



Application of Centralized Artificial Intelligence-eLearning Based System in Delivering Competency-Based and Equal Access to Quality Education in Tanzanian Secondary Schools

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Abstract: The delivery of competency-based and equal access to quality education is the main goal of developing countries to end poverty by 2030. The entire plan has been impacted by an emergency outbreak of diseases such as COVID-19 which caused schools to use unusual teaching methods to cover the learning curriculum due to school lockdown. The study examined the problem and used a purposive sampling technique to collect data from teachers in the Arusha region. Structured interviews and questionnaires data collection methods were used to collect primary data from head teachers, academic teachers, and computer subject teachers to examine the learning system and impact of COVID-19 in delivering competency-based and equal access to quality education. After data analysis, findings revealed that COVID-19 and traditional classroom teaching systems impacted the delivery of competency-based and equal access to quality education during school lockdown. This situation alters the good plans of the government for ending employment dependencies to society by promoting innovations, creativity, and self-employment opportunities by offering quality education. To address these challenges, the study recommends that the government implement a centralized Artificial Intelligence eLearning-based system in secondary schools to transform the traditional classroom learning system into a virtual classroom to avoid the interruption of the education calendar and personalize the students' learning outcomes based on his/her interests. To successfully enhance the delivery of competency-based and equal access to quality education for self-employment, the education system of Tanzanian secondary schools should focus on students' learning content and not the curriculum coverage. This system will address the shortage of science and mathematics teachers facing secondary schools. Due to the significance of education in fighting against poverty, this article calls for amendments to the national ICT policy in education to address the challenges of an emergency outbreak of disease that has been affecting the sector of education.

Keywords: Centralized Artificial Intelligence, eLearning-Based System, Competency-Based, Equal Access to Quality Education

1. INTRODUCTION

Competency-based education plays a significant role in poverty alleviation [1]. It promotes self-confidence, creativity, and innovation by preparing learners to solve various technical and non-technical problems in socio-economic activities [2]. The government of Tanzania works closely with the United Nations to end poverty by ensuring equal access to quality education for its citizens by 2030 [3]. To successfully achieve this, the government has implemented various education programs, education policies, and innovations to ensure the goals of Sustainable Development are successfully reached. Despite government efforts, an emergency rise of global diseases has been impacting the processes of ensuring the effective delivery of competency-based and equal access to quality education to students that promotes innovations towards self-employment in all sectors of the economy.

In the year 2024, the World Health Organization (WHO) announced the emergence outbreak of Mpox epidemics in Africa [4]. This kind of disease can impact the education sectors in developing countries and other socio-economic activities like COVID-19 [5]. The outbreak of the COVID-19 pandemic impacted competency-based and equal access to quality education in Tanzanian secondary schools. During the school lockdown, when students were supposed to learn at home, most students from rural areas failed to get learning materials compared to students from urban areas due to the lack of smartphones [6]. Still, the outbreak of the Mpox epidemic can impact the education sector if schools continue to use the classroom learning system rather than shifting to virtual classrooms.

Most developing countries struggle with how to achieve the Sustainable Development Goals (SDGs) due to various challenges which include the emergence rise of pandemics and epidemics which have been impacting the sector of education and other socio-economic activities across the globe [7]. In Tanzania, schools, colleges, and educational institutions of higher learning were closed to adhere to the rule of obeying social distance announced by the World Health Organization [8]. Most Tanzanian schools adopted a new learning system by using mobile phones to deliver students' learning materials to parents [9]. This learning system was ineffective for most schools and students in both urban and rural

areas since it requires parents and teachers to own a smartphone to get the students' materials [6]. This platform did not provide a platform for teachers to track and monitor the student's academic progress [10]. Furthermore, learning by phone was a new learning system for most students, and only parents with access to mobile phones and internet bundles managed to receive materials from teachers for their children [11]. These situations failed to create a safe learning environment. It leads to ineffective delivery of competency-based and unequal access to quality education.

