electricity load-shedding on online learning: 9% disagreed strongly, 15% disagreed, 15% had a neutral stance, 31% agreed, and 37% strongly agreed that it acts as an obstacle to online learning.<sup>35</sup>

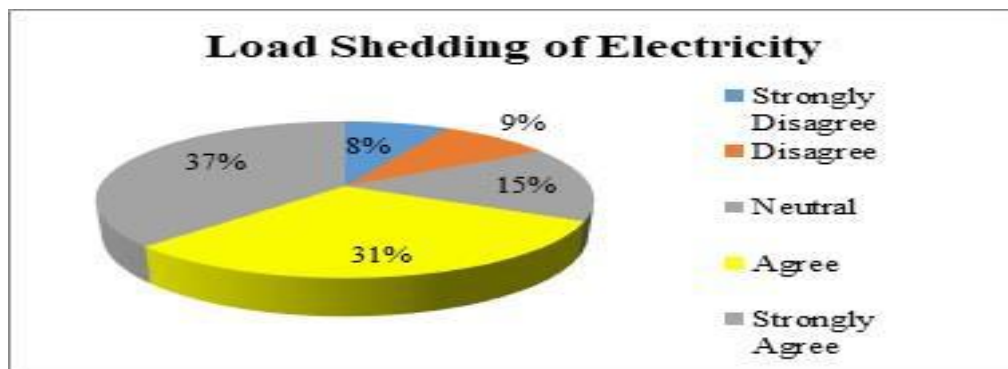


Figure 3: Impact of Load-shedding of Electricity  
Source: Kakepoto, Memon, Halepoto, Talpur & Jalban, (2021)

### Digital Divide

The "digital divide," as defined by Majola and Mudau, signifies the disparity between individuals who have access to information and communication technology, including computers, the internet, cell phones, and digital

<sup>34</sup> Hudley, Mallinson, and Bucholtz, "Toward Racial Justice in Linguistics: Interdisciplinary Insights into Theorizing Race in the Discipline and Diversifying the Profession."

<sup>35</sup> Kakepoto et al., "Exploring E-Learning Barriers of University Students during COVID 19 Pandemic."

hardware and software, and those who do not.<sup>36</sup> People who lack access to these ICT tools often encounter challenges in meeting institutional requirements. This divide is influenced by various factors including limited resources, geographical location, and demographic factors such as income, education, age, gender, and ethnicity, all of which affect physical access to technology according to Majola and Madau.<sup>37</sup> Interestingly, despite the awareness of the digital divide and its consequences, it is frequently overlooked.

According to Van Dijk, acquiring the necessary skills and capabilities for digital access can bridge this gap and provide access to technology.<sup>38</sup> Van Dijk emphasised the notable challenge of inadequate IT infrastructure in e-learning, especially in rural regions where numerous students do not possess personal laptops.<sup>39</sup> Furthermore, owing to their limited socio-economic means, students frequently find it challenging to afford broadband services or internet data contracts.<sup>40</sup>

The shift to an online education model presented difficulties for students who lacked adequate facilities and infrastructure.<sup>41</sup> This research asserts that the digital divide is most pronounced in rural areas and is exacerbated by a lack of connectivity. The performance of students engaged in online education can be adversely affected by issues such as unreliable internet connections, a deficiency in digital skills, and the unavailability of necessary technological tools. Figure 2 above illustrates that among the participants, 6% strongly disagreed, 18% disagreed, 17% had a neutral perspective, 36% agreed, and 23% strongly agreed that inadequate computer literacy represents a barrier to e-learning in online education.<sup>42</sup>

### Theory Underpinning the Study

A theory is defined as a proposition that extends beyond available data but still relies on empirical data as the foundation for educated hypotheses about hidden causal mechanisms.<sup>43</sup> This research is grounded in the theory of Human-Computer Interaction (HCI).<sup>44</sup> HCI is the interdisciplinary field that bridges psychology and the social sciences on one side and computer science and technology on the other.<sup>45</sup> Researchers in HCI study and design specific user interface technologies, such as pointing devices. As stated by Haynes & Carroll, HCI is also concerned with how individuals can effectively utilise information technology, considering the psychological, social, and technical factors that can either hinder or enhance users' experiences with technology.<sup>46</sup> Hence, this theory is relevant in this study because HCI aims to comprehend the behaviours, expectations, and feedback of users (both teachers and students). This understanding aims to facilitate the development of more intuitive and user-friendly computer interfaces, especially in the context of online learning during load-shedding.

