

DIGITAL CONNECTIVITY AND PRINCIPALS' EFFECTIVENESS IN SECONDARY SCHOOLS IN NIGERIA

OROBOSA AGHAMA^{1*}, KENNEDY AGBONS OGBEIDE²

^{1,2}DEPARTMENT OF EDUCATIONAL MANAGEMENT, FACULTY OF EDUCATION, UNIVERSITY OF BENIN, BENIN CITY, NIGERIA

Corresponding author: Orobosa.aghama@uniben.edu

To cite this article (APA): Aghama, O., & Ogbeide, K. A. (2025). Digital connectivity and principals' effectiveness in secondary schools in Nigeria. *AAU Journal of Business Educators*, 5 (2), 134-141.

Abstract

This paper discourses the role of digital connectivity on principals' effectiveness in public secondary schools in Nigeria. Digital connectivity implied having access to the internet, computers, smartphones, and other digital tools. It also includes using online platforms for teaching, learning, and school management. Many schools today are expected to use technology to improve education, but not all schools have the same level of access. This paper explains what digital connectivity means and the kind of digital tools that are available in public secondary schools. It also discusses how connected these schools are to the internet and how often digital tools are used. This paper shows how digital tools can help principals in their daily work. These tools help principals communicate with teachers and parents, keep school records, monitor teachers make decisions and improve how the school runs. The paper also considers the challenges principals face when using digital tools which include poor internet service, lack of proper training, unstable electricity, and fear of using technology. Finally, the paper discusses the link between digital connectivity and how well principals manage their schools. The paper shows that when digital tools are available and properly used, principals perform better. The paper suggests that digital connectivity can improve school leadership, but there is a need for better infrastructure and training.

Keywords: Digital Connectivity, Digital Tools, Nigeria, Principals' Effectiveness, Public Secondary Schools.

Introduction

Education is one of the most important tools for national development and nation-building. It helps in shaping the lives of young people and prepares them for the future. Through education, a country can produce skilled workers, responsible citizens, and future leaders. According to Federal Republic of Nigeria (2014), education helps in promoting economic growth, improving health, reducing poverty, and encouraging unity. In Nigeria, secondary education plays a key role in preparing students for higher education and professional life. The school principal is one of the key actors responsible for ensuring that education is delivered effectively at the secondary level.

Principals' effectiveness refers to how well school leaders perform their roles in managing school resources, supervising teachers, guiding students, and ensuring good academic performance. Effective principals set clear goals, communicate with teachers and parents, and maintain discipline in schools. According to Leithwood et al. (2021), effective principals help improve teaching quality, raise student achievement, and create a positive school climate. In the Nigerian context, principals' effectiveness is also tied to how well they adapt to modern challenges, including the use of technology and digital tools in school administration.

Digital connectivity refers to the ability to access digital tools, the internet, communication platforms, and online services that support teaching, learning, and school administration. It includes devices like computers, smartphones, internet connections, digital records, cloud storage, and learning management systems. According to UNESCO (2021), digital connectivity improves access to information, promotes collaboration, and supports innovation in schools. In today's world, digital tools have become essential for school leaders and principals to

manage their schools effectively. When schools are digitally connected, it becomes easier to manage data, interact with staff and students, and take decisions based on real-time information.

Digital connectivity in secondary schools is becoming more necessary due to changes in how schools are managed and how students learn. In many schools across Nigeria, digital tools are used to manage school records, communicate with stakeholders and access educational resources. However, the level of digital infrastructure in many of these schools is still poor. According to Adeoye and Owolabi (2023), most schools in Nigeria lack stable internet, electricity, and modern equipment, making it hard for principals to enjoy the full benefits of digital tools. Understanding how digital connectivity works in these schools is important for improving school leadership and administration.

Digital tools can play a major role in helping principals become more effective. For example, they can use email, WhatsApp, or online platforms to share information quickly with teachers and parents. They can use school management software to keep records of students and teachers, monitor attendance, and prepare reports. AI tools and digital dashboards can also help in making decisions and managing resources. According to Ugwoke and Asogwa (2021), digital tools make administrative work faster, reduce errors, and improve planning. In Nigeria, when principals have access to the right digital tools, they can carry out their roles more efficiently and make better decisions that improve school outcomes.

