The Impact of Electricity Blackouts on Academic Activities in South African Higher Institutions

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Abstract
It is evident that energy plays a pivotal role in the quality of individual's everyday life. As humans rely entirely on energy for their individual lives and efforts. The availability of energy in every sector of the economy is connected to an effective high level of living. The education sector utilises energy in the majority of activities. As the emerging technology usage is expanding in the education environment Thus, it is important that the energy supply is sufficient to the needs of the developing electrical infrastructure employed in the educational system. The study investigated the impact of electricity blackouts on academic activities in higher institutions. The study employed the qualitative approach and the quantitative approach to describe the biographical information of the participants. The sample comprised of (23) students who were conveniently sampled. The snowball procedure was used. Data collection was implemented through online interviews and the thematic analysis procedure was used for data analysis. The study findings showed that most students were concerned with the issue of loadshedding as their academic activities were affected. The recommendations indicated that students must always have backup systems so that they are able to study anywhere and anytime. The institutions management must continually plan in advance the alternative sources of creating energy to safeguard continuous supply of electricity in the college for academic activities. There should be continuous supply of electricity in the lecture halls, computer laboratories, libraries, lecturer's offices and student's residence, so that teaching learning can take place without any hindrance.

Keywords: Impact, Loadshedding, Electricity Blackouts, Academic, Activities, Higher Institutions

Introduction

Electricity plays a pivotal role in modern life because it is a requirement for obtaining the level of output and quality of life experienced in developed states (Barnes,2014). Access to energy is significant for growth and minimising poverty (Sargsyan, 2021). Loading shedding is the procedure of deliberately minimising the sections of an electrical supply to decrease the pressure on the electrical grid or network. Sometimes load shedding occurs without any notice. In other instances, the public is notified in advance so as to plan their daily activities. To avoid the electrical grid breakdown, it is essential for load shedding implementation. As the electrical grid pressure may be triggered by electricity supply interruptions (Lawson, 2021). Yet, limited literature investigates the effect and result of blackouts in countries and also the how policymakers are attending to the matter. Again, verification of the effects on blackouts on people and household results are minimal, thus further examination is required in this subject (Gertler et al., 2017).

Blackouts can differ according to their occurrence and time and they can be explained in numerous ways such as planned and unplanned. Immediate breakdowns are classified as unplanned, leading to blackouts that are taking hours for the electricity to be restored. While planned outages are scheduled in advanced and the public is notified on time. Loadshedding is a planned outage that is scheduled for certain hours or periods. Electricity generation shortages, electricity grid overload, lack of electricity facilities repairs and poor conditions of workmanship contribute to blackouts (Gertler et al., 2017). In addition, illegal electricity connections are equivalent to stealing electricity and lead to more and frequent loadshedding (Jamil,2013; Gertler et al., 2017).

Literature has indicated that unplanned electricity outages can produce a huge economic and social expenses (Anderson and Dalgaard, 2013; Harish et al., 2014; Hensher et al., 2014). Loadshedding negative effects impacts production efficiency (Carlsson et al., 2020; Kazmi et al., 2019), affects health (Byrd and Matthewman, 2014; Gehringer et al., 2018; Ndaguba, 2017), contamination (Pretorius et al., 2015), education (Lawson; 2021) and intake performance (Abi Ghanem et al., 2016). These blackouts are the results of energy systems breakdown due to high demands and increasing insecurities in energy supply (Byrd and Matthewman, 2014). In addition, the energy supply may escalate dangerously and risky due to political insecurities, peak oil, privatisation, infrastructure collapse, global warming and the move to renewable energy materials (Byrd and Matthewman, 2014).

Network instability collapses the communication lines, network tools and convertors Sometimes the network instability collapses due to natural causes or stealing of network parts, copper and convertor oil. These challenges may occur in areas with minimal or no security (Burney, Rosamond, Naylor and Sandra, 2013). Planned maintenance are necessary to avoid the electricity system supply overload, rearrange the network structure and to improve energy lines and tools. However, these supply side elements can be solved by improving and growing the energy grid system (Besant-Jones, 2006).

