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# COLLABORATIVE APPROACHES TO TEACHING EXPERIMENTAL PHYSICS IN RESOURCE-LIMITED SETTINGS

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## Abstract

*This study examines the challenges and potential solutions for experimental physics education in Nigeria, with a focus on the northern regions. The research highlights significant obstacles including inadequate resources, insufficient teacher training, overcrowded classrooms, and curriculum constraints. These challenges are particularly acute in rural and underfunded areas, creating a stark educational divide. The paper proposes collaborative approaches as a promising strategy to overcome these limitations. These include peer-to-peer learning initiatives, community partnerships, resource sharing, virtual and remote laboratory experiences, and the development of low-cost experimental setups. The study analyzes the implementation strategies for these approaches, discussing teacher training, curriculum adaptation, technology leverage, and sustainable partnerships. While acknowledging the potential benefits of collaborative methods in improving student engagement, understanding, and access to experimental learning, the research also addresses the challenges in implementing these approaches. These include issues of quality control, standardization, assessment, cultural resistance, and long-term sustainability. The paper concludes by outlining future directions for collaborative physics education in Northern Nigeria, emphasizing research opportunities, scaling successful models, and integration with broader STEM initiatives. Recommendations are provided for educators, administrators, policymakers, and community leaders to facilitate the adoption and success of collaborative approaches in experimental physics education. This research contributes to the ongoing dialogue on improving science education in resource-limited settings and offers insights that may be applicable to similar contexts in other developing nations.*

## Introduction

The teaching of experimental physics in Nigeria faces a complex array of challenges that significantly impact the quality of science education across the country. Nigeria, as Africa's most populous nation and largest economy, has a critical need for a robust STEM education system to drive technological advancement and economic growth (Pontianus and Oruonye, 2021). However, the current state of experimental physics education often falls short of meeting these aspirations, hindered by systemic issues that permeate the educational landscape.

In many Nigerian schools, particularly in rural and underfunded urban areas, the concept of a fully equipped physics laboratory remains a distant dream. Students frequently encounter physics solely through textbooks and theoretical lectures, divorced from the practical applications that bring the subject to life. (Dike, 2014). This disconnect is not merely a matter of educational preference but a fundamental gap that undermines the very essence of scientific inquiry. The absence of hands-on experimentation deprives students of the opportunity to develop crucial skills such as dataanalysis, experimental design, and the ability to reconcile theoretical predictions with real-world observations (Andersson ,2012).

The scarcity of resources extends beyond physical equipment. Many Nigerian physics teachers, despite their dedication, lack comprehensive training in modern experimental techniques (Babalola, 2017). This deficiency is often a result of their own education, which may have been similarly limited in practical exposure. The cycle perpetuates itself, with each generation of students potentially less prepared than the last to engage with the experimental aspects of physics, Archer, et.al,2020. Moreover, the rapid pace of technological advancement in physics research and industry means that even those teachers who received practical training may find their knowledge quickly outdated without ongoing professional development opportunities.

The importance of hands-on learning in physics cannot be overstated, particularly in the Nigerian context. Practical experiments serve not only to reinforce theoretical concepts but also to inspire curiosity and foster a deeper connection to the subject matter (Balogun, 2020). In a country where many students view physics as an abstract and challenging subject, tangible experiments can demystify complex principles and reveal their relevance to everyday life. This approach is especially crucial in Nigeria, where indigenous innovations in physics and engineering could play a vital role in addressing local challenges, from energy production to environmental conservation. Resource limitations in Nigerian schools vary dramatically, creating a stark educational divide. While some elite private institutions in major cities like Lagos, Abuja, and Port Harcourt may boast state-of-the-art laboratories, the vast majority of public schools and rural institutions struggle with basic infrastructural needs (Omuta,, 2010).. Many lack reliable electricity, making the operation of even simple electronic equipment a challenge. The absence of internet connectivity in numerous schools further isolates students and teachers from global educational resources and collaborative opportunities that could partly compensate for local limitations.

