

Influence of Power Supply Reliability on Academic Performance and Project Completion Rates of Architectural Students at Caleb University, Lagos, Nigeria

Temiloluwa Oluwapelumi Susan Owolabi ; Abiola Oluwabunmi Bello ; Ayomikun John Olatunji; and Steve Jayeoba

Department of Architecture, Caleb University, Imota, Lagos State, Nigeria.

Corresponding author: temiloluwa.owolabi@calebuniversity.edu.ng

DOI: <https://doi.org/10.62154/qjhc.2024.016.010391>

Abstract

This study investigates the influence of power supply reliability on academic performance and project completion rates among architecture students at Caleb University. The research adopts a quantitative approach, using a structured questionnaire to gather data from a representative sample of students across BSc, MSc, and PhD programs. Of the almost 700 population, 255 were sampled and the findings reveal that power interruptions are a frequent and significant issue, with 85% of students experiencing outages at least once a week and 60% reporting outages lasting between 1 to 3 hours. These disruptions have a pronounced negative impact on academic performance, with 78% of respondents indicating that power outages have adversely affected their grades. Furthermore, 82% of students reported delays in project completion due to power interruptions, with a substantial number having to redo portions of their work due to unsaved progress. The study highlights a strong correlation between the frequency of power outages and the decline in academic performance, as well as the delays in project completion. Additionally, the psychological impact of these outages, manifested in increased levels of stress and anxiety among 70% of respondents, further exacerbates the challenges faced by students. The research concludes that reliable power infrastructure is crucial for academic success, particularly in technology-intensive disciplines like architecture. Recommendations include improving power infrastructure, implementing energy management strategies, developing contingency plans, enhancing student support services, and fostering collaboration with power utility providers. By addressing these issues, educational institutions can create a more stable and conducive learning environment, thereby enhancing students' academic outcomes and overall well-being.

Keywords: Academic Performance, Architecture Students, Power Supply Reliability, Project Completion, Stress and Anxiety.

Introduction

According to Eze, Chinedu-Eze, Okike, & Bello (2020), the reliability of power supply is a critical factor in the functioning of educational institutions, particularly in environments that heavily rely on technology for teaching, learning, and project execution. In higher education, where students are expected to engage in complex academic tasks, complete assignments, and meet project deadlines, the stability of energy supply becomes indispensable. The advent of digital tools, online resources, and technology-based learning

methods has further heightened the need for a consistent and reliable power infrastructure (Timotheou, Miliou, Dimitriadis, Sobrino, Giannoutsou, Cachia, & Ioannou, 2023). In regions like Sub-Saharan Africa, where power supply can be erratic, students often face challenges that can impede their academic progress (Adarkwah, 2021). Caleb University, a significant academic facility in Sub-Saharan Africa, serves as a case in point where the inconsistencies in energy supply have raised concerns about their potential impact on students' academic performance and their ability to complete projects on time.

Despite the acknowledged importance of reliable power supply in academic settings, many educational institutions in Sub-Saharan Africa continue to grapple with power-related challenges. These challenges are not merely inconveniences but are believed to have a profound effect on students' academic outcomes (Mtebe & Raphael, 2017; Alutu, 2024). At Caleb University, frequent power outages and delays in power restoration create an unstable environment for students to study and complete their assignments and projects. Architecture students, in particular, are significantly impacted due to their reliance on technology for research, design, and learning activities.

Problem Statement

The problem this study seeks to address is the impact of unreliable power supply on the academic performance and project completion rates of architecture students at Caleb University. The frequent power interruptions, combined with the delays in restoration, disrupt students' ability to meet academic deadlines, complete technology-dependent projects, and perform optimally in their studies. This issue is pressing in an academic environment where digital tools are essential, and it poses a risk to the academic success and future career prospects of students. Failure to address this problem could result in prolonged project timelines, diminished academic performance, and overall dissatisfaction among students. Therefore, this study investigates how power supply reliability affects students' academic outcomes and provides recommendations to mitigate the negative consequences.

The primary aim of this study is to assess the impact of power supply reliability on students' academic performance and project completion rates. The study objectives are to:

- i. evaluate how frequent power interruptions affect students' ability to complete academic projects on time,
- ii. determine the correlation between power supply reliability and students' overall academic performance,
- iii. identify the key factors related to power supply that most significantly influence students' project completion rates, and
- iv. provide recommendations on how to mitigate the negative effects of power supply disruptions on academic outcomes.