### METHODOLOGY

This study investigated how load-shedding affects students in pursuing the Advanced Certificate in Teaching programmes. The research was situated within the interpretive paradigm. To achieve this goal, the researcher opted to use a qualitative data analysis generation process. Within this framework, qualitative methods were employed, including semi-structured interviews and the analysis of historical data.<sup>47</sup> The study ensured the confidentiality, anonymity, and privacy of the participants, and all participants were granted permission to participate. To assess the quality of the data, criteria such as authenticity, trustworthiness, and credibility were

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<sup>36</sup> Moffat Xolani Majola and Kelebogile Patience Madau, "Lecturers' Experiences of Administering Online Examinations at a South African Open Distance e-Learning University During the COVID-19," *International Journal of Educational Methodology* 8, no. 2 (May 15, 2022): 275–83, <https://doi.org/10.12973/ijem.8.2.275>.

<sup>37</sup> Majola and Madau, "Lecturers' Experiences of Administering Online Examinations at a South African Open Distance e-Learning University During the COVID-19."

<sup>38</sup> Jan A. G. M. Van Dijk, "Digital Divide: Impact of Access," in *The International Encyclopedia of Media Effects* (Wiley, 2017), 1–11, <https://doi.org/10.1002/9781118783764.wbieme0043>.

<sup>39</sup> Van Dijk, "Digital Divide: Impact of Access."

<sup>40</sup> Kakepotoa et al., "Exploring E-Learning Barriers of University Students during COVID 19 Pandemic."

<sup>41</sup> Majola and Madau, "Lecturers' Experiences of Administering Online Examinations at a South African Open Distance e-Learning University During the COVID-19."

<sup>42</sup> Kakepotoa et al., "Exploring E-Learning Barriers of University Students during COVID 19 Pandemic."

<sup>43</sup> Steven R Haynes and John M Carroll, "Theoretical Design Science in Human-Computer Interaction: A Practical Concern?," *Artifact: Journal of Design Practice* 1, no. 3 (2007): 159–71.

<sup>44</sup> John M. Carroll, "Human-Computer Interaction: Psychology as a Science of Design," *Annual Review of Psychology* 48, no. 1 (February 1997): 61–83, <https://doi.org/10.1146/annurev.psych.48.1.61>.

<sup>45</sup> Carroll, "Human-Computer Interaction: Psychology as a Science of Design."

<sup>46</sup> Haynes and Carroll, "Theoretical Design Science in Human-Computer Interaction: A Practical Concern?"

<sup>47</sup> Martyn Denscombe, "The Good Research Guide for Small Social Research Projects" (Glasgow, McGraw-Hill House, 2010); K. Hammarberg, M. Kirkman, and S. de Lacey, "Qualitative Research Methods: When to Use Them and How to Judge Them," *Human Reproduction* 31, no. 3 (March 2016): 498–501, <https://doi.org/10.1093/humrep/dev334>.

applied. Validity, which concerns the accuracy of the questions asked during data collection and the explanations provided, was a primary focus.<sup>48</sup> To enhance the validity and reliability of the research findings, this study utilised multiple data collection methods, specifically semi-structured interviews and historical data analytics.

This study was conducted at the university where the researcher is employed, which served as the sampling site. The term "sample" refers to a predetermined number of cases selected from the population under study.<sup>49</sup> The target population for this research consisted of three participants who were purposively selected due to their roles as employees in the ACT programmes. These participants included two ACT Coordinators and one assessment and moderation officer. Consequently, the total number of participants in this study was three.