Financial constraints exacerbate these issues. With limited government funding allocated to education, and much of that absorbed by basic operational costs, little is left for investment in specialized physics equipment. Schools often prioritize subjects perceived as more immediately practical or less resource-intensive, further marginalizing experimental physics (Gamoran, 2003). . This financial squeeze affects not only equipment acquisition but also teacher training, curriculum development, and the ability to conduct field trips or participate in science fairs and competitions. The time constraints imposed by an overcrowded curriculum present another significant hurdle. Nigerian physics teachers often find themselves racing against the clock to cover extensive theoretical content, leaving little room for practical work (Ogunniyi, 2007).. This pressure is intensified by high-stakes examinations like WAEC and JAMB, which heavily influence students' future academic and career prospects. The focus on exam preparation often leads to a neglect of practical skills that, ironically, are crucial for success in higher education and the workforce.

In light of these myriad challenges, collaborative approaches emerge as a beacon of hope for revolutionizing experimental physics education in Nigeria. By fostering partnerships between educational institutions, industry, and international organizations, it becomes possible to pool resources, share expertise, and create innovative solutions tailored to the Nigerian context (Kruss et al., 2015).. These collaborations could take various forms, from inter-school equipment sharing programs to industry-sponsored mobile laboratories that travel between rural areas. Peer-to-peer learning initiatives offer another promising avenue, allowing students from better-resourced institutions to share their knowledge and experiences with those from less privileged backgrounds (Budhiraja, 2023). Virtual laboratories and remote experiment platforms, while not a complete substitute for hands-on experience, can provide valuable supplementary learning opportunities, especially in schools lacking physical equipment.

Community-based projects present an opportunity to make physics education more relevant and engaging. By involving students in local issues – such as designing solar-powered solutions for areas with unreliable electricity or creating water purification systems – experimental physics can be directly linked to community development (Saarinen, 2015). This approach not only enhances learning but also demonstrates the practical value of physics to students, parents, and community leaders, potentially increasing support for science education.

The implementation of these collaborative strategies is not without its challenges. It requires careful coordination, sustained commitment from various stakeholders, and a willingness to innovate and adapt (Zollo et al., 2016). However, the potential benefits are immense. By leveraging collective resources and knowledge, Nigeria can create a more equitable, engaging, and effective system of experimental physics education . This, in turn, can contribute to developing a new generation of Nigerian physicists, engineers, and innovators equipped to tackle the country's pressing technological and environmental challenges.

As this paper will explore in subsequent sections, the collaborative approach to experimental physics education in Nigeria is not just an academic exercise but a crucial step towards national development. Through detailed case studies, analysis of outcomes, and discussion of scalable models, we will examine how these collaborative strategies can transform the landscape of physics education in Nigeria, offering valuable insights for other developing nations facing similar resource constraints in science education.

## Current Challenges in Resource-Limited Settings

The teaching of experimental physics in Nigeria, particularly in the northern regions, faces a multitude of challenges that significantly impede the quality of science education (Aina & Salau, 1992). These challenges are deeply rooted in socio-economic factors, historical disparities, and systemic issues within the education sector. To fully appreciate the complexity of the situation, it is essential to examine each of these challenges in detail, with a specific focus on how they manifest in Northern Nigeria.

Experimental physics education in Nigeria, particularly in the northern states, faces significant challenges 16. The most visible issue is the scarcity of proper equipment and laboratory facilities, especially acute in rural areas. Many schools lack even basic equipment, limiting students to rote learning without practical experience (Aina & Salau, 1992). Harsh climatic conditions and security challenges in some areas exacerbate the problem, leading to rapid deterioration or destruction of available resources.

Inadequate funding permeates every aspect of education in Nigeria, with a severe impact on experimental physics. Northern states, struggling with lower economic output, often allocate minimal funds to science education (Kaindume, 2018). This translates to a near-total absence of resources for meaningful experiments or demonstrations, with teachers resorting to makeshift equipment or purely theoretical instruction. The funding shortage also affects maintenance and replacement of existing equipment, creating a vicious cycle of diminishing resources.

The quality of experimental physics education is heavily dependent on teacher expertise, an area where Northern Nigeria faces significant challenges. Many physics teachers, particularly in public schools, lack comprehensive training in modern experimental methods (Yusuf, 2021). This deficiency stems from various factors, including their own education in resource-poor environments and limited opportunities for continuous professional development. Language barriers and broader socio-economic challenges contribute to a smaller pool of qualified physics teachers, often resulting in non-specialists teaching the subject.