Literature Review

Theoretical Framework

The relationship between power supply reliability and academic performance can be understood through several theoretical lenses. One relevant framework is the Resource-Based View (RBV), which posits that the availability and quality of resources significantly influence the performance of individuals and organizations (Ployhart, 2021; Patnaik, Munjal, Varma & Sinha, 2022). In the context of education, electricity is a critical resource that supports various academic activities, from simple tasks like reading to complex ones like conducting research or developing projects (Jili, Ede & Masuku, 2021). Another relevant theory is Maslow's Hierarchy of Needs, where stable power supply can be linked to the lower levels of the hierarchy, physiological and safety needs (Lester, 2020; Rojas, Méndez & Watkins-Fassler, 2023), forming a foundation upon which higher-level cognitive tasks, such as learning and problem-solving, can be effectively pursued. These theories highlight the importance of reliable energy as a foundational element that supports the higher-order academic achievements of students.

Impact of Power Supply on Academic Performance

Extensive research has been conducted on the impact of power supply on educational outcomes, particularly in developing countries. Studies (Abdulkareem & Lennon, 2023; Smith, Devine, Samonova, Capistrano, Sugrue, Sloan & Folan, 2024) have shown that inconsistent power supply can severely disrupt students' learning processes, leading to decreased academic performance. For instance, Olanrewaju, Adebayo, Omotosho & Olajide (2021) explored the effects of power outages on secondary school students in Nigeria, finding that frequent power interruptions were correlated with lower grades and higher dropout rates. Similar findings (Seada & Mostafa, 2017; Das, Chaudhary, Yadav, Yadav, Yadav, Chaudhary & Pandey, 2023; Konyani, Katanga, Chiundira, Mulenga & Mapulanga, 2024) have been reported in higher education contexts, where power supply issues have been linked to poor academic performance due to the inability to access online resources, complete assignments, or conduct essential research. The literature consistently underscores the negative impact of power disruptions on students' cognitive performance, motivation, and overall academic success.

Project Completion and Energy Availability

The completion of academic projects, particularly in higher education, often requires the continuous availability of energy, especially in disciplines that rely heavily on technology and digital tools. According to Moshood, Nawansir, Sorooshian, Mahmud & Adeleke (2020), the lack of a reliable power supply is a significant barrier to the timely completion of projects, particularly in fields such as engineering, architecture, and computer science, where the use of specialized software and hardware is essential. Another study (Amani, Myeya & Mhewa, 2022) highlighted that students often face delays in project completion due to power outages, which in turn affects their grades and academic progression. A study

by Kim, Hong, Kim & Yeom (2020) pointed out that energy availability not only affects the practical aspects of project work but also influences the psychological readiness of students to engage in and complete their projects suggesting a direct correlation between the stability of power supply and the ability of students to meet project deadlines, emphasizing the critical role of reliable energy in academic settings.

Technology-Dependent Learning and Power Reliability

In recent years, the integration of technology into education has transformed how students learn and complete academic tasks. The use of technology-based learning tools, such as projectors, computers, and online platforms, has become ubiquitous in higher education. However, the effectiveness of these tools is heavily dependent on the availability of a stable power supply. Research by Shrestha, Haque, Dawadi & Giri (2022) has shown that power interruptions can severely disrupt the use of these tools, leading to a decrease in student engagement and a reduction in the effectiveness of the learning process. In particular study by Nesfield (2023) has found that students in technology-intensive programs experienced greater frustration and lower satisfaction with their academic experience when power supply issues were frequent. This finding is consistent with other research that emphasizes the need for uninterrupted power supply to maximize the benefits of technology-enhanced learning environments.

Gaps in the Literature

While the existing literature provides a comprehensive overview of the impact of power supply on academic performance and project completion, there are still gaps that need to be addressed. Firstly, much of the research has focused on secondary education or on general academic performance, with limited studies specifically examining the impact on project completion rates in higher education. Another gap is the need for studies that explore the specific aspects of power supply that most critically affect academic outcomes, such as the frequency of interruptions, the duration of outages, and the time taken to restore power. This study aims to fill these gaps by providing a focused analysis of the relationship between power supply reliability and project completion rates in a higher education context, using Caleb University as a case study.

Methodology

Research Design

The research adopts a quantitative approach, utilizing a survey research design to explore the influence of power supply reliability on academic performance and project completion rates among architecture students in Caleb University. The choice of a survey design is driven by the need to collect data from a large population in a structured manner, allowing for the statistical analysis of responses to determine patterns and correlations. Given the specific focus on power supply issues and their impact, the survey method is appropriate as

it facilitates the collection of data on personal experiences, perceptions, and the direct effects of energy reliability on academic outcomes.

Population and Sampling

The study population consists of approximately 700 students from the Department of Architecture at Caleb University. This includes students across all levels of study, from undergraduate (BSc) to postgraduate (MSc and PhD) programs. To ensure a representative sample, participants were randomly selected from this population. Random sampling was chosen to minimize selection bias and to ensure that the sample accurately reflects the diverse experiences of students across different academic levels. The sample size was determined using Yamane Formula, ensuring that it is large enough to provide statistically significant results while being manageable within the scope of the study.