### **Descriptive Analytics Approach**

This study opted for a descriptive learning analytics approach. The learner analytics approach is used to understand and analyse various aspects of the learning process. It involves collecting and analysing data related to learners' activities, interactions, and performance in educational settings. The primary goals of learner analytics include Resource optimisation to improve the use of educational resources, including digital tools, materials, and instructional strategies, to enhance the overall learning experience; Learning progress to track the progress of individual learners; Learning behaviours to analyse patterns of engagement; performance assessment; Predictive Analysis using data to predict future learning outcomes, trends, or potential challenges, allowing educators to proactively address issues and improve the learning environment. In summary, learner analytics aims to leverage data-driven insights to enhance the effectiveness, efficiency, and personalisation of the learning experience for both staff and students.<sup>50</sup>

The utilization of learning analytics plays a pivotal role in comprehending human learning, teaching, and education. It involves identifying and verifying pertinent indicators of processes, results, and educational activities. Furthermore, learning analytics facilitates and advocates for evidence-based approaches rooted in the evaluation and assessment of learners' advancement, motivation, attitudes, and contentment.<sup>51</sup>

According to Mangaroska and Giannakos, the concept of learning analytics has developed to leverage digital technologies to gather the traces that users generate, allowing for the comprehension of the activities and behaviours linked to their learning experiences.<sup>52</sup> Consequently, learning analytics can achieve several objectives: 1) elucidate unforeseen learning behaviours, 2) recognise effective learning patterns, 3) pinpoint misunderstandings and misdirected efforts, 4) introduce suitable interventions, and 5) enhance users' understanding of their actions and progress.<sup>53</sup> Hence, this approach is relevant to the study because the author seeks to understand how learning analytics enhance human learning and teaching through online learning using digital technologies. Figure 4 below presents a scenario of how student data was obtained from university data sources.

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<sup>48</sup> Donna M Mertens, *Transformative Research and Evaluation* (Guilford press, 2008).

<sup>49</sup> Hamed Taherdoost, "Determining Sample Size; How to Calculate Survey Sample Size," *International Journal of Economics and Management Systems* 2 (2017).

<sup>50</sup> Manuel Sánchez et al., "Cloud Computing in Smart Educational Environments: Application in Learning Analytics as Service," in *New Advances in Information Systems and Technologies* (Springer, 2016), 993–1002; Cristobal Romero and Sebastian Ventura, "Educational Data Mining and Learning Analytics: An Updated Survey," *WIREs Data Mining and Knowledge Discovery* 10, no. 3 (May 13, 2020), <https://doi.org/10.1002/widm.1355>.

<sup>51</sup> Sánchez et al., "Cloud Computing in Smart Educational Environments: Application in Learning Analytics as Service."

<sup>52</sup> Katerina Mangaroska and Michail Giannakos, "Learning Analytics for Learning Design: A Systematic Literature Review of Analytics-Driven Design to Enhance Learning," *IEEE Transactions on Learning Technologies* 12, no. 4 (October 1, 2019): 516–34, <https://doi.org/10.1109/TLT.2018.2868673>.

<sup>53</sup> Mangaroska and Giannakos, "Learning Analytics for Learning Design."

