Journal of Management Practices, Humanities and Social Sciences
ISSN: 2604-6423, Volume 12, Issue 3, 27-35

APPLICATION OF DIGITAL TOOLS FOR EFFECTIVE SUPERVISION OF SECONDARY SCHOOLS IN THE FEDERAL CAPITAL TERRITORY, ABUJA-NIGERIA

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Abstract: In this study, the application of digital tools in the supervision of secondary schools in the FCT Abuja is being examined through the availability, utilisation, perceived effectiveness, barriers, and supervisory outcomes for public and private schools. A descriptive survey research design was adopted for the study, and 102 respondents were sampled using a questionnaire. The data were analysed using descriptive statistics, Pearson correlation, independent samples t-test and multiple regression. The results indicate that the availability of digital tools was high, but its usage is moderate and partial. Strong correlations were observed between the perceived effectiveness and supervisory outcomes ($r = 0.918$, $p<0.01$) and the correlation between utilisation and outcomes ($r = 0.746$, $p<0.01$) while barriers negatively correlate with utilisation ($r= -0.256$, $p<0.01$). The regression model was statistically significant ($F= 159.581$, $p<0.001$) and explained 86.8% variance in supervisory outcomes ($R^2=0.868$), while perceived effectiveness ($\beta =0.776$, $p<0.001$) was the strongest predictor followed by utilisation ($\beta =0.188$, $p=0.001$) while both utilisation and constraints were not significant. The t-test reveals a difference in the level of perceived effectiveness between public and private schools ($p =0.044$). In conclusion, the effectiveness of the digital tools in the context of the study is not driven by availability alone, but utilisation, followed by perceived effectiveness while constraints limit utilisation indirectly. Training interventions aimed at enhancing utilisation, improving infrastructure for better connectivity and favourable policies for continuous integration are therefore recommended.

Keywords: Digital supervision; ICT integration; Perceived effectiveness; Supervision outcomes; Secondary education; Educational administration

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Acceptance Date : 10-04-2026 Publication Date: 23-05-2026

Nomenclature and Abbreviations
ICT — Information and Communication Technology
TAM — Technology Acceptance Model
LMS — Learning Management System
r — Pearson correlation coefficient
β — Standardised regression coefficient
R^2 — Coefficient of determination
FCT — Federal Capital Territory

I. INTRODUCTION

The effective supervision of secondary schools is an essential part of educational administration because it ensures instructional quality, accountability, and adherence to the curriculum standards. Traditionally, supervision in many parts of the developing world, such as Nigeria, relied much on manual methods, ranging from physical inspection, paper-based reports, and intermittent visits to schools by officials, and these systems, however, proved to be slow, disjointed, and do not support effective, timely, data-driven decision making [1], [2]. Over the years, there has been a conscious shift worldwide towards integrating digital tools into educational

management systems. Digital tools are used in the form of LMS and web-based platforms for monitoring, accountability, and efficient reporting [3], [4].

However, the digital shift and integration in Nigerian schools remain sporadic. While digital tools are increasingly available, they are not always utilised effectively. It is evident that the provision of technology infrastructure alone can't lead to better outcomes when there are challenges with usage, as institutional capacity and systemic integration are limited [5]. It has been noted that, even though many schools are equipped with digital tools, it doesn't necessarily mean that school administrators and supervisors know how to use them, and it will ultimately fail to yield results in an optimal fashion. This raises questions about the returns on digital investments in school supervision.

This issue is particularly sensitive in the FCT Abuja, and although FCT is believed to have higher levels of infrastructure, it is still uneven in terms of how digital tools are utilised for supervision. In many of its six Area Councils—Abuja Municipal Area Council (AMAC), Bwari, Gwagwalada, Kuje, Abaji, and Kwali—the implementation seems to vary, and there are limited empirical studies of this kind of use in an African context, particularly for Nigeria, beyond the broader focus of ICT application in schools [6], [7].

This study, therefore, explores the available digital tools, the use they are put to, perceived effectiveness, the limitations, and the impact it has on school supervision across the six Area Councils within the FCT, for both public and private schools.