Using the Yamane formula:

$$n = \frac{N}{(1 + Ne^2)}$$

$$n = \frac{700}{(1 + 700 \times 0.05^2)} = 255$$

Where, n = Sample size; N = Population size; e = Margin of error = 0.05 (95% confidence level)

Data Collection Instruments

The primary data collection instrument used in this study is a structured questionnaire designed to capture students' experiences and perceptions regarding power supply reliability and its impact on their academic performance and ability to complete projects. The questionnaire was developed based on the research objectives and literature review, ensuring that it covers key aspects such as the frequency and duration of power outages, the impact of these outages on study routines and project deadlines, and the overall effect on academic performance. The questionnaire includes a mix of closed-ended and Likert-scale questions, allowing for both quantitative analysis and an understanding of the intensity of students' experiences.

Data Collection Process

Data collection was conducted over a period of two weeks, during which the questionnaires were distributed to the randomly selected architecture students in Caleb University. Participants were approached individually and informed about the purpose of the study, ensuring that they provided informed consent before participating. To encourage honest and accurate responses, the questionnaire was designed to be anonymous. Data collection was facilitated by the researchers who ensured that the process was smooth and that all questionnaires were properly filled out and returned.

Findings and Discussions

Overview of Respondent Demographics

The survey data reveals that the respondents comprised students from different academic levels within the Department of Architecture at Caleb University. Of the 700 students, a representative sample of 255 was surveyed, including students from the BSc, MSc, and PhD programs. The demographic data, depicted in Table 1, shows a balanced distribution of respondents across these levels, ensuring a comprehensive understanding of how power supply issues impact students at different stages of their academic journey. The analysis of demographic data indicates that a majority of respondents are full-time students, aged between 18 and 35, with varying levels of reliance on technology for their academic activities.

Table 1: Demographic Profile of Survey Respondents

Academic Level	Number of Respondents	Percentage
BSc	100	39.2%
MSc	80	31.4%
PhD	75	29.4%
Total	255	100%

Source: Author's Fieldwork (2024)

Frequency and Duration of Power Interruptions

One of the primary aspects examined in the study was the frequency and duration of power interruptions experienced by students in Caleb University. The questionnaire responses shown in Figure 1 indicates that power interruptions are a common occurrence, with 85% of respondents reporting experiencing power outages at least once a week. The duration of these outages varied, with a significant portion (60%) indicating that outages typically lasted between 1 to 3 hours, while 25% reported outages lasting more than 3 hours. The high frequency and extended duration of these outages suggest a significant challenge in maintaining a stable learning environment, particularly for students engaged in time-sensitive academic tasks.

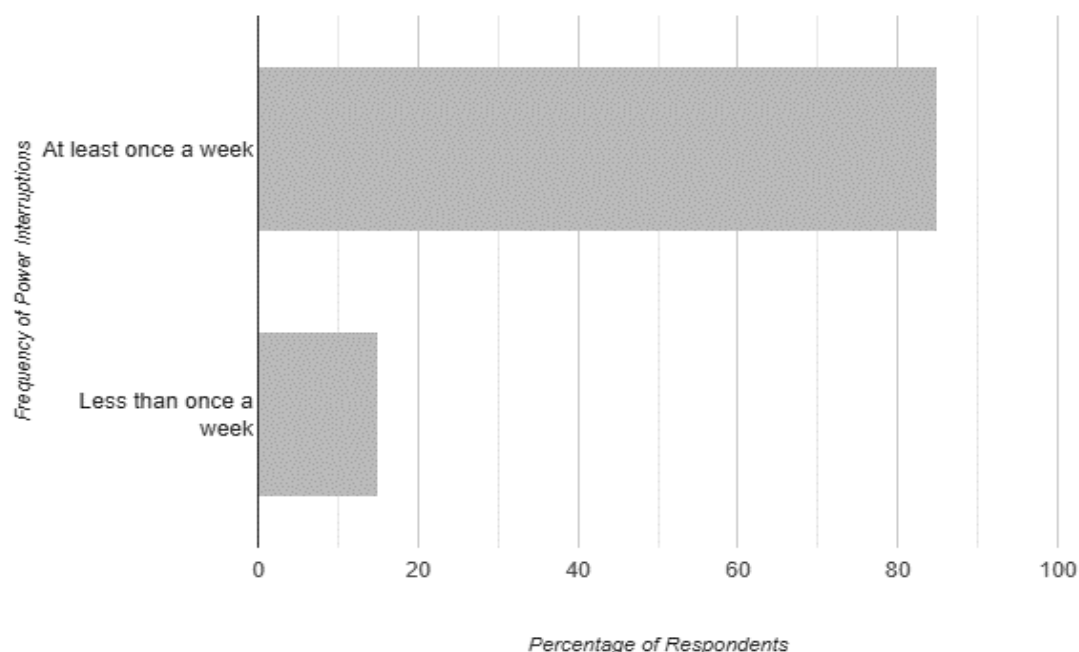


Figure 1: Frequency of Power Interruptions

Source: Author’s Fieldwork (2024)

These findings are consistent with the literature, which emphasizes the negative impact of frequent and prolonged power outages on educational outcomes. The data corroborates the assertion by (Khan, Hasan & Clement, 2012; Aminu & Rahaman, 2014; Kamat & Nasnodkar, 2019) that unreliable power supply is a significant barrier to academic success, particularly in settings where students rely heavily on technology for their studies. The frequent interruptions not only disrupt students’ study routines but also create an atmosphere of uncertainty, making it difficult for them to plan and execute their academic tasks effectively.

