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# Cloud Computing Tools and the Management of Public Secondary Schools in Abuja Municipal Area Council, Federal Capital Territory, Nigeria

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## *Abstract*

This study examined the relationship between cloud computing tools and the management of public secondary schools in Abuja Municipal Area Council (AMAC), Federal Capital Territory, Nigeria. Four research questions and four null hypotheses guided the study, addressing the extent of adoption of cloud computing tools, their relationship with record-keeping and communication, and the challenges hindering their adoption. A descriptive survey design was adopted. From a population of 192 principals, vice-principals, senior teachers, and ICT teachers across the 24 public secondary schools in AMAC, 176 respondents completed a structured questionnaire on a four-point Likert scale (response rate = 91.7%, 176 of 192). The sub-scales returned Cronbach alpha reliability coefficients ranging from .81 to .95. Data were analysed using mean, standard deviation, the Pearson product-moment correlation, and the independent-samples t test. Findings revealed that cloud computing tools were adopted to a moderate extent (M = 2.98) and that respondents affirmed their value for record-keeping (M = 3.46) and communication (M = 3.40). Significant positive relationships were found between adoption and record-keeping ($r = .39$, $p < .001$) and between adoption and communication ($r = .38$, $p < .001$). Administrators reported significantly lower adoption than teachers ($t = -3.03$, $p = .003$), whereas male and female respondents did not differ significantly on perceived challenges ($t = 1.23$, $p = .22$). Poor internet connectivity and unreliable electricity were the most pressing challenges. The study concluded that cloud computing tools are positively associated with improved school management and recommended investment in infrastructure and staff training.

**Keywords**: cloud computing tools, school management, record-keeping, communication, public secondary schools

# *Introduction*

The management of secondary schools in the twenty-first century depends increasingly on the efficient handling of information. School administrators are responsible for maintaining student records, staff records, and financial data, while communicating continually with teachers, parents, students, and education authorities. Traditionally, these functions have relied on paper-based systems and locally stored files that are vulnerable to loss, damage, duplication, and delay. The emergence of cloud computing has introduced a set of tools capable of transforming how educational institutions store, retrieve, and share information (Iyala et al., 2019).

Cloud computing refers to the on-demand delivery of computing resources, such as data storage, applications, and processing power, over the internet without direct active management by the user (Al-Zubaidie et al., 2024; Qasem et al., 2019). Common cloud computing tools relevant to school management include cloud storage services such as Google Drive and Microsoft OneDrive, and cloud-based productivity suites such as Google Workspace and Microsoft 365. These tools allow authorised users to access information from any location, collaborate in real time, and maintain secure backups of critical data. In educational settings, cloud computing has been associated with improved administrative efficiency, enhanced collaboration, and reduced operational costs (Uwaleke & Iyala, 2020; Thavi et al., 2024; Liu et al., 2025).

In Nigeria, the integration of information and communication technology (ICT) into school administration has attracted growing attention, yet adoption remains uneven, particularly in public secondary schools (Adeleke et al., 2020; Oladosu, 2023). Abuja Municipal Area Council (AMAC), within the Federal Capital Territory, hosts a substantial number of public secondary schools serving a growing urban population. Although these schools operate within the nation's capital and might be expected to enjoy comparatively better infrastructure, the extent to which cloud computing tools are adopted in their day-to-day management, and the relationship between such adoption and key management functions, has not been sufficiently documented. This study addresses that gap.

**Statement of the Problem**

Effective school management requires the timely, accurate, and secure handling of records and communication. In many public secondary schools, however, administrative processes remain largely manual, resulting in misplaced files, damaged records, duplicated effort, and slow communication among stakeholders. These inefficiencies undermine planning, accountability, and service delivery. Cloud computing tools offer a promising remedy, yet their adoption in Nigerian public secondary schools is often constrained by infrastructural, financial, and human-capacity challenges (Santos et al., 2024; Vu et al., 2026). It is unclear to what extent public secondary schools in AMAC have adopted cloud computing tools, whether such adoption is associated with improvements in record-keeping and communication, and what challenges impede wider adoption. This study was designed to provide empirical answers to these questions.

**Objective of the Study**

The main objective of this study was to examine the relationship between cloud computing tools and the management of public secondary schools in AMAC. Specifically, the study sought to determine the extent to which cloud computing tools are adopted; examine the relationship between cloud computing tools and record-keeping; examine the relationship between cloud computing tools and communication among stakeholders; and identify the challenges militating against the adoption of cloud computing tools in the management of public

secondary schools in AMAC.