Furthermore, the distribution of electricity is a political matter because the government plays a significant part in the energy sphere (Cohen, 2006). Political misuse promotes regular blackouts that hinders the smooth running of teaching and learning (Harish, Morgan and Subrahmanian, 2014). Min and Golden revealed that in Indian politicians in Uttar Pradesh encourage the stealing of electricity with the hope of influencing elections. Olukoju, 2004 mentioned that Nigerian government does not act promptly in preserving the electricity

infrastructure, instead individuals are paying bribes for service delivery. Which ultimately negatively impacts the smooth delivery of numerous departments especially the education sectors.

Lawson (2021), Pretorius and Burger (2015) studies indicated that several countries such as Cyprus, England, Iceland, India, Sudan, Turkey, Ukraine, Chile, China, United States and Indonesia to quote a few experienced huge blackouts. Several developing states are still experiencing a shortage of access to reliable energy supply because of deteriorating infrastructure, blackouts and high economy costs (Sargsyan, 2021).

Similarly, loadshedding is a common challenge facing the South Africans on a daily basis affecting the educational institutions, other departments and households (Goldberg, 2015). The periodic loadshedding started in 2007 and 2008 when Eskom was unable to control the increasing demand for electricity without executing load shedding. Sadly, Eskom abandoned the maintenance for years (Van der Nest, 2015), which led to Eskom numerous infrastructure breakdown at their plants and shutting down several plants that supply the electricity grid. All these Eskom challenges headed to frequent black outs in 2014. Sometimes blackouts can be caused by weather (Lawson, 2021). Load shedding has various phases of blackouts strains known as stages, as the electricity networks are overloaded. Eskom increased the loadshedding stages in areas which varies from two to four hours (Lawson, 2021).

Background

Onwuegbuzie and Ojo (2021) study findings stated that several students complained about the frequent and lengthy loadshedding that negatively affects their studies and the use of technology devices during online classes. Load shedding greatly impacts students by disrupting their studies especially at night irrespective of their socio-economic classes (Bwalya Umar et al., 2022; Babajide et al., 2016). In addition, students mentioned that due to loadshedding they are unable to study at night and end up sleeping. They fall behind with their studies and unable to cope on their own. Although, distance learning offer students flexible learning but lack of electricity supply due to loadshedding negatively impacts the students learning (Gurajena et al.,2021; Samsuri et al., 2014).

The findings of Mwila et al. (2021) and Omodan and Ige (2021) reported that students' online studies are impacted negatively due to frequent loadshedding and network connection, which is an indication of the imbalances to the right to education. Students are unable to prepare and learn for their assessments, they lack behind in their studies especially during numerous load shedding every day (Bwalya Umar et al., 2022). Lodhi and Malik (2013) findings indicated that loadshedding negatively affected the daily routines of households in Pakistan, students were unable to complete their academic activities and not effectively learning.

Phiri and Phiri (2017) study findings stated that the load shedding results on students in Zambia is far above the domestic phase. Load shedding negatively affects the integration of Information Communication and Technology policy in the country. As such, ICT teaching and learning, activities and resources are affected as they rely on electricity (Abagi and Odipo, 1997). In addition, the educational institutions tuck shops are most of the time not capable of selling or providing food and school nutrition to students due to power cuts (Bwalya Umar et al., 2022). In support of the previous authors, Pasha and Saleem (2013) revealed that students in Pakistan are challenged with the completion of their academic activities, homework, projects, getting ready to go to school/college/ university and arriving late due to load shedding.

Blackouts impact revenue contributing to departments and households and multiply functioning costs for various sectors specifically the businesses in South Africa (Goldberg, 2015), in addition to fiscal expenses power outages can create other costs to the public (Andersen and Dalgaard, 2013).

Furthermore, Praktiknjo et al., (2011) findings mentioned that most households especially students in South Africa encounter challenges of lack of relaxation during evening load shedding. Academic activities relying on electricity are suspended, leading to more energy utilisation through the time of electricity supply (Ngoma et al., 2018).

South Africa is experiencing this pandemic load shedding which has negative effects on the country. Although, some respondents mentioned that load shedding has positive results of enhancing businesses (Goldberg, 2015). Cissokho and Seck (2013) concur that load shedding does not globally negatively affect. Their study findings stipulated that load shedding in Senegal had a positive impact as it motivates improved management performs to alleviate the negative effect of load shedding.