Hypotheses

H1: There is no significant relationship between availability and perceived effectiveness of digital tools.
H2: There is no significant difference between public and private secondary schools in perceived effectiveness.
H3: There is no significant relationship between perceived effectiveness and supervision outcomes.
H4: There is no significant relationship between constraints and utilisation of digital tools.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Digital Supervision in Secondary Education

The use of digital technology in education has really transformed the practice of supervision in secondary education by moving away from manual processes to efficient and data-driven systems, but while traditional supervisory methods relied on paper-based records and on-site inspections, digital tools, such as learning management systems and online dashboards, offer real-time monitoring and enhanced record keeping [1], [2].

Sub-Saharan Africa has adopted digital supervision practices in a bid to increase system accountability and monitoring; studies in countries like South Africa and Rwanda show great improvement in these aspects with centralised digital systems [4]. However, the implementation in Nigeria is often inconsistent, and the provision of ICT facilities does not always guarantee a positive outcome. This is as a result of limited connectivity and lack of capacity among users [5]. As such, many schools still have a hybrid system in terms of digital integration for supervision.

2.2 Conceptualisation of Key Variables

The study involves five key variables as listed above in the abstract. **Availability** refers to the extent to which the needed digital tools are available in schools. Accessibility and quantity of tools fall under availability. However, availability does not guarantee effective usage; it serves as the first phase of integration. **Utilisation** is the actual use of the digital tools for supervisory tasks, and this is usually measured based on how often they are utilised in schools, and it is more relevant as it proves user engagement with the tools [7]. **Constraints** refers to any barrier to using digital tools, such as a lack of ICT skills, poor infrastructure, or resistance to change, which inhibit users' full engagement with the tools [6]. **Perceived effectiveness** is the users' beliefs about the impact the digital tool has on how they achieve supervisory objectives and improve its outcomes. **Supervision outcomes** are effects on the supervisory process from using digital tools. It is measured as improvement in records, reports, the decision-making process, and general quality of supervision.

2.3 Theoretical Framework: Technology Acceptance Model (TAM)

This study is guided by the Technology Acceptance Model (TAM). Davis's [8] Technology Acceptance Model (TAM) explained that perceived usefulness and perceived ease of use are central to individuals' technology adoption and usage. In the current study, perceived effectiveness and utilisation relate closely to the perceived usefulness and ease of use. Barriers (e.g. inadequate skills, poor connectivity, costs, etc.) in the supervision context are similar to factors that reduce the perceived ease of use, thus influencing user acceptance of the system. Therefore, TAM serves as a suitable framework for examining how factors such as availability,

utilisation, perceived effectiveness, and constraints are intertwined and how they influence supervisory outcomes.

III. METHODOLOGY

3.1 Research Design and Study Context

This research employed a descriptive survey research design, and this design is suitable for describing phenomena based on collected data. The research explores the utilisation of digital tools for the supervision of secondary schools in the Federal Capital Territory, Abuja. The FCT is made up of six Area Councils and they are AMAC, Bwari, Gwagwalada, Kuje, Abaji, and Kwali, and they cover the entire geographical scope and include both urban and semi-urban areas.

The population was made up of both school administrators and government supervisors in secondary schools under the jurisdiction of the FCT Education Board, with both public and private secondary schools taken into account in order to get a balanced representation.

3.2 Sample and Sampling Technique

A total of 102 respondents were sampled for the study. The sampling was conducted using a multi-stage sampling approach where the Area Councils were selected, thereafter both public and private secondary schools were included from the respective councils, before purposefully selecting the respondents on the basis that they are directly involved in supervisory activities and understand digital tools.

3.3 Instrumentation, Validity, and Reliability

A questionnaire was developed as the instrument for data collection. It consisted of six sections with section one pertaining to demographic characteristics and sections two through six relating to availability, utilisation, perceived effectiveness, constraints, and supervisory outcomes, respectively. Answering on a five-point Likert scale ranging from 'Strongly Disagree' (1) to 'Strongly Agree' (5), each response was summed and divided by the number of questions to give the scale meaning.

Validity of the items was ascertained by expert review by specialist educators in educational administration and measurement who edited the questions to suit the context. Reliability of the questionnaire scales was computed using Cronbach's alpha, and all the alpha values obtained were above 0.70, which is considered acceptable for the study.