**Research Questions**

The following research questions guided the study:

1. To what extent are cloud computing tools adopted in the management of public secondary schools in AMAC?
2. What is the relationship between cloud computing tools and record-keeping in public secondary schools in AMAC?
3. What is the relationship between cloud computing tools and communication among stakeholders in public secondary schools in AMAC?
4. What challenges militate against the adoption of cloud computing tools in the management of public secondary schools in AMAC?

**Hypotheses**

The following null hypotheses were tested at the .05 level of significance:

**Ho1:** There is no significant relationship between the adoption of cloud computing tools and record-keeping in public secondary schools in AMAC.

**Ho2:** There is no significant relationship between the adoption of cloud computing tools and communication among stakeholders in public secondary schools in AMAC.

**Ho3:** There is no significant difference between the mean responses of principals and teachers on the extent of adoption of cloud computing tools.

**Ho4:** There is no significant difference between the mean responses of male and female respondents on the challenges militating against adoption.

**Concept of Cloud Computing**

Cloud computing is widely described as a model that enables convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort (Al-Zubaidie et al., 2024). The model is commonly organised into three service layers: infrastructure as a service, platform as a service, and software as a service (Qasem et al., 2019). For school management, software as a service is the most immediately relevant layer, as it delivers ready-to-use applications, such as cloud storage and collaborative productivity suites, that require no local installation or maintenance.

**Cloud Computing in Educational Management**

A growing body of scholarship has examined the role of cloud computing in education. Systematic reviews report that cloud computing offers educational institutions a cost-effective means of accessing computing resources while reducing the burden of maintaining physical infrastructure (Thavi et al., 2024; Santos et al., 2024). Cloud-based platforms have been linked to more efficient administrative processes and improved data management in schools (Govea et al., 2023; Yang et al., 2025). Studies of higher-education institutions in developing contexts similarly report that organisational and environmental factors strongly shape adoption (Alghushami et al., 2020). Reviews of ICT in educational administration further indicate that digital tools can streamline planning, monitoring, and decision-making when adequately supported (Liu et al., 2025). Within the Nigerian context, studies of university administration and of cloud school-management use in secondary schools report positive but uneven

patterns of adoption shaped by infrastructure and skills (Adeleke et al., 2020; Oladosu, 2023; Olowonefa & Iyala, 2017).

**Cloud Computing and Record-Keeping**

Record-keeping is a core function of school management, encompassing the creation, storage, retrieval, and preservation of student, staff, and financial records. Cloud-based systems have been associated with easier retrieval, reduced risk of loss or damage, minimised duplication, and enhanced security relative to paper-based systems (Wang & Wang, 2023). Evidence from Nigerian secondary schools similarly highlights the benefits of cloud-based record management while drawing attention to the confidentiality concerns that accompany the storage of sensitive data online (Bakwaph et al., 2026). At the same time, migrating sensitive records to online platforms raises data-protection concerns that schools must manage through appropriate privacy safeguards (Alier et al., 2021).

**Cloud Computing and Communication**

Communication among school stakeholders is central to effective administration. Cloud-based communication and collaboration tools enable the rapid dissemination of information, reduce the cost of circulars and physical meetings, and create reliable, retrievable records of correspondence (Onwughai et al., 2026). Studies of school leadership indicate that cloud technologies can strengthen the administrative performance of principals and support coordination among staff (Khasawneh et al., 2023; Mogas et al., 2022).

**Challenges of Cloud Computing Adoption**

Despite its benefits, the adoption of cloud computing in schools faces notable challenges, particularly in developing contexts. Recurrent themes in the literature include inadequate internet connectivity, unreliable electricity supply, limited digital skills among staff, and concerns about data privacy and security (Santos et al., 2024; Alier et al., 2021). Evidence from education-oriented organisations suggests that technological readiness and supportive conditions are decisive for successful adoption (Vu et al., 2026). Experiences of deploying cloud-based learning environments in secondary schools likewise highlight infrastructural and capacity constraints as principal barriers (Oleksiuk et al., 2023; Iyala et al., 2026)).

**Research Design**

A descriptive survey design was adopted. The design was considered appropriate because the study sought to describe the extent of adoption of cloud computing tools and to examine relationships and differences among variables as they naturally occurred, without manipulation.

**Population of the Study**

The population of the study comprised 192 respondents drawn from the 24 public secondary schools in Abuja Municipal Area Council. The population consisted of 24 principals, 48 vice-principals, 96 senior teachers, and 24 ICT teachers, based on an average of one principal, two vice-principals, four senior teachers, and one ICT teacher per school. These categories were considered appropriate because their administrative, supervisory, instructional, and technological responsibilities position them to provide relevant information on the use of cloud computing tools in the management of public secondary schools.