Despite the benefits, there are still many challenges. For instance, many school principals face problems such as poor internet service, lack of technical knowledge, irregular power supply, and fear of new technology. These issues affect how well they can use digital tools. According to Okolie et al. (2023), without proper training and reliable infrastructure, digital connectivity cannot bring the expected improvements in school leadership. To move forward, there is need for investment in digital infrastructure, regular training for school leaders, and government support in making digital tools available in all public schools. This paper will explore these issues in detail using secondary schools in Nigeria.

Concept of Digital Connectivity

Akomolafe and Ilesanmi (2021) defined digital connectivity as the ability of individuals, schools, and organizations to stay connected through internet-based tools and digital communication systems for the purpose of accessing information, sharing knowledge, and managing tasks. They emphasized that in the context of education, digital connectivity makes it possible for school leaders and teachers to carry out administrative duties, teaching, and learning through computers, mobile devices, and online platforms. Bassey and Edem (2022) defined digital connectivity as the use of technological infrastructure such as internet access, computers, mobile phones, and digital software that support the smooth flow of communication and information in schools and other public institutions. They noted that digital connectivity is not just about having internet access, but also about using it effectively to achieve administrative goals, support learning, and improve school management processes.

According to Nwankwo and Eze (2023), digital connectivity was defined as the level of access and ability to use digital technologies and online resources to enhance communication, decision-making, and data management in educational settings. They added that digital connectivity helps school principals coordinate activities, manage school data, and maintain effective communication with teachers, students, and parents. Obasi and Olorunfemi (2022) defined digital connectivity as the presence and use of digital systems that link individuals, tools, and institutions together through the internet and other electronic means to improve efficiency and service delivery. In the school environment, they explained that digital connectivity allows principals to monitor staff, track performance, and implement policies using real-time data. Edeh and Agbo (2023) defined digital connectivity as a digital bridge that connects school leaders to educational resources, stakeholders, and support systems by using digital tools like email, cloud storage, websites, and school management applications. They stressed that digital connectivity reduces delays in information sharing, enhances transparency, and supports quick decision-making in schools.

Principals' Effectiveness

Adebayo and Ogunyemi (2021) defined principals' effectiveness as the ability of school heads to successfully perform their administrative, instructional, and leadership roles in a way that promotes academic excellence, staff commitment, and positive student behavior. They explained that an effective principal ensures proper planning, supervises classroom instruction, and creates a learning environment that supports both teachers and students. Ezeugwu and Oladele (2022) defined principals' effectiveness as the extent to which a

principal is able to achieve school goals through efficient management of resources, staff motivation, enforcement of discipline, and communication with stakeholders. They added that effectiveness is seen in the way the principal solves problems, implements policies, and ensures smooth daily school operations.

According to Okafor and Akinyemi (2023), principals' effectiveness was defined as the capability of school administrators to lead, influence, and coordinate teachers and students towards achieving desired educational outcomes. They stressed that effective principals are visionary, proactive, and skilled in using both human and material resources to drive school development and academic success. In the view of Musa and Bello (2023), principals' effectiveness was defined as the degree to which a school leader positively impacts the performance of the school by ensuring teacher productivity, student discipline, proper record-keeping, and effective use of technology. They emphasized that an effective principal does not only enforce rules but also inspires the school community through good leadership practices.

Understanding Digital Connectivity in Secondary Schools

Digital connectivity in schools means having access to internet services, digital devices, and technology tools that help with communication, learning, and administration. It includes things like having strong Wi-Fi connections, computers, tablets, smartphones, and using apps or websites to carry out school activities. It allows schools to connect with students, teachers, parents, and government bodies through digital platforms. This connection helps everyone share information faster and makes learning more modern and interactive.

Importance of Digital Connectivity in Nigerian Schools

In Nigerian secondary schools, digital connectivity is important because it helps improve the quality of teaching and administration. With proper internet access and digital tools, teachers can plan better lessons and principals can manage school activities more effectively. Nwachukwu and Ibrahim (2021) noted that digital connectivity is linked to better school planning, access to online resources, and increased collaboration among staff. It also helps schools join online training, webinars, and workshops that improve their performance. Schools with digital tools are more likely to meet modern educational goals and global standards.