3.4 Data Collection and Ethical Considerations

All participants were briefed on the nature of the study and gave their consent before participating. Their responses were kept anonymous and confidential and are used only for the purpose of this research.

3.5 Data Analysis

SPSS version 26 was used to perform the analysis of data, and results were tabulated with Microsoft Excel. Descriptive statistics such as mean and standard deviation were used to summarise the obtained data, and reliability and validation were done with Cronbach’s alpha. Multiple regression and Pearson correlation were also employed to analyse and test hypotheses and draw conclusions on the relationship between variables at a 0.05 significance level.

IV. RESULTS

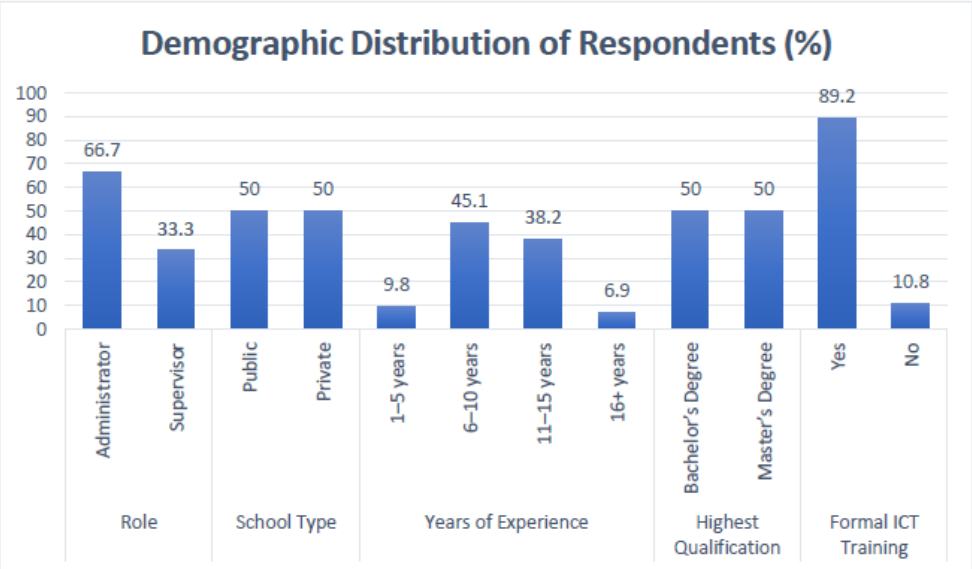
4.1 Demographic Characteristics of Respondents

The demographic data of the respondents is presented in Table 3.1 using frequency and percentage distributions. The demographic variables considered are role, school type, Area Council, years of experience, highest qualification, and formal ICT training.

The table shows that the respondents were mostly school administrators (66.7%), while 33.3% of them were supervisors. This indicates that data was obtained primarily from school-level officials. Public schools were equally represented (50.0%), just as private schools (50.0%). All six Area Councils had representation, with 16.7% of respondents drawn from each, meaning adequate geographical coverage was obtained in the FCT. The majority of respondents have 6–10 years (45.1%) of work experience, with 38.2% having between 11–15 years of experience. The majority of the respondents had a Bachelor's degree (50.0%), with an equal percentage of respondents having Master's degrees (50.0%). A vast majority of respondents have had formal training on ICT in schools (89.2%), and only 10.8% indicated none.

Table 3.1: Demographic Distribution of Respondents (N = 102)

Variable	Category	Frequency (N)	Percentage (%)
Role	Administrator	68	66.7
	Supervisor	34	33.3
School Type	Public	51	50.0
	Private	51	50.0
Area Council	AMAC	17	16.7
	Bwari	17	16.7
	Gwagwalada	17	16.7
	Kuje	17	16.7
	Abaji	17	16.7
	Kwali	17	16.7
Years of Experience	1–5 years	10	9.8
	6–10 years	46	45.1
	11–15 years	39	38.2
	16+ years	7	6.9
Highest Qualification	Bachelor's Degree	51	50.0
	Master's Degree	51	50.0
Formal ICT Training	Yes	91	89.2
	No	11	10.8