**Sample and Sampling Technique**

A total of 176 respondents completed and returned the questionnaire, representing a response rate of 91.7% (176 of 192). The sample comprised 22 principals, 45 vice-principals, 89 senior teachers, and 20 ICT teachers. Given the manageable size of the population, a census approach was adopted, in which all members of the population were invited to participate rather than a smaller sub-sample being selected.

**Instrument for Data Collection**

Data were collected using a structured questionnaire titled Cloud Computing Tools and School Management Questionnaire (CCTSMQ). The instrument comprised two sections. Section A elicited demographic information on respondents' status, gender, years of working experience, and highest qualification. Section B contained 19 items measured on a four-point Likert scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1), organised into four clusters corresponding to the extent of adoption, record-keeping, communication, and challenges of adoption.

**Validity and Reliability**

The instrument was subjected to face and content validation by experts in educational management and in measurement and evaluation. Reliability was established using Cronbach's alpha, which yielded coefficients of .95 for the adoption cluster, .86 for record-keeping, .91 for communication, and .81 for challenges, with an overall coefficient of .90. These values indicate that the instrument was highly reliable for the study.

**Method of Data Analysis**

Data were analysed using descriptive and inferential statistics. Research Question 1 was answered using mean and standard deviation, with a criterion mean of 2.50; items with a mean of 2.50 or above were regarded as accepted. Research Questions 2, 3, and 4 were answered using mean and standard deviation, while the corresponding hypotheses were tested using the Pearson product-moment correlation coefficient and the independent-samples t test at the .05 level of significance.

**Demographic Characteristics of Respondents**

Table 1 presents the demographic distribution of respondents. Senior teachers constituted the largest proportion of respondents, followed by vice-principals, principals, and ICT teachers. Female respondents outnumbered male respondents, respondents were distributed across all experience bands, and the majority held a first degree or a higher qualification.

**Table 1**

*Demographic Distribution of Respondents (N = 176)*

| Variable/Category | Frequency | Percentage (%) |
|---|---|---|
| ***Status*** | | |
| **Senior Teacher** | 89 | 50.6 |
| **Vice-Principal** | 45 | 25.6 |
| **Principal** | 22 | 12.5 |
| **ICT Teacher** | 20 | 11.4 |
| ***Gender*** | | |

| Variable/Category | Frequency | Percentage (%) |
|---|---|---|
| **Female** | 105 | 59.7 |
| **Male** | 71 | 40.3 |
| ***Years of Experience*** | | |
| **11-15** | 71 | 40.3 |
| **6-10** | 43 | 24.4 |
| **16 and above** | 31 | 17.6 |
| **1-5** | 31 | 17.6 |
| ***Highest Qualification*** | | |
| **B.Sc./B.Ed./HND** | 92 | 52.3 |
| **M.Sc./M.Ed.** | 60 | 34.1 |
| **Ph.D.** | 19 | 10.8 |
| **Other** | 3 | 1.7 |
| **NCE** | 2 | 1.1 |

*Note.* Field survey data.

**Research Question 1: Extent of Adoption**

**Table 2**

*Mean Ratings on the Extent of Adoption of Cloud Computing Tools*

| Item | Statement | *M* | *SD* | Decision |
|---|---|---|---|---|
| **1** | My school uses cloud storage (e.g., Google Drive, OneDrive) to keep school data | 3.10 | 0.97 | Agree |
| **2** | My school uses a cloud-based productivity suite (Google Workspace or Microsoft 365) | 2.99 | 0.97 | Agree |
| **3** | Staff in my school can access school records online from different locations | 2.91 | 1.00 | Agree |
| **4** | My school uses a cloud-based platform for storing student records | 2.96 | 0.98 | Agree |
| **5** | Cloud computing tools are part of my school's routine administration | 2.91 | 1.00 | Agree |

*Note.* Criterion mean = 2.50. M = mean; SD = standard deviation.

Table 2 shows that all five items on the extent of adoption recorded means above the criterion mean of 2.50, with a cluster mean of 2.98 (SD = 0.9). This indicates that cloud computing tools are adopted to a moderate extent in the management of public secondary schools in AMAC.