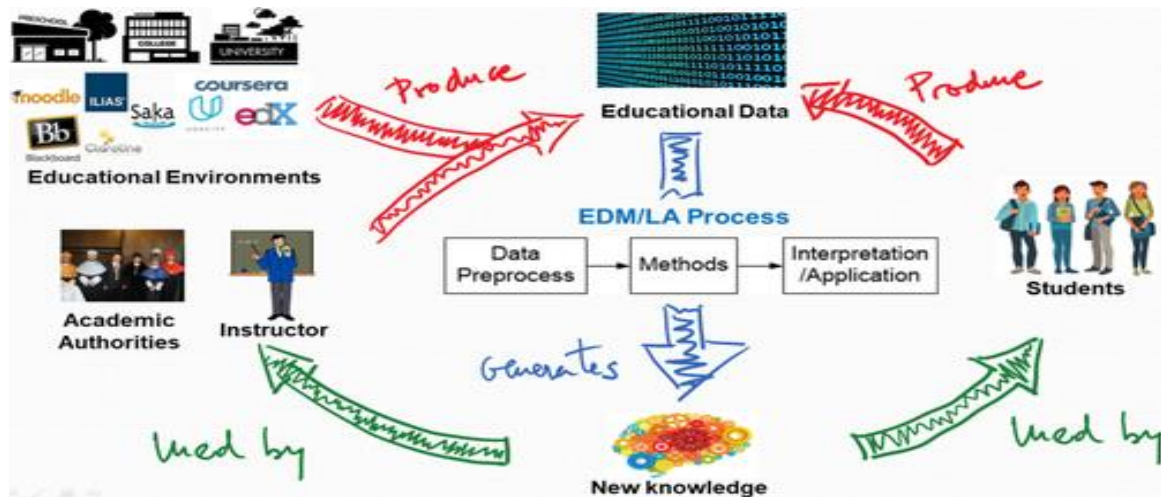


Figure 4: Graphical Presentation of Educational Data Mining and Learning Analytics  
Adapted from: Romero, C., & Ventura, S. (2020)

Figure 4 above provides a schematic view of how learner analytics data was mined through PowerHEDA. Data analytics was mined from various sources, i.e. students, LMS and academics. University authorities also produce learner analytics data, like, enrolment figures, pass rates, throughput rates, etc.

### Data Analysis

Data analysis is the procedure of bringing order, structure, and significance to the extensive collection of data, as outlined by Maluleke in 2019. In the context of this study, the qualitative data were examined by extracting themes from semi-structured interviews and historical learner analytics data obtained from desktop sources. Thematic analysis is an approach employed to recognise, scrutinise, arrange, portray, and communicate the themes identified within documents, as described by Nowell et al.<sup>54</sup> In this study, data acquired from participants was transcribed and classified into themes based on the emerging themes from participants' responses.

### FINDINGS OF THE STUDY

This section focuses on presenting and discussing the data that were generated from the university under study. The objective of this article is to investigate the impact of load-shedding on students who were enrolled in the ACT programmes. The researcher used semi-structured interviews and documentary analysis (historical data analytics) to find answers to the research questions.

The four research questions asked were:

- In your view, what were the challenges experienced by students during the load-shedding era?
- When asked, in your view, what are the reasons that attributed to a sharp drop in ACT enrolments?
- In your view what are the reasons for the low graduation rate amongst ACT students?
- In your view, why do students pass with a high number of distinctions whereas, there is a low graduation rate?

### Presentation of Findings of Semi-Structured Interviews

Four sub-research questions were employed to gather information from the participants. Here are the questions along with their respective responses.

**Question 1: In your view, what were the challenges experienced by students after COVID-19 and during the load-shedding era?**

In response to question 1, Participant No. 1 stated:

*“Learning how to submit their assignments via Blackboard. Using more Technology like Skype meetings/ Blackboard collaborate, etc.”*

<sup>54</sup> Lorelli S Nowell et al., “Thematic Analysis: Striving to Meet the Trustworthiness Criteria,” *International Journal of Qualitative Methods* 16, no. 1 (2017): 1609406917733847.

In response to question 1, Participant No. 2 asserted:

*“Students use load-shedding as an excuse. They do not prepare for submissions and want to do assignments in the last minutes.”*

In response to question 1, Participant No. 3 stated:

*“No submissions, late submissions, all of this results in negative academic records as the University needs valid reasons for non-submissions, for example, doctor notes, death notes, etc.”*

**Question 2: When asked, in your view, what are the reasons that attributed to a sharp drop in ACT enrolments?**

In response to question 2, Participant No. 1 stated:

*“The Department of Education availed money for a certain time to assist with the upgrade of their Teacher’s Qualifications. Most teachers made use of this opportunity. The focus of the department has shifted. The Department now focuses on new teachers doing the B.Ed qualification”.*

In response to question 2, Participant No. 2 asserted:

*“Financial and UFS do not tender. Meaning, that the student teachers had no bursaries because the university stopped bidding for tenders to register students who were funded by the Department of Basic Education.”*

In response to question 2, Participant No. 3: asserted:

*“COVID-19 remains the main course of the students drop out, visits were prohibited, and new COVID-19 regulations were implemented. Students lost interest due to the given reason. Fewer Center visits, less face-to-face Student support. Additionally, ACT Students are mature teachers who need to upgrade their qualifications through face-to-face support as age is also one of the disadvantage barriers, language is also a barrier to them, e.g., English is a barrier to the majority of them, Technology, etc.”*

**Question 3: In your view what are the reasons for the low graduation rate amongst ACT students?**

In response to question 3, Participant No. 1 stated:

*“Some Provinces – “Forced” their teachers to complete the ACT. The heart and soul of some of these students were not in the ACT programme. Other Provinces gave Laptops to students if they did register for the ACT. Once some of these students receive a laptop -they quit the programme.”*

In response to question 3, Participant No. 2 stated:

*“Students did not attend class or submit assignments. Tender students only apply to get a computer, and never finish the ACT. If they fail a module, they are responsible for payment of their fees, therefore they did not return.”*

In response to question 3, Participant No. 3 stated:

*“The participant stated that she had no clue about this question because her job doesn’t involve this question.”*

**Question 4: In your view, why do students pass with a high number of distinctions whereas, there is a low graduation rate?**

Participant No. 1 stated:

*“The way the Assessments and Assessments Rubrics were compiled, it is not possible to fail. Only one type of assessments has been used no diversity of types of Assessments.”*

Participant No. 2 stated:

*“Study guides as well as assignments did not change at all throughout the years. Students use other students’ assignments and just change some wording. The fact that the ACT is only assignment-based and no exam or even multiple-choice question papers.”*

Participant no. 3 asserted:

No response was provided, this participant felt that she didn’t have accurate answers to this question.

**Presentation of Findings from Historical Data Learner Analytics / Documents**

Data obtained from the historical data analytics of the university is provided in figures and table/s, offering evidence of how load-shedding has influenced the enrollment, graduation rates, and learning experiences of ACT students during periods of load-shedding prevalence.

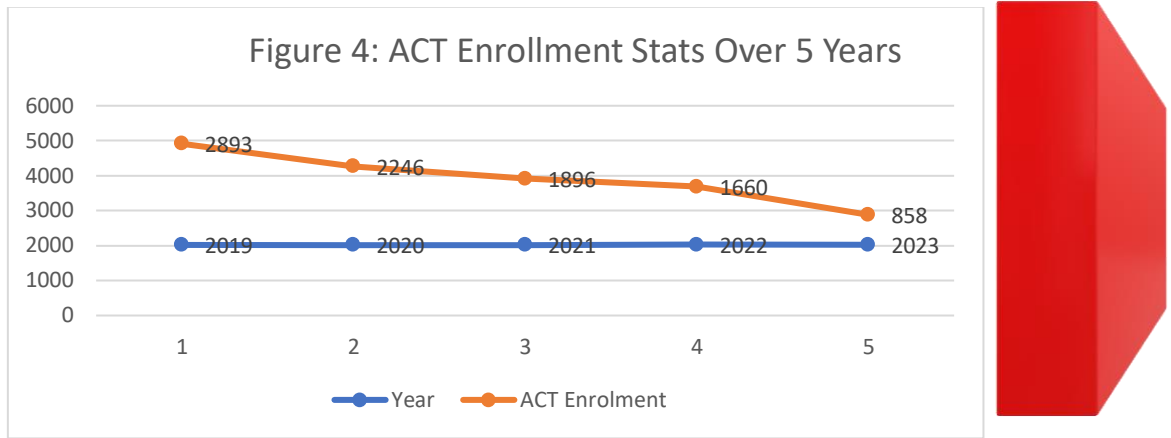


Figure 4 provides ACT enrolment statistical data over 5 years. A sharp decline in enrolment took place between 2022 and 2023 when load-shedding was rife in South Africa.