Impact of Power Interruptions on Academic Performance

The survey explored the direct impact of power supply reliability on students' academic performance. A substantial proportion of respondents (78%) indicated that power interruptions have negatively affected their grades as shown in Figure 2. Specifically, students reported that power outages during critical study periods or while working on assignments led to reduced study time, missed deadlines, and lower-quality work submissions. The correlation analysis between the frequency of power outages and self-reported academic performance revealed a statistically significant negative relationship, suggesting that as the frequency of power outages increases, students’ academic performance tends to decline.

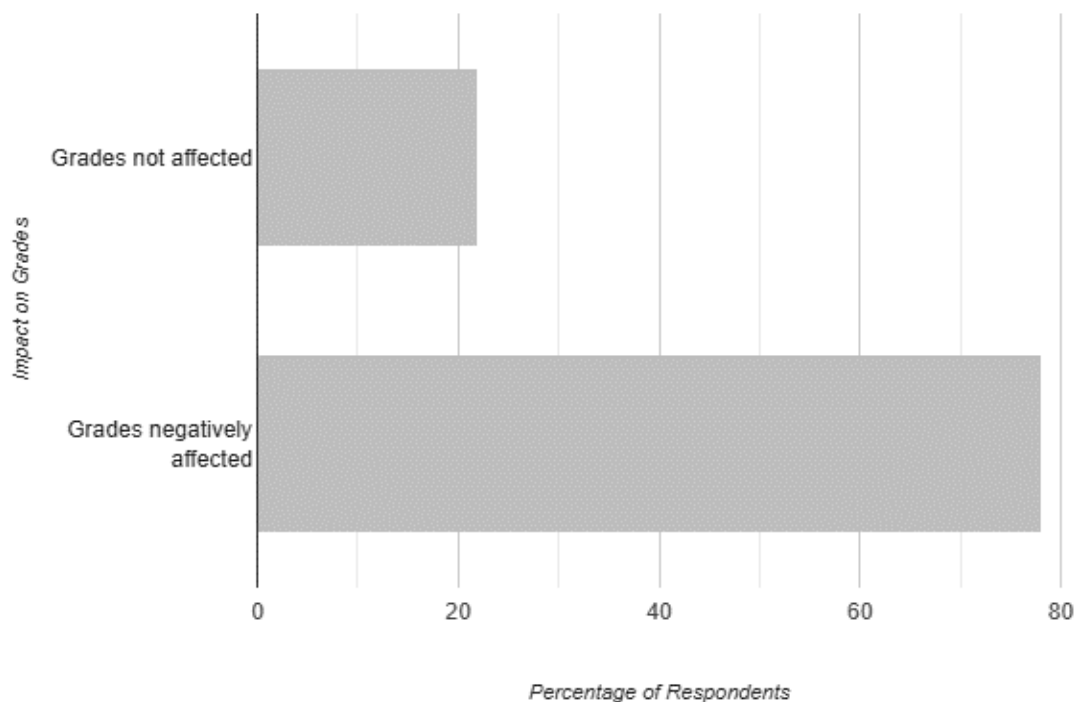


Figure 2: Impact of Power Interruption on Grades

Source: Author's Fieldwork (2024)

These findings align with previous research by (Olanrewaju, Adebayo, Omotosho & Olajide, 2021), who identified a similar trend in secondary education settings. The consistent disruptions in power supply not only hinder students' ability to complete assignments but also diminish their cognitive focus and motivation, leading to poorer academic outcomes. The data from this study reinforces the critical need for reliable power infrastructure to support academic achievement, particularly in technology-driven disciplines like architecture.

Influence of Power Supply on Project Completion Rates

The completion of academic projects, especially in the field of architecture, requires the use of specialized software and tools, which are heavily dependent on a stable power supply. The survey data indicates that 82% of respondents as shown on Figure 3 experienced delays in project completion due to power interruptions. These delays were attributed to the inability to use necessary tools, such as computer-aided design (CAD) software, during outages. Moreover, 65% of students reported that they had to redo portions of their projects because power outages disrupted their progress, leading to a loss of unsaved work.