**Research Question 2: Cloud Computing Tools and Record-Keeping**

**Table 3**

*Mean Ratings on Cloud Computing Tools and Record-Keeping*

| Item | Statement | *M* | *SD* | Decision |
|---|---|---|---|---|
| **1** | Cloud computing tools make student records easier to retrieve | 3.47 | 0.70 | Agree |
| **2** | Cloud storage reduces the loss or damage of school records | 3.48 | 0.67 | Agree |
| **3** | Records kept in the cloud are more secure than paper files | 3.55 | 0.67 | Agree |
| **4** | Cloud computing tools reduce the duplication of records | 3.38 | 0.77 | Agree |
| **5** | Updating school records is faster with cloud computing tools | 3.44 | 0.74 | Agree |

*Note.* Criterion mean = 2.50.

As shown in Table 3, respondents agreed with all five record-keeping items, producing a cluster mean of 3.46 (SD = 0.57). Respondents most strongly affirmed that records kept in the cloud are more secure than paper files (M = 3.55).

**Research Question 3: Cloud Computing Tools and Communication**

**Table 4**

*Mean Ratings on Cloud Computing Tools and Communication*

| Item | Statement | *M* | *SD* | Decision |
|---|---|---|---|---|
| **1** | Cloud computing tools speed up communication among staff | 3.41 | 0.71 | Agree |
| **2** | Cloud computing tools improve communication with parents and students | 3.34 | 0.74 | Agree |
| **3** | Information from education authorities reaches staff faster through cloud platforms | 3.38 | 0.73 | Agree |
| **4** | Cloud-based communication reduces the cost of circulars and meetings | 3.38 | 0.71 | Agree |
| **5** | Cloud computing tools create a reliable record of communications | 3.48 | 0.66 | Agree |

*Note.* Criterion mean = 2.50.

Table 4 indicates that all five communication items were accepted, with a cluster mean of 3.4 (SD = 0.61). The creation of a reliable record of communications (M = 3.48) was the most strongly endorsed benefit.

**Research Question 4: Challenges Militating Against Adoption**

**Table 5**

*Mean Ratings on Challenges Militating Against Adoption*

| Item | Statement | *M* | *SD* | Decision |
|---|---|---|---|---|
| **1** | Poor internet connectivity limits the use of cloud computing tools | 3.42 | 0.74 | Agree |
| **2** | Unreliable electricity supply hinders the adoption of cloud tools | 3.23 | 0.88 | Agree |
| **3** | Staff lack the digital skills needed to use cloud computing tools | 3.15 | 0.77 | Agree |
| **4** | Concerns about data privacy and security discourage adoption | 3.20 | 0.80 | Agree |

*Note.* Criterion mean = 2.50.

Table 5 shows that respondents identified all four items as challenges, with a cluster mean of 3.25 (SD = 0.64). Poor internet connectivity (M = 3.42) and unreliable electricity supply (M = 3.23) were rated the most serious constraints.

**Test of Hypotheses**

**Ho1.** There is no significant relationship between the adoption of cloud computing tools and record-keeping.

**Table 6**

*Pearson Correlation Between Adoption and Record-Keeping*

| Variables | *n* | *r* | *p* | Decision |
|---|---|---|---|---|
| **Adoption and record-keeping** | 176 | .39 | < .001 | Rejected |

*Note.* Significant at p < .05.

A significant positive relationship was found between the adoption of cloud computing tools and record-keeping ($r = .39$, $n = 176$, $p < .001$). Because p was less than .05, the null hypothesis was rejected. The association was positive and moderate in strength.

**Ho2.** There is no significant relationship between the adoption of cloud computing tools and communication among stakeholders.

**Table 7**

*Pearson Correlation Between Adoption and Communication*

| Variables | *n* | *r* | *p* | Decision |
|---|---|---|---|---|
| **Adoption and communication** | 176 | .38 | < .001 | Rejected |

*Note.* Significant at $p < .05$.

A significant positive relationship was found between adoption and communication ($r = .38$, $n = 176$, $p < .001$). The null hypothesis was rejected.

**Ho3.** There is no significant difference between the mean responses of principals and teachers on the extent of adoption of cloud computing tools.

To test this hypothesis, respondents were grouped into administrators (principals and vice-principals, $n = 67$) and teachers (senior and ICT teachers, $n = 109$). An independent-samples t test compared the two groups on the extent of adoption.

**Table 8**

*Independent-Samples t Test Comparing Administrators and Teachers on Extent of Adoption*

| Group | *n* | *M* | *SD* | *t* | *p* | Decision |
|---|---|---|---|---|---|---|
| **Administrators** | 67 | 2.71 | 1.00 | -3.03 | .003 | Rejected |
| **Teachers** | 109 | 3.14 | 0.79 | | | |

*Note.* Administrators = principals and vice-principals; teachers = senior and ICT teachers. Significant at $p < .05$.