Level of Digital Infrastructure in Schools

Many schools in Nigeria still struggle with poor digital infrastructure. This includes lack of computers, weak internet signals, and no steady electricity. According to Usman and Taiwo (2022), most rural and suburban schools do not have enough digital equipment to support proper learning and school management. Where digital connectivity exists, it is often limited to the principal's office and not available to the rest of the school. These challenges affect how well digital tools are used by both teachers and school leaders.

Use of Digital Platforms for School Administration

Digital platforms such as emails, Zoom, Google Meet, school management software, and WhatsApp groups have become very useful for managing schools. Principals use these platforms to hold meetings, track school attendance, monitor teachers' performance, and communicate with the education board. Etta and Ekong (2021) observed that digital tools help reduce paperwork and allow school heads to make quicker and more accurate decisions. These platforms also help principals to supervise multiple school operations at once and maintain transparency in school records.

Digital Literacy and Capacity Building for School Leaders

Even when digital tools are available, the skills to use them matter a lot. Digital literacy means knowing how to operate technology tools properly. Principals who are trained in digital skills are more likely to use these tools well. Okocha and Ezeani (2023) stressed that school leaders need regular digital training so they can use technology to improve school leadership. Many principals in Nigeria lack enough training in digital tools, which limits the effectiveness of digital connectivity. Training helps them understand new technologies and apply them in school management.

Digital Equity and Access for All

Digital connectivity should be available to everyone in the school community not just the principal or a few teachers. Digital equity means making sure that all students and teachers can access and use digital resources equally. According to Bolarinwa and Adedokun (2023), schools must create policies that promote

equal access to devices, internet, and online learning platforms. Without digital equity, some people in the school will be left behind, and this can affect learning and performance. Ensuring digital access for all supports inclusive education and makes the school system more balanced.

Digital Connectivity: Its role in Enhancing Principals' Administrative Effectiveness

In today's modern world, digital connectivity has changed how schools are managed and how principals perform their duties. Digital connectivity means having access to the internet, digital devices, and online platforms. For school principals, these tools can make communication, supervision, planning, and decision-making much easier and faster.

Easy and Fast Communication

Digital tools like emails, WhatsApp, and school websites help principals communicate quickly with teachers, parents, and students. These tools allow for faster sharing of school updates, meeting reminders, and feedback from staff and parents. With good digital communication, principals can solve problems faster and keep everyone informed. According to Chukwu and Ibrahim (2023), digital communication improves how principals manage schools and respond to challenges.

Better Supervision and Monitoring

Digital devices such as CCTV cameras, online attendance systems, and classroom monitoring apps help principals supervise both teachers and students more effectively. These tools help track teaching activities and student behaviour, even when the principal is not physically present. Bala and Hassan (2022) noted that digital tools make school supervision easier and improve discipline by helping principals see what is happening in real time.

Accurate Record Keeping and Data Management

Digital tools also help principals store student records, teacher information, and school reports in an organized way. Instead of using paper files, information can be kept on computers or in cloud storage. This makes it easy to access data, make reports, and plan school activities. Chukwu and Ibrahim (2023) also pointed out that digital record-keeping reduces errors and supports good school management.

Smarter Decision-Making

When principals have access to digital reports and data, they can make better and quicker decisions. For example, they can use data on student performance or teacher attendance to decide on training needs or student support. Eze and Okoroafor (2021) stated that digital tools help principals make informed decisions that improve learning and teaching outcomes in schools.

Access to Professional Development

Digital connectivity allows principals to join online training, conferences, and meetings with education experts. This helps them learn new leadership skills and share ideas with others. According to Ogedengbe and Adamu (2022), digital platforms help school leaders improve their knowledge and stay updated with new education practices.

Building Transparency and Accountability

When principals use digital systems to manage finances, teacher attendance, and student results, it becomes easier to detect problems like cheating, missing funds, or unfair treatment. This helps build trust and accountability in the school system. Bala and Hassan (2022) explained that transparency increases when digital systems are used for school management.

Nexus between Digital Connectivity and Principals' Effectiveness

Digital connectivity plays a big role in today's education system. It refers to how well schools and staff are connected to the internet and digital tools. Principals, who lead and manage schools, can become more effective when they have access to good digital connectivity. This among others includes:

Access to Timely and Accurate Information

When principals have good internet access, they can easily find and use the latest information about education. This helps them make better decisions. For example, they can access government updates, school policies, teaching resources, and research online. Without digital connectivity, it would take a long time to get this information. Access to educational data allows principals to support teachers better. A connected principal can track changes in the school curriculum or exam guidelines, and share updates with staff. According to Arshad and Akram (2021), digital connectivity helps school leaders make informed decisions quickly, which leads to better school performance. Digital platforms such as educational websites, online forums, and mobile apps offer useful resources for school leaders. These platforms help principals stay updated on student performance tools and teaching strategies. It also helps in comparing best practices with other schools.