Overcrowded classrooms present another major obstacle, especially in populous northern states. Large class sizes make individual attention during practical sessions nearly impossible and create logistical challenges for conducting experiments (Amusa, 2020). Time constraints imposed by these conditions, combined with an extensive, examination-focused curriculum, leave little room for meaningful experimental work. Cultural factors in some conservative areas may also limit opportunities for extended school activities, particularly for female students (Dalieh, 2017). These multifaceted challenges significantly hinder the quality of experimental physics education in Northern Nigeria.

**Collaborative Approaches to Overcome Limitations**

In the face of the significant challenges facing experimental physics education in Nigeria, particularly in the northern regions, collaborative approaches emerge as a beacon of hope. These strategies leverage the power of collective effort, shared resources, and innovative thinking to overcome the limitations imposed by scarce funding, inadequate facilities, and insufficient training.

Collaborative approaches offer promising solutions to enhance experimental physics education in Northern Nigeria. Peer-to-peer learning strategies capitalize on students' knowledge and skills, creating a collaborative environment that compensates for resource scarcity (Charitonos et al., 2022). This can involve inter-school partnerships, student-led physics clubs, and peer tutoring programs. Community partnerships and resource sharing extend support networks beyond traditional educational boundaries, establishing centralized resource centers, partnering with local industries and universities, and engaging local craftsmen in rural areas.

The digital revolution presents opportunities through virtual and remote laboratory experiences, overcoming physical limitations of under-resourced schools. While internet connectivity remains challenging, targeted investments could yield significant benefits (Evans & Annunziata, 2012). Virtual laboratory software and remote laboratory experiences can provide access to a wide range of experiments. Developing low-cost and improvised experimental setups is crucial given severe resource constraints (Brossmer, 2019). This approach encourages creativity and resourcefulness among teachers and students, utilizing locally available materials and integrating recycling initiatives into the physics curriculum.

These collaborative approaches offer numerous benefits beyond addressing resource limitations. They improve student engagement and understanding by connecting physics to local realities and catering to different learning styles (El Kharki et al., 2021). Enhanced problem-solving and critical thinking skills are developed as students work on real-world challenges, preparing them for future careers. Teamwork and communication abilities are fostered, bridging the gap between communal values and formal education.

Perhaps most significantly, these approaches democratize access to experimental learning opportunities. Resource sharing initiatives, virtual and remote laboratories, and community partnerships have dramatically increased the number of students able to engage in hands-on physics experiments (Ali, 2023). This not only enhances physics education but also bridges the urban-rural divide in technological literacy, contributing to the overall development of Northern Nigeria.

**Implementation Strategies for Collaborative Approaches in Experimental Physics Education in Northern Nigeria**

The successful implementation of collaborative approaches in experimental physics education in Northern Nigeria requires a comprehensive and well-planned strategy (Lee et al., 2023). This strategy must address the unique challenges and opportunities present in the region while leveraging its strengths and resources. Let's explore in detail the key implementation strategies that can help realize the benefits of collaborative approaches in this context.

Enhancing experimental physics education in Northern Nigeria requires a multifaceted approach focusing on teacher training, curriculum adaptation, technology leverage, and sustainable partnerships (Busari, 2023). Teacher training is crucial, given the lack of comprehensive training in experimental methods. A cascading model of training, involving master trainers at the state level who then train local teachers, has proven effective in states like Kano and Kaduna 30. Hands-on workshops, continuous professional development, and culturally sensitive training programs are essential components of this approach.

Curriculum adaptation is necessary to incorporate collaborative experiments relevant to the local context. A modular approach allows flexibility across diverse school settings, while inter-disciplinary projects can make learning more holistic and engaging (Anunobi, 2022). Assessment methods need alignment with collaborative approaches, and language considerations are crucial for better understanding and engagement. Despite limited availability, technology can significantly enhance collaborative approaches. Mobile physics apps, solar-powered computer labs, remote access to experiments, online teacher forums, and data collection tools can transform how students engage with physics (Tomkinson et al., 2008)

Building sustainable partnerships with institutions and industry is vital. University-school partnerships, industry internships, collaborations with research institutions, community science centers, and corporate social responsibility initiatives can provide valuable resources and real-world exposure (International Higher Education Teaching and Learning Association, 2020). These strategies collectively address the challenges of experimental physics education in Northern Nigeria, promoting engagement, critical thinking, and access to quality education. By contextualizing learning, leveraging available resources, and fostering collaboration at multiple levels, these approaches can significantly enhance the quality of physics education and contribute to the region's overall development Challenges and Limitations of Collaborative Approaches in Experimental Physics Education in Northern Nigeria