The practice of delivering competency-based and equal access to quality education can be achieved by creating a conducive eLearning system. The only eLearning that can enhance quality education is to implement a centralized eLearning system that provides interactivity to make teachers monitor and track students' learning progress more easily. During COVID-19, South Wales, Germany, India, Austria, Australia, and other developing countries used an eLearning system to teach students during school lockdown [12]. The system was not primarily intended to enhance the delivery of competency-based and equal access to quality education. However, it was just for letting schools provide education for students despite school lockdowns [13]. In Tanzania, competency-based and equal access to quality education is required to promote self-confidence, innovation, creativity, and self-employment opportunities to its citizens to end employment dependences and poverty by 2030. To achieve this mission, a centralized artificial intelligence eLearning-based system is required in Tanzanian secondary schools to personalize students learning based on their interests and enhance teachers' tracking and monitoring of students' learning progress.

2. RELATED WORKS

This section critically examines the related studies conducted by various scholars on the impact of COVID-19 on delivering competency-based and equal access to quality education during school lockdown. The part consists of a theoretical and empirical literature review. The theoretical literature review was used to extract the major concepts and theories discovered by past educational scholars on the importance of quality education in promoting creativity and self-employment opportunities for poverty alleviation. To contribute scientific knowledge of enhancing the delivery of competency and equal access to quality education towards SDGs 2030, the study used an empirical literature review to examine challenges facing the educational sector in developing countries including Tanzania when an outbreak of global diseases led to a school lockdown.

2.1 Theoretical Literature Review

The study examines the impact of the learning system adopted by most schools during lockdown where students were required to learn at home with the supervision of parents. The term equal access to quality education consists of two terms "quality" and "education". Quality refers to the term used to describe the standard of something or services provided, whether low or high [14]. The term education in this study refers to the discipline that provides knowledge and skills to the people who are required to perceive success [15]. Equal access to quality education is explained as an effective process of transferring knowledge and skills to the students to achieve the desired learning outcomes [3]. Access to quality education is a continuous process of monitoring the performance of the prior goal to determine the achievement of the desired standard. In education, the quality of education ensures the high achievements of students in terms of understanding, knowledge, and skills in the aspects of human life [16]. For Tanzania to successfully achieve the goal, the application of centralized artificial intelligence eLearning-based systems is required to customize and personalize the student's learning based on his /her interest without any disruption for the whole academic year.

The delivery of competency-based and equal access to quality education is the main agenda of developing countries in ending poverty by 2030[17]. A safe learning environment in schools that promotes effective learning is one of the major indicators of the provision of quality education [18]. However, the outbreaks of Mpox and COVID-19 have been altering the achievements of these goals [19]. The creation of a safe learning environment for students as the plan of ending poverty by 2030 through the provision of quality education using traditional classroom teaching methods is not enough in this era when there is an unregular disruption of the education system due to outbreaks of global diseases like Mpox and COVID-19. Tanzania and other developing countries can only achieve this goal, by preventing disruption of the education systems and by implementing a centralized eLearning system that provides a personalized learning platform for students' learning outcomes based on his / her competency and interest. Also, the centralized eLearning platform is intended to address the shortage of teachers in the country by assigning one subject teacher to teach all schools. The system has to support teachers in monitoring and tracking the progress of the individual students learning outcomes.

2.2 Empirical Literature Review

Various studies reported the impacts of COVID-19 on the education sector [20], [21]. Education scholars recommend that schools, colleges, and universities transform classroom teaching methods into virtual classroom teaching methods and not wait until school lockdown [12], [23]. Due to the various emerging eLearning technologies, these studies did not specify the types of eLearning systems that customized and personalized the students' learning to enhance the delivery of competency-based and equal access to quality education. For Tanzania to deliver competency-based and equal access to quality education that promotes innovative skills for self-employment, schools need an artificial intelligence eLearning-based system that personalizes the student's learning outcomes based on his/her interest.

A study conducted in the Lindi region [24] investigated how public schools managed the risks associated with COVID-19. The study recommended schools implement risk management plans to avoid the disruption of education activities caused by emergency outbreaks of global diseases. Despite a good recommendation, the study did not clearly explain how risk

management plans can help schools to successfully achieve delivery of competency-based and equal access to quality education for poverty alleviation. Another study conducted by [25] explored the academic challenges faced by teachers, students, and parents during COVID-19 when teachers were forced to use mobile phones to deliver learning materials to some students whose parents had mobile phones. However, the study did not disclose scientific knowledge to educational policymakers on how these teaching tools deliver equal access to quality education for students whose parents did not have access to mobile phones.