Improved Communication with Staff, Parents, and Students

Digital connectivity helps principals communicate better with everyone in the school community. Through emails, messaging apps, and virtual meetings, principals can stay connected with teachers, students, and parents. This creates a strong school network. Using platforms like WhatsApp, Telegram, or Google Meet, principals can call for meetings without needing to gather everyone physically. This saves time and helps in emergencies. As noted by Adeyemi and Ogunyemi (2021), digital communication has helped Nigerian school principals send instructions and receive feedback more quickly. It is also easier for principals to collect opinions and suggestions from teachers and students when communication tools are available. Online surveys and feedback forms help principals learn what works and what needs change. This improves decision-making.

Efficient Digital Record-Keeping and Data Management

Digital tools allow principals to keep school records safely and access them anytime. This includes attendance, staff details, student grades, and budgets. Before now, records were kept in books, which could get lost or damaged. Using digital software, principals can store, search, and update records easily. Tools like Microsoft Excel, Google Drive, or school management systems make the work faster. According to Musa and Tukur (2021), digital record-keeping reduces stress and increases principals' efficiency. Data management also helps in monitoring teacher performance. Principals can record teachers' lesson plans, punctuality, and training. This data helps them provide useful feedback and support where needed. Similarly, principals can track student performance over time using digital tools. They can quickly identify students who need help and plan interventions. This supports academic improvement.

Online Training and Professional Development

Digital connectivity allows principals to learn new skills online. They can attend webinars, take online courses, and join leadership communities. This helps them grow in their roles and lead better. Websites like Coursera, FutureLearn, and EdX offer leadership courses that principals can take from anywhere. They can learn about school safety, teacher motivation, digital tools, and more. According to Eze and Nwankwo (2023), many school principals in Nigeria improved their management skills through online leadership training. Online learning is flexible and can be done during holidays or weekends. This means principals do not need to travel or leave their schools for training. It is cost-effective and saves time. In addition, the Ministry of Education and NGOs now provide free online training for school heads. With good internet access, principals can take part in these programs easily.

Challenges of Digital Connectivity Faced by School Principals

In today's modern education system, digital connectivity is very important for school management. It helps school principals to access online tools, communicate better, manage records, and attend trainings. However, in many public schools, especially in developing areas, principals face serious problems when it comes to using digital technologies such as:

Lack of Digital Infrastructure in Schools

Many schools do not have the basic facilities needed for digital connectivity. These include computers, projectors, smart boards, routers, and internet devices. Without these tools, principals cannot access the internet or use educational technology to improve school management. In some public schools, even electricity supply is

not stable. This makes it very hard to keep devices working or to stay connected online. According to Adebayo and Ojo (2021), lack of digital infrastructure in Nigerian public schools is one of the biggest barriers to effective digital learning and school leadership. In rural areas, the problem is even worse. Many schools have no internet signal or are too far from urban centers where digital resources are easier to get. This leads to unequal access to digital opportunities. In short, without proper infrastructure, digital leadership cannot happen. Schools need good equipment and a strong power supply for digital connectivity to be possible.

Limited Digital Skills Among School Principals

Another major problem is that many principals do not have the skills to use digital tools effectively. Even when digital devices are available, some principals struggle to operate them or use online platforms for school management. Many school leaders did not receive formal training in ICT during their education or professional careers. As a result, they are not confident in using technology to carry out their duties. According to Okafor and Umezina (2021), lack of digital competence among school principals affects their ability to implement digital education policies. Because of their limited digital skills, principals may avoid using online systems or fail to train their teachers to use them. This slows down digital growth in the entire school. To fix this challenge, regular digital training programs are needed to improve the capacity of school principals in ICT use. This will make them more effective leaders in the digital age.