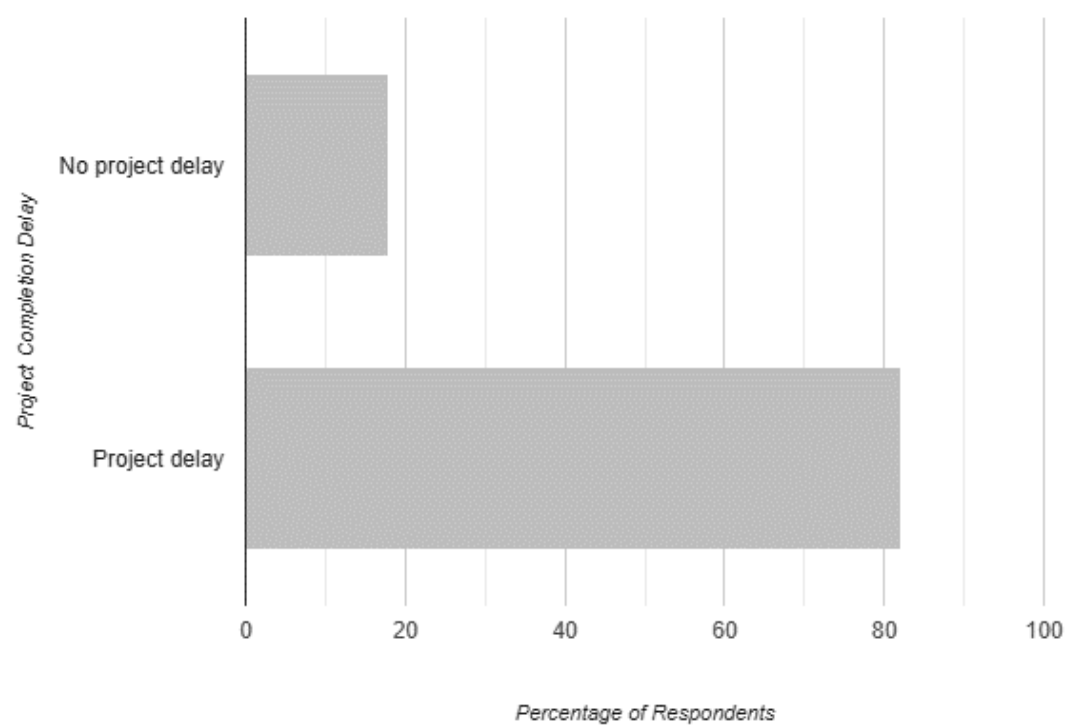


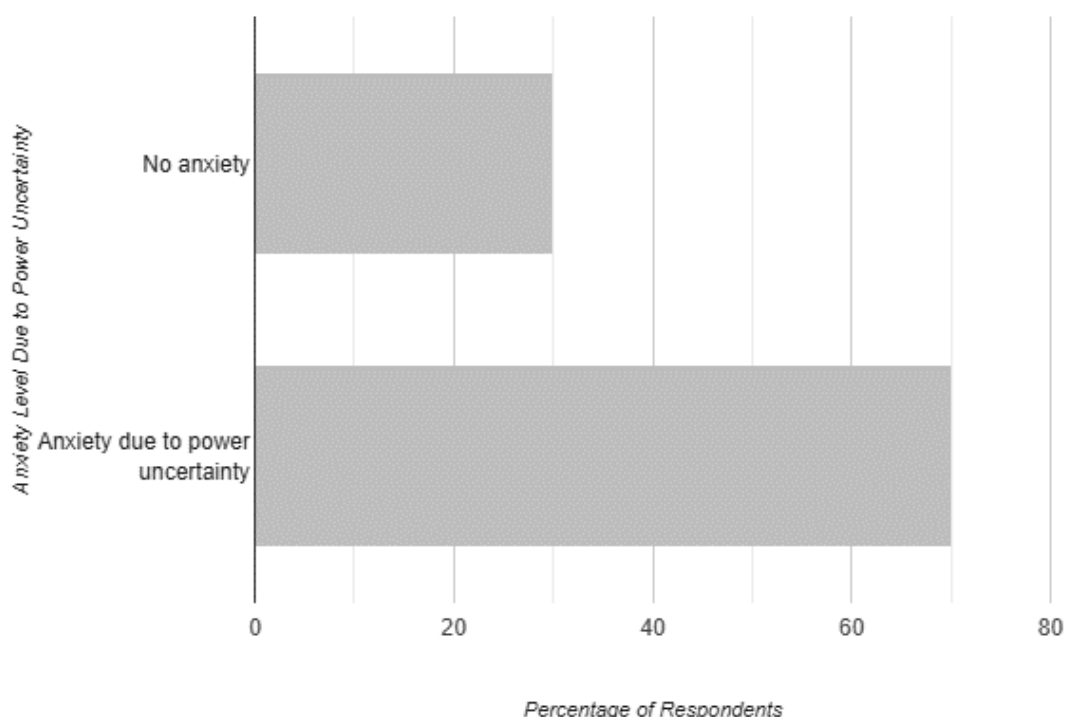
Figure 3: Impact of Power Interruptions on Project Completion

Source: Author’s Fieldwork (2024)

The regression analysis conducted on the data shows a strong positive correlation between power supply reliability and project completion rates, indicating that more reliable power supply is associated with higher rates of on-time project completion. This finding is consistent with the work of Khan, Ayub & Farooq (2022), who emphasized the importance of uninterrupted power supply in ensuring the timely completion of academic projects. The data from this study underscores the critical role that energy reliability plays in supporting students’ ability to meet project deadlines and achieve academic success.