3. METHODOLOGY

Research methodology is a scientific approach used to describe the methods and techniques used to investigate the research study on a specific topic to contribute scientific knowledge [26]. The approaches outline the research design, data collection methods, sampling techniques, sample size, materials, and tools used for data analysis and interpretations. The study investigated the impact of COVID-19 in Tanzanian secondary schools by collecting primary data from teachers. The study considered all ethical issues and the privacy of participants. Ethics are philosophical issues that involve practices that include an exercise of the protection of the privacy of research participants, reporting and publishing faith information, and ensuring adequate confidentiality of the data collected from the respondents [27].

3.1 Sampling Criteria

This study used purposive sampling to choose the study area and participants for data collection. Individual academic background, work experience, and demographic characteristics were used to select the study area and participants. The study was conducted in the Arusha region a northern zone of Tanzania. The north zone of Tanzania consists of the Arusha region popularly known as a city of tourism, the Kilimanjaro region, the Tanga region, and the Manyara region. The main factor that led to the selection of the Arusha region for the study area was the interaction of tourists from different countries visiting the region for tourism purposes. To obtain quality data and reliability of the findings, the study collected primary data from head teachers, academic teachers, and science subject teachers who teach computer studies subjects.

3.2 Sample Size

The Arusha region consists of a finite number of teachers of public secondary schools. To overcome research constraints associated with time and budgets, the study collected primary data from a sample size of ninety-six teachers of public secondary schools. For the accuracy and reliability of the research findings, the study used Cochran's sample size formula to obtain the total number of representatives for the study. The equations below outline Cochran's formula for obtaining a sample size of ninety-six teachers to participate in this study.

$$n_o = \frac{Z^2 p(1-p)}{me}$$
$$n_o = \frac{1.96^2 (1-0.5) 0.5}{0.01^2} = 96$$

Wherein n_o stands for the sample size, Z for the z-score, P for the population proportion, and me for the margin error. This study used a Z-score of 1.96 for a confidence level of 95%, a margin error (me) of 1%, and a population proportion P of 50% to obtain a sample size of ninety-six participants of the study.

3.3 Methods of Data Collection

This study used structured interviews and questionnaires to collect primary data from teachers. To obtain an insight into how pandemic diseases have been altering the processes of delivering competency-based and equal access to quality education in Tanzanian secondary schools, a face-to-face conversation with head teachers and computer teachers of public secondary schools was used to collect data. A structured interview is a quantitative data collection method whereby the interviewer sets prepared defined questions to be answered by the respondents in a face-to-face conversation [28]. Moreover, to get more opinions from teachers on the use of e-learning in teaching, the study used questionnaires to allow participants to disclose their knowledge and safeguard their privacy. Questionnaire data collection methods are a type of data collection that optimizes the privacy of respondents in a large sample of the population. To get high support from the respondents, the study used structured interviews to collect primary data from the government school teachers.

3.4 Data Analysis and Interpretation

The study cleaned the collected data before the data analysis processes started. After data cleaning, data analysis was performed to obtain reliable findings on how the traditional classroom learning system affects the delivery of competency-based and equal access to quality education in Tanzanian secondary schools during school lockdown.

4. RESULTS AND DISCUSSION

4.1 Learning System Used by Secondary Schools to Teach Students During School Lockdown

The study investigated the learning system adopted by secondary schools during lockdown. With this respect, the study collected primary data from ninety-six sample sizes of teachers of secondary schools in the Arusha region. After data

analysis, findings revealed that 43 % of teachers used smartphones to deliver learning materials to the students during school lockdown. 57 % of teachers failed to use smartphones or any other ICT digital tool to deliver learning materials for the students due to various factors such as costs of internet bundles, lack of electricity, and smartphones.

This kind of students' learning system experienced during school lockdown, did not consider the close supervision of teachers in monitoring students' learning progress. However, the system required parents to play the role of teacher in monitoring and managing the student's learning progress despite their educational background, professional skills, and availability. This situation made most students fail to get effective academic assistance and close supervision of teachers and parents. Figure 1 illustrates the findings from the study.