Unstable and Expensive Internet Access

Even when digital tools and skills are available, many principals still struggle with internet connectivity. Poor internet connection and high data costs are common problems in many public secondary schools. In many places, network service is slow or completely unavailable. This makes it hard to access emails, online reports, or virtual meetings. According to Etta and Ituma (2021), poor internet service continues to affect educational progress in remote schools, especially in sub-Saharan Africa. Expensive internet costs also discourage regular usage. Some principals have to use personal funds to buy data or pay for mobile internet services. This is not sustainable and affects how often they can go online. To solve this problem, governments and education stakeholders must work with internet providers to offer affordable and strong internet access in schools.

Lack of Government and Policy Support

Many school principals face challenges because of poor government support and weak policies on digital education. Without clear guidelines or proper funding, it is hard for principals to plan and manage digital activities in their schools. Most governments do not allocate enough money for digital development in schools. This means there is little or no budget for buying equipment, providing internet, or training staff. According to Bello and Ajani (2022), lack of strong government backing is a major reason why ICT use in Nigerian schools remains low. To make real progress, education authorities must create clear policies, increase funding, and provide support to principals who are trying to improve their schools digitally.

Conclusion

Education is a powerful tool for national growth and development. In Nigeria, secondary school principals play an important role in helping students succeed and move on to higher education. To do this well, they need access to digital tools like computers, the internet, and communication platforms. These tools help them manage school records, connect with teachers and parents, and make better decisions. However, many schools, in Nigeria lack good digital infrastructure. Poor internet service, limited electricity, and lack of modern equipment make it hard for principals to work effectively. Without proper internet, electricity, training, and government support, digital tools cannot be used well. It is important to fix these problems so that all schools across Nigeria can enjoy the full benefits of digital education.

Recommendations

- Base on the problems identified, the following suggestions are made:
1. The government and education authorities should ensure that all public secondary schools are equipped with digital devices such as laptops, projectors, and internet routers. Reliable internet access must be made

- available in schools so that principals can use online platforms to manage school activities, access information, and communicate with stakeholders more easily.
2. Principals should be given regular training on how to use computers, software, and online tools for school administration. These trainings should be simple, practical, and hands-on so that school leaders can feel confident using digital technology in their everyday work.
 3. To support digital connectivity, stable electricity must be provided in schools. The government can explore alternative energy solutions like solar power, especially in rural areas where public electricity is unreliable. A steady power supply will allow digital tools to function without interruption.
 4. There should be well-planned and properly explained policies on how digital tools should be used in schools. These policies should include guidelines on digital infrastructure, data management, teacher support, and school monitoring.
 5. Every school should have at least one trained ICT officer or technician who can help maintain digital equipment and support the principal and staff in solving technical problems.