Electricity Reliability

Reliability energy is a global challenge (Lawson, 2021). Reliability energy is a problem in developed and developing countries, numerous countries that have limited access to energy and together with those that experience excessive levels of access (Gertler et al., 2017; Lawson, 2021). Reliability may be significant in cities unlike to rural areas because of high population in cities, at the same time reliability may be less in cities due to challenges such as over congestion and electricity stealing (Allcott et al., 2016). Reliability plays a pivotal role in economic growth, even though there is not enough proof in this matter. In support, Meles (2020) study findings emphasises the significance of the electricity supply reliability. Their report indicated the monthly costs of the household monthly hours of blackouts. Also, the use of backup systems due to loadshedding influences interior air contamination and global warm.

According to the World Bank (2014; 2015; 2017) during the winter season the electricity reliability is weak led by recurrent blackout and emergency shut-downs. Thus, compelling households, colleges and universities to use alternative backup systems during load shedding for various things such as cooking, heating and lighting. Compared to summer, the loadshedding is minimal.

Load Shedding and Sustainable Development

Energy is one of the keystones of sustainable growth as it confirms the global admittance reasonable, consistent, maintainable and recent energy services by 2023 (The World Bank, 2015). UNESCO pointed out that Sustainable Development Goal (SDG) 4 is affected by electricity shortages. However, SDG 4 on education needs a reliable and affordable electricity to deliver quality education in the teaching and learning environment, physical infrastructure, teaching and learning equipment and human resources (The World Bank, 2017). Access to consistent electricity could help the teachers to integrate technology in their teaching, to enhance and clarifying the new content taught in the classrooms. Also, reliable electricity can assist the students by improving and providing sufficient hours to study (Cabraal et al., 2005; Lodhi and Malik, 2013). The positive use of energy projects contributes positively on education and health because better and advanced education and health systems enhance individuals' earnings (Barkat, 2003).

Energy Alternatives During Load Shedding

In Zambia, Kitwe's households and students replaced the energy supplies during loadshedding. For example, charcoal was used for lightning and cooking (95 %), portable generators used to power the electrical appliances (less than 1%). For lightning the replacement were candles and torches. Then 4% of the respondents used solar as an alternative source of energy during load shedding (Bwalya Umar et al., 2022). In the United Kingdon the findings revealed that respondents/students bought generators, candles, battery powered devices (Abi Ghanem et al., 2016). Also, in South Africa the most alternative system used during load shedding is the generators and other substitutions that are reliable for the respondents (Pretorius et al., 2015). Unfortunately, the higher institutions, households and individuals spend more on alternative backup systems (Pretorius et al., 2015), because they are compelled due to frequent blackouts (Goldberg, 2015).

In Ethiopia, households suffer more expenses on generators, candles, charcoal, firewood, gas (LPG) due to repeated load shedding (World Bank, 2015). In support of other studies, Goldberg (2015) study findings revealed that during load shedding the respondents are using LED lamps, backup lights and generators to mitigate the impact of load shedding. During load shedding individuals /students rely on their alternative sources such as generators or postpone their academic activities until the electricity returns (Gertler et al., 2017).

In Nepal the colleges, universities and hospitals are connected to the generators to mitigate the load shedding. Load shedding affects the higher institutions negatively during teaching and learning, teachers resort to traditional teaching using black and white board. During the lessons the students are unable to use LCD projectors and audiovisual aids. While colleges and universities use alternative systems during the lessons such as inverters and solar panels (Shankar, 2012).

Research Objective

The aim of the study is determining the impact of loadshedding on academic activities in higher institutions. The study addresses the following questions:

1. How do a learner and student residing in your household adapt to the irregular power supply caused by load-shedding to ensure uninterrupted study?
2. What role does technology play in mitigating the effects of load-shedding on their learning?
3. What are the specific challenges that they face during load-shedding when trying to engage in educational activities outside the classroom?
4. What innovative pedagogical approaches or teaching methods have you observed as a response to load-shedding, and how do they affect the learning experience?

Methodology

The study employed a qualitative approach that explains and analyse individuals and collective social behaviours, beliefs, minds and perceptions (Mc Millan & Schumacher, 2012). Again, the study used the quantitative approach to describe the biographical information of the participants.