While collaborative approaches offer significant potential for improving experimental physics education in Northern Nigeria, it's crucial to acknowledge and address the challenges and limitations associated with their implementation. These issues are particularly pronounced in the unique socio-economic, cultural, and educational landscape of Northern Nigeria. Let's explore these challenges in detail:

Implementing collaborative approaches in experimental physics education in Northern Nigeria faces significant challenges. Quality control and standardization issues arise from disparities in resources, teacher competence, and infrastructure across the region (Kola, 2020). The diverse linguistic and cultural landscape further complicates standardization efforts. For instance.

Assessment and evaluation present unique hurdles. The misalignment between collaborative approaches and traditional exam systems, such as WASSCE, discourages adoption of experiment-based methods (Babalola & Ojobola, 2022). Measuring soft skills developed through collaboration is challenging, especially in large classes common in Northern Nigeria (Mahmoud, 2018). Limited expertise in alternative assessment methods among teachers. Cultural resistance to peer and self-assessment, particularly in conservative areas, adds another layer of complexity.

Sustainability of collaborative initiatives faces numerous challenges. Funding constraints, exemplified by a USAID project in State struggling post-funding, pose a major hurdle. Political instability, brain drain of qualified teachers, security issues (particularly in the North-East), and technological obsolescence threaten long-term viability (Alkali, 2020). Maintaining teacher motivation and scaling successful pilot programs to cover entire states or the region present significant logistical and resource challenges. These challenges revealed the complexity of implementing and sustaining collaborative approaches in experimental physics education in Northern Nigeria.

**Future Directions in Collaborative Physics Education in Northern Nigeria**

The landscape of experimental physics education in Northern Nigeria is ripe for transformation, with collaborative approaches offering promising pathways for improvement. As we look to the future, several key directions emerge, each presenting unique opportunities and challenges in the educational, cultural, and socio-economic environment.

The implementation of collaborative approaches in physics education in Northern Nigeria presents significant research opportunities and potential for scaling successful models, while also offering possibilities for integration with broader STEM initiatives. Research opportunities are diverse and crucial. Studies on culturally adapted collaborative methods could examine how incorporating local knowledge into physics experiments affects student engagement and learning outcomes (Dusdal & Powell, 2021). Research on the impact of language of instruction, particularly the use of Hausa alongside English, could provide valuable insights into science education in multilingual contexts. Investigating gender dynamics in collaborative learning environments is especially relevant in a region with strong conservative cultural norms. Studies on innovative technology integration in resource-poor settings and the long-term impact of collaborative approaches on career choices are also vital (Babalola & Ojobola, 2022). Additionally, research on effective teacher professional development models, particularly in remote areas, is needed.

Scaling successful models presents both challenges and opportunities. Mobile physics labs and virtual collaboration platforms offer potential for reaching remote areas. Cascading training models for teachers and public-private partnerships present avenues for wide-scale implementation of collaborative methods.

Integration with broader STEM education initiatives is crucial for the future of collaborative physics education in Northern Nigeria 49. This includes aligning with national STEM policies, developing interdisciplinary projects that combine physics with other relevant fields like agriculture or environmental science, and linking collaborative physics education to STEM career pathways. Exploring community STEM engagement models and integrating collaborative physics education with technical and vocational programs could enhance its practical relevance and impact.

These research areas, scaling strategies, and integration opportunities collectively offer a pathway to significantly enhance physics education in Northern Nigeria, potentially transforming the educational landscape and contributing to broader socio-economic development in the region 51.

**Recommendation**

The potential of collaborative approaches in transforming physics education in Northern Nigeria is clear, but realizing this potential requires concerted action from educators, policymakers, and community leaders. For educators, the key is to embrace collaboration, both with colleagues and in the classroom. Continuous professional development is crucial, as is creativity in developing low-cost, locally relevant experiments. Fostering a classroom culture of peer learning and group problem-solving is essential. Documenting and sharing experiences contributes to the growing knowledge base on effective collaborative approaches.