As shown in Table 8, administrators ($M = 2.71$, $SD = 1$) and teachers ($M = 3.14$, $SD = 0.79$) differed significantly in the extent of adoption, $t(174) = -3.03$, $p = .003$. The null hypothesis was rejected. Notably, administrators reported a lower extent of adoption than teachers, suggesting that those in supervisory and administrative roles perceived cloud computing tools to be less embedded in school management than did classroom-based staff.

**Ho4.** There is no significant difference between the mean responses of male and female respondents on the challenges militating against adoption.

**Table 9**

*Independent-Samples t Test Comparing Male and Female Respondents on Challenges*

| Group | *n* | *M* | *SD* | *t* | *p* | Decision |
|---|---|---|---|---|---|---|
| **Male** | 71 | 3.32 | 0.66 | 1.23 | .22 | Not rejected |
| **Female** | 105 | 3.20 | 0.62 | | | |

*Note.* Not significant at $p < .05$.

Male and female respondents did not differ significantly in their perception of the challenges militating against adoption, $t(174) = 1.23$, $p = .22$. The null hypothesis was not rejected.

**Discussion**

The study found that cloud computing tools are adopted to a moderate extent in public secondary schools in AMAC (M = 2.98). This suggests that, within the relatively well-served environment of the Federal Capital Territory, cloud storage and productivity tools have begun to feature in routine administration, consistent with evidence that cloud computing is an increasingly embedded feature of educational management (Thavi et al., 2024; Govea et al., 2023).

The significant positive relationship between adoption and record-keeping ($r = .39$, $p < .001$) supports the view that cloud computing tools enhance the retrieval, security, and integrity of school records (Wang & Wang, 2023). Respondents most strongly affirmed that cloud-stored records are more secure than paper files. Although the correlation is moderate in magnitude, it indicates that record-keeping outcomes are also shaped by additional factors, including staff competence and institutional privacy policy (Alier et al., 2021).

Similarly, the significant positive relationship between adoption and communication ($r = .38$, $p < .001$) indicates that cloud computing tools contribute to faster and more reliable communication among stakeholders (Liu et al., 2025; Khasawneh et al., 2023). Respondents particularly valued the capacity of cloud tools to create dependable records of communication.

Regarding challenges, poor internet connectivity and unreliable electricity supply emerged as the most pressing constraints, mirroring barriers documented in prior adoption research (Santos et al., 2024; Vu et al., 2026; Oleksiuk et al., 2023). A significant difference emerged between administrators and teachers in the extent of adoption ($t = -3.03$, $p = .003$), with administrators reporting lower adoption than teachers. This is a noteworthy finding: principals and vice-principals, who oversee school-wide systems, may be more aware of the gaps and inconsistencies in cloud adoption than classroom staff, whose exposure is limited to the tools they use directly. By contrast, male and female respondents did not differ significantly in perceived challenges ($t = 1.23$, $p = .22$), suggesting that infrastructural constraints are experienced broadly across the workforce regardless of gender.

**Conclusion and Recommendations**

The study concluded that cloud computing tools are adopted to a moderate extent in public secondary schools in AMAC and are significantly and positively associated with improved record-keeping and communication. Adoption was found to differ by administrative role, with administrators reporting lower adoption than teachers. The sustained and expanded use of these tools is constrained principally by poor internet connectivity and unreliable electricity supply, alongside concerns relating to digital skills and data security.

Based on the findings, the following recommendations are made:

1. The FCT Education Secretariat and school authorities should prioritise sustained investment in reliable internet connectivity and stable power supply, as these were the most pressing barriers to adoption.
2. Regular capacity-building programmes and training workshops should be organised to strengthen the digital skills of principals, vice-principals, teachers, and administrative staff.
3. Schools administrators should develop clear data-management and privacy policies to safeguard sensitive records stored in the cloud.
4. Education authorities should formulate and fund explicit policies that encourage the integration of cloud computing tools into routine school administration, with particular attention to supporting administrators, who reported lower adoption.

5. Future researchers should extend the scope to other area councils and school types, and employ comparative designs to explore why adoption differs between administrators and teachers.

**Limitations of the Study**

Several limitations should be noted. The study relied on self-reported perceptions collected through a questionnaire, which may be subject to response bias. Although the response rate was high and all four respondent categories were well represented, the findings are specific to public secondary schools in AMAC and should be generalised to other contexts with caution. Finally, the study established statistical relationships but did not establish causation; the observed associations between adoption and school-management outcomes should therefore be interpreted as correlational.

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