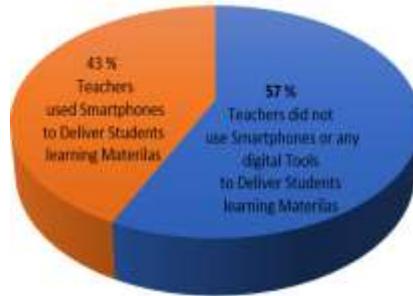


Figure 1: Learning system used by the school during school lockdown

Based on the above responses of the respondents regarding the system used by the school to teach students, it is clear that this kind of learning did not enhance equal access to quality education as some students failed to get learning materials due to various factors which include family' financial limitation while did not to get an effective academic assistant from professional experts and full guidance from their family members due to socio-economic activities. This system did not provide a platform for teachers to interact with students during the learning processes and has no ability for teachers to monitor and track the students' academic achievement and progress regarding the learning materials for a given learning outcome.

4.2 Learning System Used by Secondary Schools to Cover the Curriculum After School Lockdown

This study investigated the system used by schools to cover the curriculum after the lockdown when schools were opened to examine whether the system used by schools considers the delivery of competency-based quality education for students' academic achievements. In this regard, participants were asked how schools managed to cover the curriculum by involving those students who did not get learning materials during the school lockdown. After data analysis, findings revealed that due to time constraints, curriculum coverage was given more priority by schools than the delivery of competency-based quality education. After the school lockdown, schools were opened and teachers were asked to teach and compensate for the lost time caused by the lockdown by covering the curriculum before the end of the academic year. Study shows that, regardless of the remaining time for the entire academic year, teachers managed to cover the curriculum. In this respect, this learning system used to cover the curriculum after school lockdown opposes the learning system that enhances the delivery of competency-based education for students' academic achievements. The competency-based education does not focus on the completion of the syllabus or curriculum coverage but it focuses on the academic achievement of individual students in mastering a particular learning outcome of the subject matter [29].

4.3 Strategic Plan of the Education Policymakers

Moreover, the study assessed whether there is any strategic plan implemented by educational policymakers that aimed at addressing the challenges encountered by schools during lockdown. In this respect, the study collected data from head teachers to examine the plan of the education policymakers. After data collection and analysis findings revealed that 86 % of the respondents said that, there is no strategic plan implemented by the schools or educational stakeholders for safeguarding the future education prosperity in secondary schools. While 14 % of the respondents said that, they don't know whether there is any strategic plan implemented by the schools or educational stakeholders for safeguarding the future education prosperity in secondary schools in case of an emergence rise of the diseases like COVID-19. Figure 2 illustrates the findings of the assessment of the strategic plan for preserving future educational prosperity in case there is any emergency rise of diseases.



Figure 2. Assessment of the strategic plan of the education policymakers

4.4 Assessment of National ICT Policy for Education

The study reviewed the national ICT Policy for education to examine whether it addresses challenges encountered during school lockdowns. In this respect, the study conducted a face-to-face interview with computer teachers by asking questions about how the national ICT policy helped schools address the challenges of distance learning encountered during school lockdown. After discussion with participants, the study discovered that the national ICT policy for education has not been counted as a medium of instruction. The policy is meant to equip schools with the ability to teach students about computer literacy and not to solve education challenges that align with innovation and improving education skills for self-employment.

5. CONCLUSION

Competency-based and equal access to quality education for students of primary schools, secondary schools, colleges, and universities remains a tool for poverty eradication in developing countries. Competency-based and equal access to quality education promotes innovation skills and self-employment opportunities for graduates [30]. Due to the lack of employment opportunities for students graduating from higher learning institutions, competency-based and equal access to quality education will make Tanzanian citizens creative and innovative in their daily socio-economic activities. For Tanzania to successfully achieve sustainable development goals, the government should implement a centralized artificial intelligence eLearning-based system to personalize the learning of students based on his/her interests. Since competency-based and equal access to quality education plays a significant role in ending poverty, future research is highly needed to examine the viability of implementing personalized emerging eLearning systems for vocational and training education, colleges and universities to maximize the learning skills of students to promote students' innovation and creativity to reduce the employment dependences.

6. RECOMMENDATION

To successfully enhance the delivery of competency-based and equal access to quality education and promote innovative skills and self-employment opportunities for students graduating in their field of study. Investing efforts in eLearning technology has to be given priority by the government to innovate traditional teaching. Moreover, for Tanzania to achieve the goals of the SDGs 2030 successfully, investment in teachers of science, technology, and mathematics subjects should be given high priority to promote the ability of students to enroll in the fields of engineering, science, and technology at higher learning institutions. To successfully adapt to technological changes in the application of ICT in education, the study calls for educational policymakers to amend the innovative national ICT policy for education. Moreover, extensive training is required for teachers on the use of centralized artificial intelligence eLearning-based systems to effectively enhance competency-based and equal access to quality education regardless of any disruption of academic activities.