School administrators play a vital role in creating supportive structures and policies for collaborative teaching methods. They should seek partnerships with other educational institutions and local industries to enhance learning opportunities. Allocating resources for collaborative initiatives and teacher training, and recognizing successful implementation, are important steps. Policymakers need to develop and implement supportive policies, including curriculum and assessment revisions. Allocating specific funding for collaborative science education initiatives, creating industry-education partnership incentives, and investing in enabling infrastructure like internet connectivity are crucial. Commissioning research on the effectiveness of these approaches in the Northern Nigerian context is also vital. Community leaders can make a significant impact by advocating for quality science education, supporting schools' collaborative learning efforts, and facilitating connections with local resources that can contribute to practical physics education.

Students are encouraged to actively participate in collaborative learning opportunities, provide feedback for improvement, and form study groups to enhance their understanding of physics concepts.

**Conclusion**

The benefits of these collaborative approaches are multifaceted. They not only improve student understanding and engagement but also foster critical thinking, problem-solving skills, and teamwork abilities. Importantly, they increase access to experimental learning opportunities for students who would otherwise have little to no hands-on experience in physics. However, the implementation of these strategies is not without challenges. Issues of quality control, standardization, assessment, and potential resistance to new teaching methods have been identified. The sustainability of collaborative initiatives in the face of funding constraints and political instability remains a significant concern.

The path to transforming physics education in Northern Nigeria through collaborative approaches is challenging but full of potential. It requires a shift in mindset, a willingness to innovate, and a commitment to overcoming obstacles. However, the rewards – in terms of improved educational outcomes, enhanced scientific literacy, and the development of critical thinking and problem-solving skills – are immense.

By working together, stakeholders at all levels can create a future where every student in Northern Nigeria has the opportunity to engage meaningfully with experimental physics, regardless of their school's resources. This not only enhances individual educational outcomes but also contributes to the broader goals of technological advancement, economic development, and social progress in the region. The time for action is now. Let us collaborate to build a brighter future for science education in Northern Nigeria, one experiment, one school, and one community at a time.

## Reference

Aina, T. A., & Salau, A. T. (1992). *Challenge of sustainable development in Nigeria*. NEST, Ibadan, NG.

Ali, A. (2023). Exploring the transformative potential of technology in overcoming educational disparities. *International Journal of Multidisciplinary Sciences and Arts*, *2*(1).

Alkali, U. (2020). *University-Industry-Government Interaction: Drivers for Innovation in Nigeria* (Doctoral dissertation, Oxford Brookes University).

Amusa, J. O. (2020). Appraisal of the physics education programme in the National Open University of Nigeria. *Annual Journal of Technical University of Varna, Bulgaria*, *4*(1), 79-90.

Andersson, O. (2012). *Experiment!: planning, implementing and interpreting*. John Wiley & Sons.

Anunobi, O. K. E. C. H. I. (2022). Teachers' deployment and utilization for quality service delivery in public secondary schools in rivers state. *Journal. Pract*, *6*, 112.

Archer, L., Moote, J., & MacLeod, E. (2020). Learning that physics is 'not for me': Pedagogic work and the cultivation of habitus among advanced level physics students. *Journal of the Learning Sciences*, *29*(3), 347-384.

Babalola, F. (2017). *Advancing practical physics in Africa's schools*. Open University (United Kingdom).

Babalola, F. (2017). *Advancing practical physics in Africa's schools*. Open University (United Kingdom).

Babalola, F. E., & Ojobola, F. B. (2022). Improving Learning of Practical Physics in Sub-Saharan Africa—System Issues. *Canadian Journal of Science, Mathematics and Technology Education*, *22*(2), 278-300.

Babalola, F. E., & Ojobola, F. B. (2022). Improving Learning of Practical Physics in Sub-Saharan Africa—System Issues. *Canadian Journal of Science, Mathematics and Technology Education*, *22*(2), 278-300.

Babalola, F. E., & Ojobola, F. B. (2022). Improving Learning of Practical Physics in Sub-Saharan Africa—System Issues. *Canadian Journal of Science, Mathematics and Technology Education*, *22*(2), 278-300.

Balogun, O. G. (2020). *Entrepreneurship education: A study of culture, mindsets and teaching practices in Nigeria*. University of Pennsylvania.

Brossmer, R. (2019). *The Influence of Globalization and Educational Policy on the Development of 21st-Century Skills Through Implementation of Science, Technology, Engineering, and Mathematics (STEM) Education and Inquiry-Based Instructional Practices in Science Competitions in Schools such as JG Downey Secondary School in Ireland* (Doctoral dissertation, University of Southern California).