References

- Adebayo, F. O., & Ojo, R. A. (2021). Infrastructure challenges in Nigerian public schools and their effects on ICT use. *African Journal of Educational Research*, 24(1), 33–42.
- Adeoye, A., & Owolabi, A. (2023). The role of artificial intelligence and digital tools in Nigerian secondary schools. *Journal of Educational Technology*, 15(1), 34–45.
- Adeyemi, B. A., & Ogunyemi, B. (2021). Principals' communication skills and school effectiveness. *African Journal of Educational Management*, 22(1), 67–78.
- Ajayi, A. O. (2021). Integrating digital technology in Nigerian schools: The role of connectivity. *Journal of Educational Technology and Research*, 4(1), 25–36.
- Akinsola, M. A., & Chukwuma, O. L. (2022). Leadership effectiveness of principals and student academic performance in Nigerian secondary schools. *International Journal of Educational Leadership and Management*, 5(2), 37–49.
- Akomolafe, C. O., & Ilesanmi, O. O. (2021). Digital tools and administrative effectiveness in Nigerian secondary schools. *African Journal of Educational Management*, 19(2), 45–56.
- Arshad, M., & Akram, M. (2021). Role of digital tools in improving school leadership. *Journal of Educational Technology*, 18(2), 112–125.
- Bala, U. M., & Hassan, Y. A. (2022). *Digital monitoring and supervision in secondary schools: Opportunities and limitations*. *African Journal of School Management*, 6(2), 49–60.
- Bassey, I. E., & Edem, D. A. (2022). Exploring the impact of internet access on public school management in Nigeria. *Journal of ICT and Education Development*, 7(1), 60–71.
- Bello, A. T., & Ajani, K. A. (2022). Policy gaps in the digitalization of education in Nigeria. *Journal of Education Policy and Leadership*, 12(1), 44–56.
- Bolarinwa, S. A., & Adedokun, R. T. (2023). Digital equity and inclusion in Nigerian public secondary schools. *African Journal of Education and Innovation*, 6(2), 59–72.
- Chukwu, L. C., & Ibrahim, T. M. (2023). Digital record keeping and data management in public secondary schools in Nigeria. *International Journal of Educational Management Systems*, 8(1), 22–35.
- Edeh, M. O., & Agbo, C. I. (2023). Digital connectivity and school leadership: Bridging the technology gap in Nigerian education. *International Journal of Educational Innovations*, 10(1), 15–28.
- Etta, E. E., & Ekong, V. A. (2021). The use of digital platforms in secondary school administration in Nigeria. *International Journal of Modern Educational Management*, 3(4), 45–58.
- Etta, F. E., & Ituma, E. A. (2021). Internet access challenges and digital divide in African schools. *Journal of Information and Communication Technology in Education*, 10(4), 89–97.
- Eze, A. C., & Okoroafor, P. O. (2021). Principals' decision-making and the role of digital tools in school planning. *Journal of Educational Innovation and Practice*, 4(3), 15–28.
- Eze, C. C., & Nwankwo, E. A. (2023). Online professional development and school leadership in Nigeria. *Nigerian Journal of Educational Leadership*, 10(2), 55–70.
- Ezeugwu, J. C., & Oladele, K. M. (2022). An assessment of school principals' administrative effectiveness in South-West Nigeria. *Journal of School Administration and Supervision*, 8(3), 20–34.
- Federal Republic of Nigeria. (2014). *National Policy on Education* (6th ed.). Lagos: NERDC Press.
- Leithwood, K., Harris, A., & Hopkins, D. (2021). Seven strong claims about successful school leadership

- revisited. *School Leadership & Management*, 40(1), 5–22.
- Musa, H. Y., & Bello, M. U. (2023). The role of school principals in achieving quality education in Nigeria: A leadership perspective. *Journal of Educational Administration in Africa*, 11(1), 18–30.
- Nwachukwu, N. F., & Ibrahim, J. M. (2021). Technology and leadership effectiveness in Nigerian schools: An overview. *Journal of Educational Leadership and Development*, 7(1), 31–44.
- Nwankwo, A. I., & Eze, F. N. (2023). Technology integration in school administration: The case of digital connectivity in Nigerian secondary schools. *Nigerian Journal of Educational Leadership*, 8(2), 34–49.
- Obasi, K. C., & Olorunfemi, T. A. (2022). Digital transformation in school systems: A framework for connectivity and inclusion. *Journal of Modern Educational Research*, 6(4), 22–37.
- Ogedengbe, T. A., & Adamu, K. I. (2022). Digital connectivity and continuous professional development among Nigerian school leaders. *Journal of Educational Research in Africa*, 7(2), 40–52.
- Okafor, C. N., & Akinyemi, T. O. (2023). Principals' leadership effectiveness and school performance: Evidence from selected public schools in Nigeria. *African Journal of Contemporary Education*, 9(1), 42–57.
- Okafor, M. U., & Umezina, C. I. (2021). ICT skill gap and educational leadership in Nigeria. *Journal of Contemporary Educational Research*, 15(2), 67–75.
- Okocha, I. N., & Ezeani, K. C. (2023). Building digital capacity in school management: Challenges and prospects in Nigeria. *Journal of Digital Literacy and Education*, 5(1), 18–29.
- Okolie, U. C., Nwajiuba, C. A., & Eze, S. C. (2023). Challenges of adopting digital technologies in Nigerian public schools. *Nigerian Journal of ICT in Education*, 8(2), 61–72.
- Ugwoke, S. C., & Asogwa, V. C. (2021). Digital transformation and school administration: Experiences from Nigerian secondary schools. *Journal of Educational Administration and Policy Studies*, 13(2), 22–30.
- UNESCO. (2021). *Leveraging information to enhance education systems*. Retrieved from <https://unesdoc.unesco.org/>
- Usman, M. S., & Taiwo, R. A. (2022). Digital infrastructure and public school effectiveness in South-West Nigeria. *Nigerian Journal of ICT and Education*, 8(2), 20–35.