REFERENCES

- [1] Tarkar, P. (2021). Impact of Covid-19 Pandemic on Education System. *EPRA International Journal of Environmental Economics, Commerce and Educational Management*, 29(9), 6–8. <https://doi.org/10.36713/epra6363>
- [2] Chasubuta, A., & Ndibalema, P. (2024). Barriers hindering Effective Engagement in Online Assessment for Teacher Education in Tanzania: Perspectives from two Teachers' Colleges. *Journal of Issues and Practice in Education*, 16, 31–48. <https://doi.org/10.61538/jipe.v16i.1422>
- [3] Cilliers, J., & Oza, S. (2021). What Did Children Do During School Closures? Insights from a Parent Survey in Tanzania. *Research in Improving System of Education*, 5(2), 1–10.
- [4] Datzberger, S., & Parkes, J. (2021). The Effects of COVID-19 on Education in Sub-Saharan Africa. *The Global South- Perspectives and Challenges*, 3(8), 45–56.
- [5] Galati, A. S. M. F. A. (2023). The Impact of Education and Culture on Poverty Reduction : Evidence from Panel Data of European Countries. *Social Indicators Research*, 0123456789. <https://doi.org/10.1007/s11205-023-03155-0>
- [6] Gitschthaler, M., Erling, E. J., Stefan, K., & Schwab, S. (2022). *Teaching Multilingual Students During the COVID-19 Pandemic in Austria: Teachers' Perceptions of Barriers to Distance Learning*. 13(3), 1–15. <https://doi.org/10.3389/fpsyg.2022.805530>
- [7] González-salamanca, J. C., Agudelo, O. L., & Salinas, J. (2020). Key competencies, education for sustainable development, and strategies for the development of 21st-century skills. A systematic literature review. *Sustainability (Switzerland)*, 12(24), 1–17. <https://doi.org/10.3390/su122410366>
- [8] Head, G. (2020). Ethics in educational research: Review boards, ethical issues, and researcher development. *European Educational Research Journal*, 19(1), 72–83. <https://doi.org/10.1177/1474904118796315>
- [9] Shayo, H., Mubyazi, G., Barongo, V., Bakari, M., Kiwale, Z., Fabbri, C., Turner, E., Rodrigues, K., & Devries, K. (2024). Experiences of teachers and students on school closures and their consequences during the COVID-19 pandemic in Nyarugusu refugee. *PLOS Blog Public Health*, 4(3), 1–17. <https://doi.org/10.1371/journal.pgph.0002917>
- [10] Unesco. (2017). *Guide to Indicators for SDG 4 Quality Education: Vol. 1.1* (Issue June). https://download.ei-ie.org/Docs/WebDepot/2017_SDGs_Toolkit_eng_v1.1.pdf
- [11] Kimario, T., & Otieno, K. (2022). Effects of Competency-Based Curriculum on Students' Education Achievement: A Study of Secondary Schools in Arusha City Council, Tanzania. *Journal of Research Innovation and Implications in*