Population and Sampling

The sample comprised of twenty-five (23) students who were conveniently sampled. The participation was intentional, relying on accessibility, convenience and eager to contribute to the study (Price et al., 2017). The Snowball sampling procedure was employed in this study (also referred as "chain-referral methods"). (Cohen, Manion and Morrison, 2018), with the intention of multiplying the sample size based on the chance that participants would suggest others vial their social networks to participate in the study (Gideon, 2012). The online interviewing was used to collect data (James, 2016) and the semi-structured interview questions were asked to 23 participants. Ethical clearance and permission to conduct the study was obtain from the College management. The anonymity of the participants was kept private and confidential (Cohen et al., 2018). The participants were informed that their participation is voluntary, they are at liberty to withdraw at any given period.

Results

Descriptive Analysis

Respondents Gender

The demographics of the twenty-three (23) respondents such as the gender, age and the highest level of education is indicated in Figures below. Figure1displays the gender, out of the twenty-three (23) respondents, fifty-two percent (52.2%) were females and forty-eight percent (47.8%) were males and others preferred not to indicate their gender.

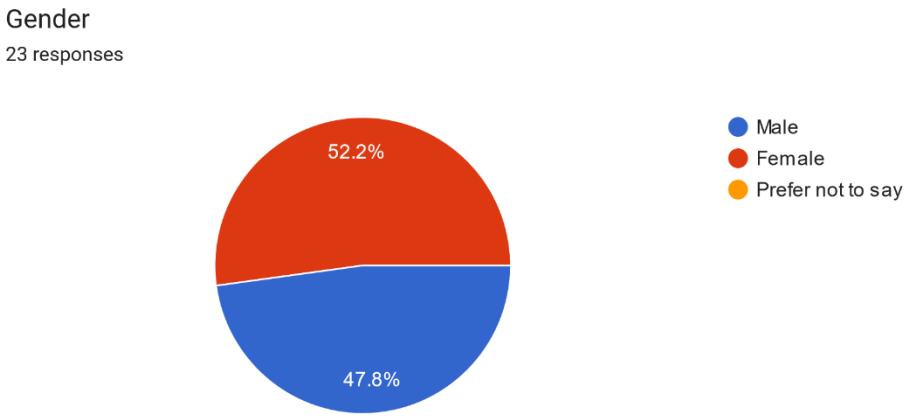

Figure 1: Gender of Respondents

Respondents Age

Table 1 indicated the respondents age as follows:

Age	*Percentage*
18yrs >	8.7%
27yrs>	13%
44yrs>	8.7%
51yrs>	13%

Table 1: Respondents Age

Respondents School Attendance

The results showed that the 30.4% of respondents do not have children who are currently attending school or university. Most of the participants (69.6%) have children who are attending school/university.

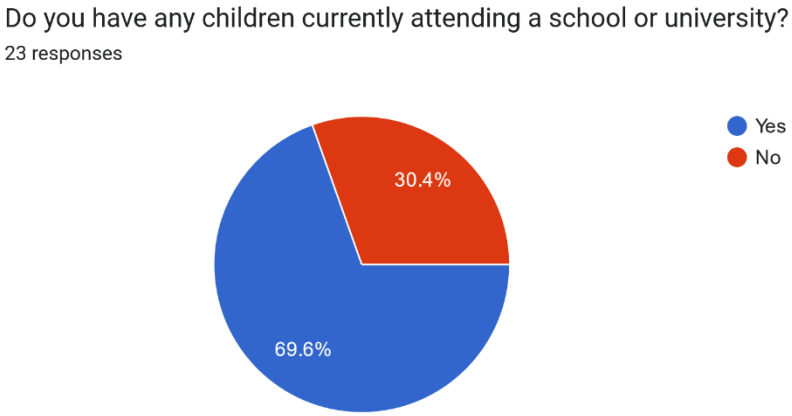

Figure 2: School Attendance

Respondents Level of Education

The findings revealed that most of respondents (17.4%) are studying Grade 12, NQF Level 4 (8.7%), Bachelor's degree (8.7%), Honours degree (8.7%) and Masters degree (4.3%).

The participants shared their challenges regarding loading as a barrier to learning. The most regular responses were grouped in themes. Some of the verbatim responses to the interview questions are categorised in themes and presented below.