Budhiraja, K. (2023, March). Infrastructures of Sociality: How Disadvantaged Students Navigate Inequity at the University 1. In *Sociological Forum* (Vol. 38, No. 1, pp. 254-276).

BUSARI, T. (2023). *EVALUATION OF THE IMPLEMENTATION OF SENIOR SECONDARY SCHOOL PHYSICS CURRICULUM USING TYLER'S EVALUATION*
*MODEL IN NORTH-CENTRAL STATES, NIGERIA* (Doctoral dissertation).

Charitonos, K., Khalil, B., Bonfini-Hotlosz, C., Webster, B., Tara, R., Salim, A., ... & Aristorenas, M. (2022). Researching communicative approaches to English language teaching using peer ethnographic method in Jordan's refugee settings. *Teachers in Crisis Contexts: Promising Practices in Teacher Professional Development, Management, and Well-being.*

Dalieh, F. T. (2017). *Liberian Educational Stakeholders' Perceptions of Overcrowding in an Urban Public Elementary School in Monrovia* (Doctoral dissertation, Walden University).

Dike, V. E. (2014). Leadership and the Nigerian economy. *Sage Open*, *4*(1), 2158244014523792.

Dusdal, J., & Powell, J. J. (2021). Benefits, motivations, and challenges of international collaborative research: A sociology of science case study. *Science and Public Policy*, *48*(2), 235-245.

El Kharki, K., Berrada, K., & Burgos, D. (2021). Design and implementation of a virtual laboratory for physics subjects in Moroccan universities. *Sustainability*, *13*(7), 3711.

Evans, P. C., & Annunziata, M. (2012). Industrial internet: Pushing the boundaries. *General Electric Reports*, 488-508.

Gamoran, A. (Ed.). (2003). *Transforming teaching in math and science: How schools and districts can support change*. Teachers College Press.

Kaindume, A. N., Educationis, M., & Education, N. S. (2018). *Factors limiting science teachers from engaging learners in practical work: A case study* (Doctoral dissertation, Master's Dissertation. University of South Africa, Pretoria).

Kola, A. J. (2020). The Effectiveness of peer instruction (PI) in enhancing pre-service teachers' understanding of electromagnetism I in a Nigerian college of education.

Kruss, G., Adeoti, J. O., & Nabudere, D. (2015). Bracing for change: making universities and firms partners for innovation in sub-Saharan Africa. In *Developing national systems of innovation* (pp. 31-54). Edward Elgar Publishing.

Lee, G. G., Kang, D. Y., Kim, M. J., Hong, H. G., & Martin, S. N. (2023). The emergence of remote laboratory courses in an emergency situation: University instructors' agency during the COVID-19 pandemic. *Cultural Studies of Science Education*, *18*(3), 601-629.

Mahmoud, O. (2018). Local, global, or in between? Boko Haram's messaging, strategy, membership, and support networks. *Boko Haram Beyond the Headlines: Analyses of Africa's Enduring Insurgency*, 87-114.

Ogunniyi, M. B. (2007). Teachers' stances and practical arguments regarding a science-indigenous knowledge curriculum: Part 2. *International Journal of Science Education*, *29*(10), 1189-1207.

Omuta, G. E. (2010). The place of private participation in higher education: A periscope on private Universities in Nigeria. *CEPD Monograph Series*, *2*.

Pontianus, V. J., & Oruonye, E. D. (2021). The Nigerian population: A treasure for national development or an unsurmountable national challenge. *International Journal of Science and Research Archive*, *2*(1), 136-142.

Saarinen, R. (2015). Wellbeing of African villagers within their community empowered by sustainable new energy services.

Tomkinson, B., Tomkinson, R., Dobson, H., & Engel, C. (2008). Education for sustainable development–an inter-disciplinary pilot module for undergraduate engineers and scientists. *International Journal of Sustainable Engineering*, *1*(1), 69-76.

Yusuf, A. A. (2021). Importance and challenges of science education in the development of Ilorin and its environ: Some policy implications.

Zollo, M., Bettinazzi, E. L., Neumann, K., & Snoeren, P. (2016). Toward a comprehensive model of organizational evolution: Dynamic capabilities for innovation and adaptation of the enterprise model. *Global Strategy Journal*, *6*(3), 225-244.