Education, 6(1), 201–210

- [12] Mahundu, G. F. (2020). COVID-19 Disease Pandemic Lockdown: Schools Closure and Students E-Learning Options in Tanzania. *SSRN Electronic Journal*, 7(4), 1–15. <https://doi.org/10.2139/ssrn.3698554>
- [13] Makunja, G. (2015). Adopting Competence-Based Curriculum to Improve Quality of Secondary Education in Tanzania : “ Is it a Dream or Reality ”? *International Journal of Education and Research*, 3(11), 175–188.
- [14] Mohzana, Arifin, M., Pranawukir, I., Mahardhani, A. J., & Hariyadi, A. (2024). Quality Assurance System In Improving The Quality Of Education In Schools. *Mudir (Jurnal Manajemen Pendidikan)*, 6(1), 115–123. <https://ejournal.insud.ac.id/index.php/MPI/article/view/830/646>
- [15] Mutura, E., Massam, W. E., Oluga, M. A., Rarieya, J., & Wango, N. (2024). Investigating the Management of COVID-19 Pandemic Risks in Primary Schools: A Case of Public Primary Schools in Lindi Region, Southern Tanzania. *International Journal of Learning and Development*, 14(1), 73. <https://doi.org/10.5296/ijld.v14i1.21077>
- [16] Mwamwaja, E. E. (2020). An Assessment of the Impact of the COVID-19 Pandemic on the Tourism Sector in Tanzania. *International Tourism and Hospitality Journal*, 3(4), 1–15. <https://doi.org/10.37227/ithj-2020-02-56>
- [17] Rahi, S. (2017). Research Design and Methods: A Systematic Review of Research Paradigms, Sampling Issues and Instruments Development. *International Journal of Economics & Management Sciences*, 6(2). <https://doi.org/10.4172/2162-6359.1000403>
- [18] Rashid, S., & Yadav, S. S. (2020). Impact of Covid-19 Pandemic on Higher Education and Research. *Indian Journal of Human Development*, 14(2), 340–343. <https://doi.org/10.1177/0973703020946700>
- [19] Ruslin, Mashuri, S., Rasak, M. S. A., Alhabsyi, F., & Syam, H. (2022). Semi-structured Interview: A Methodological Reflection on the Development of a Qualitative Research Instrument in Educational Studies. *IOSR Journal Of Research & Method in Education (IOSR-JRME)*, 12(1), 22–29. <https://doi.org/10.9790/7388-1201052229>
- [20] Seni, A. J. (2022). *Journal of Management and Development Dynamics* 31(2) (2022). 31(2), 1–31.
- [21] Septianti, R., Wahab, A., Hastuti, R., & Purnama, Y. (2023). Re-examining the Impact of Covid-19 on Education. *Jurnal Pendidikan*, 7(1), 3934–3940.
- [22] Shavega, T. J., & Mabagala, D. L. (2023). COVID-19 Pandemic in Pre-Primary Children in Tanzania: Strategies and Challenges. *Huria Journal of the Open University of Tanzania*, 29(1), 136–151. <https://doi.org/10.61538/huria.v29i1.1234>
- [23] Shukia, R., & Marobo, S. (2024). Parental Engagement in Children’s Pre-Primary Education in Marginalized Communities in Tanzania Before and During the COVID-19 Era. *Journal of Research in Childhood Education*, 38(1), 61–76. <https://doi.org/10.1080/02568543.2023.2281556>
- [24] Sullivan, M. C. O. (2008). *Teacher Development : An international journal of teachers ’ professional development What is Happening in the Classroom ? A Commonsense Approach to Improving the Quality of Primary Education in Developing Countries What is Happening in the Classroom? January 2015*, 37–41. <https://doi.org/10.1080/13664530500200257>
- [25] Tsalis, T. A., Malamateniou, K. E., Koulouriotis, D., & Nikolaou, I. E. (2020). New challenges for corporate sustainability reporting: United Nations’ 2030 Agenda for sustainable development and the sustainable development goals. *Corporate Social Responsibility and Environmental Management*, 27(4), 1617–1629. <https://doi.org/10.1002/csr.1910>
- [26] Vuzo, M. (2018). Towards achieving the Sustainable Development Goals: Revisiting language of instruction in Tanzanian secondary schools. *International Review of Education*, 64(6), 803–822. <https://doi.org/10.1007/s11159-018-9740-z>
- [27] Walker, C. N. (2017). *Parents ’ and Teachers ’ Perspectives Regarding Parental Involvement and Student Achievement* [Walden University]. <http://scholarworks.waldenu.edu/dissertations> Part of the Teacher Education and Professional Development Commons.
- [28] WHO. (2023). Multi-country outbreak of Mpox. *WHO External Situation Report*, 28. <https://www.who.int/publications/m/item/multi-country-outbreak-of-mpox--external-situation-report-28-19> accessed on September-2023.
- [29] Zickafoose, A., Ilesanmi, O., Diaz-Manrique, M., Adeyemi, A. E., Walumbe, B., Strong, R., Wingenbach, G., Rodriguez, M. T., & Dooley, K. (2024). Barriers and Challenges Affecting Quality Education (Sustainable Development Goal No. 4) in Sub-Saharan Africa by 2030. *Sustainability*, 16(7). <https://doi.org/10.3390/su16072657>