Backup Systems to Loadshedding

Some respondents (n=18) indicated that in order for the learners and students to adapt to loadshedding, they have backup plans in place. It was mentioned that solar panels, solar lights and rechargeable bulbs are important during loadshedding. Some of the respondents indicated with sign of relieve that when it is loadshedding, the study time is not over. Parents and students ensure that they use their backup solar systems, inverters and Ups so that students are able to study without any challenges. While other students mentioned that they are using candles to study during load shedding. Participants pointed out that the solar panels, solar lightning and rechargeable bulbs make life easier during loadshedding, so that learners and students are able to continue with their studies. Although other backups need to be charged on time to avoid difficulties that can be encountered during loadshedding. Higher institutions in Nepal are connected to the generators to mitigate the load shedding (Shankar, 2012). Students use LED lamps, backup lights and generators to study during loadshedding (Goldberg (2015).

Technology

Most participants indicated the importance of technology and alternative sources used during loadshedding. The findings clearly stated that students check the load shedding schedule in

advance to manage time effectively. So that their technology tools such as phones and laptops are charged on time. Students revealed that they are able to communicate among themselves regarding their studies any clarification needed and what to cover in their studies through the use of technology tools. In order that no student misses the work due to loadshedding. Abi Ghanem et al. (2016) agreed that students in the United Kingdom bought generators, candles, battery powered devices and technology devices to be able to learn during blackouts.

Although, technology plays a very significance role irrespective of loadshedding. some of the respondents complained that sometimes they are unable to do their studies due technology difficulties. The students and learners cannot complete homework during loadshedding due to lack of network and electricity. There is no Wi-Fi for them to access the internet and all the work given. The electronic devices batteries die and learners and students are unable to access their work. They become clueless in knowing what to do and what work to complete where there is no electricity.

Results suggested that most of the respondents encounter various challenges when trying to engage in educational activities outside the classroom during loadshedding. It was shared that the students and learners cannot complete homework during loadshedding due to lost study time and poor lighting. Students and learners sleep during loadshedding and start to work after loadshedding. Most participants stated that they are unable to effectively study due to no light, they do not see clearly when the solar lights are not charged on time. They end up being bored, experiencing loss of concentration and having too much homework without enough practical work. Thus, it is difficult for students to study and complete homeworks during load shedding. Gurajena et al. (2021) and Samsuri et al. (2014) concurred that students are unable to study at night, they get bored and end up sleeping.

The participants comments showed that they are embracing Hybrid learning models such as synchronous online classes, asynchronous content and blended approach. The lecturers are employed innovative pedagogical approaches that minimised the challenges impacting negatively on academic activities. Lectures upload online materials, deliver lectures, provide pre-recorded lessons, online resources and self-paced learning materials that students access anytime irrespective of the load shedding. Digital learning makes teaching and learning enjoyable and easy during load shedding. However, respondents shared that most of the time loadshedding disturbs the online teaching and learning. The findings are supported by Onwuegbuzie and Ojo (2021); Mwila et al. (2021), Omodan and Ige (2021) and Bwalya Umar et al. (2022) stating that loadshedding affects the use of technology tools during online classes.

Nevertheless, few participants (n=2) indicated that they have not experienced any innovative teaching methods that positively impacted their learning experiences during loadshedding.

Absenteeism

Respondents stated that loadshedding affect them during loadshedding as they arrive late at the lecture rooms. The traffic lights are not operating and causes traffic. Conversely, other student implied that loadshedding does not affect them to be absent at school/university/college. Pasha and Saleem (2013) support the findings that students in Pakistan arrive late at the college due to blackouts.

Implications

Higher institutions need to plan ahead and have strategies in place, so as to mitigate the difficulties faced by students when learning their academic activities during loadshedding. Strategies such as provision of hybrid learning and provision of alternative backup systems that are in place at all times. So that students' academic studies are flexible, whereby students are able to study anywhere and anytime. The colleges/ universities management must continually plan in advance the alternative sources of creating energy to safeguard continuous supply of electricity in the college for academic activities. There should be continuous supply of electricity in the lecture halls, computer laboratories, libraries, lecturer's offices and student's residence, so that teaching learning can take place without any hindrance.

Conclusion

Load shedding is a hindrance to daily life, individuals need to adjust, plan in advance because they have to face it nearly every day. Literature has revealed that blackouts are expensive to manage and maintain. Higher institutions, households are obliged to have alternative backup systems almost daily, otherwise they will be left in the dark. Appropriate planning and arrangement in previous years could have assisted South Africa to mitigate the electricity challenges that are being faced currently (Pretorius and Burger, 2015).

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