Source: UFS PowerHEDA through Directorate for Institutional Research and Academic Planning (DIRAP)

Table 1, presented below, illustrates the enrollment statistics versus graduation rates for the ACT Blended in Foundation Phase Teaching. The table indicates a significantly low graduation rate when juxtaposed with the enrollment rate spanning the period from 2018 to 2022. The study attributes the observed low throughput rate to dropout incidents resulting from the absence of access to e-learning platforms during electricity load-shedding.

**Table 1: ACT Online Blended Foundation Phase: Graduate Rate vs Enrolment Rate (2018-2022)**

YEAR	ACAD_PLAN	GRADUATES	ENROLMENT
2018	LO711819	36	190
2019	LO711819	54	234
2020	LO711819	49	238
2021	LO711819	59	319
2022	LO711819	59	376

Source: UFS PowerHEDA 2023

**DISCUSSION OF FINDINGS**

Three main themes emanated from the collected data. These themes are unpacked hereunder.

**Learners’ Experiences with Load-shedding**

In response to the question of whether load-shedding presents challenges in accessing e-learning, Participant No.1 indicated that load-shedding was to blame for most complaints regarding access to learning. However, this participant thought that using WhatsApp was useful because it allowed students to catch up at their own pace. The second participant agreed that load-shedding is a hindrance to learning because students complain that they cannot access the internet and that their devices are running low on battery life. Participant No. 3 claimed that because most ACT students live in remote rural areas with inadequate network coverage, they are unable to attend virtual classes because of these issues and their laptop batteries are not fully charged. Facilitators for e-learning are not immune to load-shedding. They also cannot offer classes when students are not online, and at times, they are unable to join the online sessions due to poor network and drain of laptop batteries as they cannot charge laptops due to intense load-shedding. According to this study, network, and load-shedding contribute to a higher absentee rate for scheduled online classes. The escalating electricity problem has an impact on daily activities. A study conducted in Pakistan revealed that the country is grappling with an acute electricity shortage, which represents one of the most severe energy crises. This has resulted in extensive load-shedding,

leading to significant social and economic challenges, disruptions in students' learning, and heightened stress levels. The load-shedding has presented significant challenges for students engaged in e-learning, with reports indicating that they struggle to meet assignment deadlines, ultimately affecting their academic performance.<sup>55</sup> In addition, Malik, *et al*, contend that the majority of university students suffered from worst load shedding which had badly affected their punctuality, assignments, self-study, competencies, performances, results, and stress and anxiety.<sup>56</sup>

The study by Khan, Anwar & Farooq explains the problems of electric shutdowns faced by students at university campuses.<sup>57</sup> The result shows that the electricity shortfall has a prominent adverse effect on the studies of the students in university as students suffer more in nighttime as compared to daytime. Additionally, power outages make the students unable to precede their studies conveniently and prepare a proper timetable due to these electric shutdowns. Lectures based on multimedia are not properly delivered. The grades of the students are also affected due to late submission of the assignments and homework.

Furthermore, educational institutions face difficulties in conducting classes smoothly, which diminishes students' interest in their studies. The electricity shortage also has repercussions on the availability of water, making it challenging for students to maintain personal hygiene, consequently causing mental and physical discomfort.<sup>58</sup>

### ***Sharp Decline in ACT Enrolment***

The significant decline in ACT enrolment after the COVID-19 pandemic was attributed to various reasons. Participant alluded that The Department of Education availed bursaries for a limited period to assist with the upgrade of their Teacher's Qualifications. Most teachers made use of this opportunity. However, there has been a shift in focus where the Department of Basic Education now focuses on New Teachers – doing the BED qualification while Participant No. 2, briefly stated that, lack of finance from the students' side coupled with poor marketing led to a sharp drop in enrollment figures in ACT programmes. In addition, participant No. 3, attributed the sharp drop in ACT enrolments to various reasons including; the COVID-19 pandemic, and the prohibition of centre visits due to social distancing regulations. Furthermore, participant No. 3 raised a pertinent issue of age, English language, and poor digital literacy as other reasons for the sharp drop in ACT enrolments.