Psychological Impact of Power Interruptions on Students

Beyond the practical challenges posed by power outages, the survey also highlighted the psychological toll these disruptions take on students. Figure 4 shows that a significant number of respondents (70%) reported feeling anxious or stressed due to the unpredictability of power supply. This anxiety was particularly pronounced among students who were nearing project deadlines or preparing for examinations. The data suggests that the uncertainty surrounding power availability contributes to a heightened sense of stress, which in turn affects students' overall well-being and academic performance.



Source: Author's Fieldwork (2024)

The literature on this topic, including studies by (Kim, Hong, Kim & Yeom, 2020; Brink, Loomans, Mobach & Kort; 2021), suggests that environmental stressors, such as unreliable power supply (as many of the lecture rooms rely on Air Conditioning Systems for cooling), can significantly impair students' cognitive function and motivation. The findings from this study corroborate these conclusions, highlighting the need for a more stable power infrastructure to mitigate these psychological effects and support a more conducive learning environment.

Discussion of Key Findings

The findings from this study clearly indicate that power supply reliability is a critical factor influencing academic performance and project completion rates among architecture students in Caleb University. The frequent and prolonged power outages reported by students have a direct and negative impact on their ability to study effectively, complete assignments on time, and meet project deadlines. The psychological stress associated with these outages further exacerbates these challenges, leading to diminished academic outcomes.

These findings have significant implications for educational policy and infrastructure development. They underscore the urgent need for improvements in the power supply to academic buildings, where students' reliance on technology is high. The study also suggests that universities should consider alternative power solutions, such as backup generators or

renewable energy sources, to ensure that students have access to the resources they need to succeed academically.

The discussion of these findings in relation to existing literature highlights the consistency of these issues across different educational contexts. However, this study adds to the body of knowledge by providing specific insights into the experiences of architecture students in a Nigerian university setting, offering a nuanced understanding of the challenges posed by unreliable power supply in this context.

Broader Context of the Findings Implication

These findings have significant implications not only for Caleb University but also for other higher educational institutions in Sub-Saharan Africa and beyond, where power infrastructure challenges are prevalent. The implications are twofold: institutional and policy-related.

Institutional Implications

For academic institutions, the results underscore the need for a more reliable power infrastructure, especially in fields like architecture where students are heavily dependent on technology. Without consistent access to power, students may struggle to meet academic expectations, which could lead to higher dropout rates or prolonged time to graduation. Beyond the immediate academic effects, unreliable power supply may discourage students from pursuing certain technologically intensive courses or careers, limiting the potential for innovation and growth in industries reliant on these fields. This suggests that universities, particularly those in regions with unreliable power grids, must prioritize investment in alternative energy sources such as solar power, inverters, or backup generators to create more resilient learning environments.

Policy-Related Implications

At a policy level, this study highlights the importance of national and regional government involvement in infrastructure development for education. The negative impact of power instability on academic performance is a critical issue that needs to be addressed through stronger policies advocating for stable and reliable energy supply in educational institutions. Furthermore, educational policymakers could work to integrate contingency measures for mitigating the effects of power outages, such as providing access to community learning hubs equipped with uninterrupted power or developing guidelines for universities to manage power-related disruptions to minimize their impact on academic schedules.

Significance in the Broader Educational and Development Context

The broader significance of these findings can be extended to the socio-economic development of the region. Reliable access to power is often seen as a prerequisite for economic growth, innovation, and improved quality of life. In the context of education, a

stable power supply plays a critical role in the development of a knowledge economy, where students and future professionals rely on digital literacy and technological competence. The frequent power outages experienced by students at Caleb University not only hinder their academic progress but also reflect the infrastructural challenges that may impede the region's long-term educational and economic goals.

Moreover, addressing power supply issues in academic institutions could serve as a model for other sectors of society. If universities can implement innovative energy solutions, these approaches could be scaled to broader community development projects, particularly in urban planning, healthcare, and other sectors that rely on consistent energy access.

This study's findings highlight the urgent need for infrastructural improvements to support academic achievement, particularly in technology-dependent fields. Addressing power supply issues is not only crucial for the immediate academic success of students but also for the broader development goals of fostering innovation and economic growth in regions where energy reliability remains a critical challenge.

Conclusion and Recommendations

Conclusion

The findings of this study unequivocally demonstrate that the reliability of power supply has a profound impact on the academic performance and project completion rates of architecture students at Caleb University. The frequent and prolonged power interruptions experienced by students significantly disrupt their academic activities, leading to lower grades, delayed project completions, and heightened levels of stress and anxiety. These disruptions are particularly detrimental in a discipline like architecture, where students are heavily reliant on technology for design work, research, and the completion of complex projects.

The study's analysis shows a clear correlation between the frequency and duration of power outages and the negative academic outcomes reported by students. The data also reveals the critical role that stable power supply plays in enabling students to meet deadlines, maintain high academic standards, and complete their projects on time. Additionally, the psychological impact of these power interruptions cannot be overlooked, as the uncertainty surrounding power availability adds a layer of stress that further impairs students' ability to focus and perform academically.

In conclusion, this study underscores the urgent need for reliable power infrastructure in educational settings, particularly in higher education institutions where the use of technology is integral to the learning process. The challenges faced by students in Caleb University are reflective of broader systemic issues within Nigeria's power sector, which, if left unaddressed, will continue to hinder the academic progress of students across the country.

Recommendations

Based on the findings of this study, several recommendations are proposed to mitigate the impact of power supply issues on students' academic performance and project completion rates:

- i. **Improvement of Power Infrastructure:** The most immediate and critical recommendation is the enhancement of power infrastructure. This could involve upgrading the existing power systems to ensure more reliable service, reducing the frequency and duration of outages. Additionally, investing in backup power solutions, such as generators or solar power systems, would provide a more stable energy supply during outages, thereby minimizing disruptions to academic activities.
- ii. **Implementation of Energy Management Strategies:** The university should consider implementing energy management strategies that prioritize the allocation of power resources to critical academic areas. For instance, during periods of limited power supply, essential facilities such as lecture halls, computer labs, and studios could be given priority to ensure that students can continue their work with minimal disruption. This approach would require coordination between the university's facilities management team and the power utility providers.
- iii. **Development of a Contingency Plan for Power Outages:** It is recommended that the university develop a comprehensive contingency plan to manage the impact of power outages on academic activities. This plan could include guidelines for students on how to save their work regularly, the use of uninterruptible power supplies (UPS) for essential equipment, and the scheduling of critical tasks during times when power supply is typically more stable. Additionally, the university could establish a communication protocol to inform students of expected outages and provide alternative solutions, such as extended deadlines or alternative study spaces.
- iv. **Enhancement of Student Support Services:** Recognizing the psychological impact of power interruptions, the university should enhance its student support services to help students cope with the stress and anxiety associated with these disruptions. This could include offering counseling services, stress management workshops, and academic support programs that provide resources and strategies for managing academic tasks during power outages. Such services would help mitigate the negative effects of power-related stress on students' academic performance.
- v. **Collaboration with Power Utility Providers:** Finally, it is recommended that Caleb University establish a formal partnership with local power utility providers to address the specific power supply challenges faced by the university. By collaborating with these providers, the university could advocate for more reliable service, participate in pilot programs for improved energy solutions, and explore opportunities for joint investment in infrastructure upgrades. This collaboration

would not only benefit the university but could also serve as a model for other educational institutions facing similar challenges.

In summary, addressing the power supply issues in Caleb University is essential for ensuring that architecture students can achieve their full academic potential. By implementing the recommendations outlined above, the university can create a more stable and supportive learning environment that fosters academic success and enables students to complete their projects on time, thereby contributing to the overall quality of education provided.