### ***Causes for ACT Low Throughput Rate***

In response to the low throughput rate, participant No.1 stated "Some Provinces *forced* their Teachers to complete the ACT but the heart and soul of some of these students were not into the ACT programme. Other Provinces gave laptops to students when they registered for ACT. Once some of these students receive laptops, they quit the programme." This study contends that some registered for ACT as a gateway to obtain to receive free laptops which contributed to learner drop-outs. Participants No. 2 & No. 3, concur with the latter participant when they stated that bursary holders only registered for ACT to get computers, in addition, this participant stated that some students drop out of the ACT programme because of the stringent bursary conditions which state that if they fail any module, they will be personally responsible for their tuition fees. In addition, the study contends that the load-shedding conundrum which is a barrier to e-learning will further negatively affect the throughput rate.

The historical data on learner analytics for the university in question presented a distinct and noteworthy perspective on ACT throughput rates across various years. An analysis of enrollment versus graduation rates highlighted a concerning throughput trend from 2018 to 2022. Specifically, Table 1 indicated that ACT Online and Foundation Phase Teaching experienced the most significant impact, exhibiting consistently high enrollments but alarmingly low throughput rates each year. The data revealed that out of the 376 students enrolled in 2021-2022, only 59 successfully graduated on schedule, with a substantial number dropping out due to challenges posed by both COVID-19 and electricity load-shedding issues. Electricity outages presented acute challenges for e-learning students. In a study conducted in Ethiopia, the level of effects of load-shedding on students included problems in concentration during lectures, irritation and perspiration, grades and general results, examination preparation, and feelings of anxiety.<sup>59</sup>

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<sup>55</sup> Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students."

<sup>56</sup> Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students."

<sup>57</sup> Khan, Ayub, and Farooq, "Effects of Electric Load Shedding on Academic Performance of Students in Khyber Pakhtunkhwa."

<sup>58</sup> Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students."

<sup>59</sup> Malik et al., "Impacts of Coping Strategies for Electricity Load Shedding among University Students."

## RECOMMENDATIONS

ACT programmes aim to support underqualified in-service teachers, resulting in a limited lifespan compared to mainstream programs due to their specific purpose. Despite this, there are still unqualified in-service teachers, especially those who have dropped out due to various reasons, including load shedding conundrum. Given the fact that inactive students dropped out during the transition from ODL to ODeL, this study recommends that providing extra digital literacy training support is essential for these students to thrive in an increasingly digital world. In conclusion, the study recommends that universities embrace the evolution of e-learning by digitising learning processes to enhance efficiency. A reliable infrastructure is fundamental in creating an environment where students can concentrate on their studies without additional obstacles related to necessities like power outages, lack of digital skills, and network coverage.

## CONCLUSION

Various factors were cited for the notable decrease in ACT enrollment both during and after the COVID-19 pandemic, particularly amid prevalent electricity load shedding. One contributing factor was the absence of bursaries, stemming from the university's decision to discontinue tender bidding issued by the Department of Basic Education (DBE). The primary issues encompassed are the lack of access to e-learning platforms due to electricity load shedding, digital literacy gaps, and a shortage of personal laptops.

The observed low throughput rate had diverse underlying causes. Many students enrolled because the Department of Basic Education offered free laptops to all registered students, with some students primarily seeking to acquire a free laptop rather than aiming to enhance their qualifications. Additionally, certain students faced delays in graduation as they grappled with the challenges of adapting to e-learning, having been accustomed to traditional face-to-face instruction.

A majority of ACT students reside in remote rural areas with generally inadequate network coverage. The transition to online learning, coupled with electricity load shedding, posed significant challenges for these students, hindering their ability to attend virtual classes due to connectivity issues and uncharged laptop batteries. Furthermore, e-learning facilitators were not exempted from the impact of load shedding, as they too encountered difficulties logging into online platforms to conduct teaching sessions.

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