References

- Abdulkareem, Z., & Lennon, M. (2023). Impact of digital divide on students' performance in computerised UTME in Nigeria. *Information Development*, 02666669231191734.
- Adarkwah, M. A. (2021). An Outbreak of Online Learning in the COVID-19 Outbreak in Sub-Saharan Africa: Prospects and Challenges. *Online Submission*, 21(2), 1-10.
- Alutu, C. E. (2024). Barriers to the use of computer-managed instruction in teaching and learning Basic Technology in Anambra State, Nigeria. *Konfrontasi: Jurnal Kultural, Ekonomi dan Perubahan Sosial*, 11(2), 60-70.
- Amani, J., Myeya, H., & Mhewa, M. (2022). Understanding the motives for pursuing postgraduate studies and causes of late completion: supervisors and supervisees' experiences. *Sage Open*, 12(3), 21582440221109586.
- Aminu, H., & Rahaman, S. (2014, June). Barriers thrusting e-learning to the backseat: Nigeria a case study. In *2014 IEEE Canada International Humanitarian Technology Conference-(IHTC)* (pp. 1-4). IEEE.
- Brink, H. W., Loomans, M. G., Mobach, M. P., & Kort, H. S. (2021). Classrooms' indoor environmental conditions affecting the academic achievement of students and teachers in higher education: A systematic literature review. *Indoor air*, 31(2), 405-425.
- Das, N., Chaudhary, G. P., Yadav, S., Yadav, U., Yadav, A. K., Chaudhary, S., & Pandey, J. (2023). Perception of Nepalese nursing students toward E-learning in Nepal. *Journal of Education and Health Promotion*, 12(1), 51.
- Eze, S. C., Chinedu-Eze, V. C., Okike, C. K., & Bello, A. O. (2020). Factors influencing the use of e-learning facilities by students in a private Higher Education Institution (HEI) in a developing economy. *Humanities and social sciences communications*, 7(1), 1-15.
- Jili, N. N., Ede, C. I., & Masuku, M. M. (2021). Emergency remote teaching in higher education during COVID-19: challenges and opportunities. *International Journal of Higher Education*, 10(5), 1-9.
- Kamat, Y., & Nasnodkar, S. (2019). A survey on the barriers and facilitators to edtech adoption in rural schools in developing countries. *International Journal of Intelligent Automation and Computing*, 2(1), 32-51.
- Khan, J. A., Ayub, A., & Farooq, U. (2022). Effects of Electric Load Shedding on Academic Performance of Students in Khyber Pakhtunkhwa. *Advances in Gender and Development Studies*, 1(1), 32-41.
- Khan, M. S. H., Hasan, M., & Clement, C. K. (2012). Barriers to the introduction of ICT into education in developing countries: The example of Bangladesh. *International Journal of instruction*, 5(2).
- Kim, H., Hong, T., Kim, J., & Yeom, S. (2020). A psychophysiological effect of indoor thermal condition on college students' learning performance through EEG measurement. *Building and Environment*, 184, 107223.
- Konyani, B., Katanga, P., Chiundira, F., Mulenga, C., & Mapulanga, P. (2024). E-learning preparedness of nursing students at Kamuzu University of Health Sciences in Malawi. *Education and Information Technologies*, 1-20.
- Lester, D. (2020). Hierarch of Needs (Maslow). In *Encyclopedia of Personality and Individual Differences* (pp. 1939-1944). Cham: Springer International Publishing.

- Moshood, T. D., Nawanir, G., Sorooshian, S., Mahmud, F., & Adeleke, A. Q. (2020). Barriers and benefits of ICT adoption in the Nigerian construction industry. A comprehensive literature review. *Applied System Innovation*, 3(4), 46.
- Mtebe, J., & Raphael, C. (2017). A decade of technology enhanced learning at the University of Dar es Salaam, Tanzania: Challenges, achievements, and opportunities. *International Journal of Education and Development using ICT*, 13(2).
- Nesfield, F. L. (2023). *International students' perception of the development of their digital academic writing identity based on their participation in an intensive English language program*. Pepperdine University.
- Nwuke, T. J., & Nwanguma, T. K. (2024). Provision and Utilization of Physical Resources for Effective Teaching and Learning Effectiveness in Public Universities in Rivers State.
- Olanrewaju, G. S., Adebayo, S. B., Omotosho, A. Y., & Olajide, C. F. (2021). Left behind? The effects of digital gaps on e-learning in rural secondary schools and remote communities across Nigeria during the COVID19 pandemic. *International journal of educational research open*, 2, 100092.
- Patnaik, S., Munjal, S., Varma, A., & Sinha, S. (2022). Extending the resource-based view through the lens of the institution-based view: A longitudinal case study of an Indian higher educational institution. *Journal of Business Research*, 147, 124-141.
- Ployhart, R. E. (2021). Resources for what? Understanding performance in the resource-based view and strategic human capital resource literatures. *Journal of Management*, 47(7), 1771-1786.
- Rojas, M., Méndez, A., & Watkins-Fassler, K. (2023). The hierarchy of needs empirical examination of Maslow's theory and lessons for development. *World Development*, 165, 106185.
- Seada, A. I., & Mostafa, M. F. (2017). Students' satisfaction and barriers of e-learning course among nursing students, Mansoura University. *IDOSI Publications*, 3(3), 170-178.
- Shrestha, S., Haque, S., Dawadi, S., & Giri, R. A. (2022). Preparations for and practices of online education during the Covid-19 pandemic: A study of Bangladesh and Nepal. *Education and information technologies*, 27(1), 243-265.
- Smith, A. J., Devine, D., Samonova, E., Capistrano, D., Sugrue, C., Sloan, S., ... & Folan, A. (2024). The COVID-19 pandemic and children's engagement with learning in rural Sierra Leone. *Cambridge Journal of Education*, 54(2), 221-237.
- Timotheou, S., Miliou, O., Dimitriadis, Y., Sobrino, S. V., Giannoutsou, N., Cachia, R., ... & Ioannou, A. (2023). Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review. *Education and information technologies*, 28(6), 6695-6726.