4.2 Descriptive Statistics

The respondents strongly agree that digital tools are available in their schools (M = 4.17), that the relevant hardware and facilities are available (M = 4.17). That access to educational platforms was adequate (M = 4.01). However, internet connectivity had a relatively lower mean score (M = 3.17), indicating it is an area that needs improvement. The use of digital tools for supervisory tasks is moderate (M = 3.55), with higher use for reporting (M = 3.71) and monitoring (M = 3.71), but significantly lower for communication (M = 2.83) and data management (M = 3.01), indicating that utilisation is partial. The overall perceived effectiveness of the digital tools is moderate, with high values for the efficiency and communication aspects (M = 3.54 and M = 3.50, respectively), lower scores were registered for the accountability and decision-making aspects (M=2.75 and M=2.77 respectively). There are constraints that are not extremely serious in the schools sampled; cost had the lowest score (M = 1.99), but internet connectivity and resistance to change scored higher (M=2.81 and M=2.65, respectively) and represent key barriers. Supervision outcomes were generally good; decision-making had a high score (M = 3.55), just as efficiency (M=3.54).

Table 3.2: Descriptive Statistics (N = 102)

Variable	Mean	Std. Dev.
Digital tools available	4.17	0.691
Infrastructure available	3.82	0.681
Internet access	3.17	0.691
Platforms accessible	4.01	0.589
Devices provided	4.17	0.691
Used for supervision	3.55	1.050
Used for reporting	3.71	0.765
Used for communication	2.83	0.719
Used for monitoring	3.71	0.791
Used for data management	3.01	0.960
Improves efficiency	3.54	1.078
Improves accuracy	3.17	0.732
Enhances accountability	2.75	0.829
Improves communication	3.50	0.887
Supports decisions	2.77	1.014
ICT skill limitation	2.60	0.812
Connectivity barrier	2.81	0.671
Cost barrier	1.99	0.711
Resistance to change	2.65	0.740
Training limitation	2.02	0.703
Improves monitoring	3.45	0.886
Improves record keeping	3.05	0.937
Improves decisions	3.55	0.875
Improves overall quality	3.33	1.047

4.3 Reliability Analysis

The analysis shows that all the variables have a very high internal consistency ranging from 0.894 to 0.972, thus reliable for the analysis to be carried out.

Table 3.3: Reliability Statistics

Construct	Alpha	Items
Availability	0.969	5
Utilisation	0.972	5
Effectiveness	0.894	5
Constraints	0.960	5
Outcomes	0.944	5

4.4 Correlation Analysis

The table shows a strong positive relationship between effectiveness and supervisory outcomes ($r = 0.918$, $p<0.01$) and a very strong relationship between utilisation and supervisory outcomes ($r = 0.746$, $p<0.01$). A strong positive relationship exists between effectiveness and utilisation ($r=0.692$, $p<0.01$). There is a significant negative relationship between constraints and utilisation ($r = -0.256$, $p<0.01$), but no significant relationship with effectiveness or supervisory outcomes.

Table 3.4: Correlation Matrix (N = 102)

Variable	Effectiveness	Outcomes	Utilisation	Constraints
Effectiveness	1	0.918**	0.692**	−0.113
Outcomes	0.918**	1	0.746**	−0.178
Utilisation	0.692**	0.746**	1	−0.256**
Constraints	−0.113	−0.178	−0.256**	1

4.5 Independent Samples t-Test

The study reveals a significant difference in the level of perceived effectiveness of the digital tools between public (Mean=2.9922, SD=0.5946) and private (Mean=3.2980, SD=0.8885) schools, ($t = -2.043$, $p = 0.044$). This indicates that perceived effectiveness is higher in private schools.

Table 3.5: Group Statistics

School Type	N	Mean	Std. Dev.
Public	51	2.9922	0.5946
Private	51	3.2980	0.8885

Table 3.6: t-Test Results

t	df	Sig.	Mean Diff.
−2.043	87.304	0.044	−0.30588

4.6 Regression Analysis

The multiple regression analysis shows that the predictor variables explain 86.8% of the variation in supervision outcomes (R=0.868) which is statistically significant (F= 159.581, p<0.001). Of the four predictor variables in the model, only effectiveness (β =0.776, p<0.001) and utilisation (β =0.188, p=0.001) were significant predictors of supervisory outcomes. Availability and constraints were not significant predictors of supervision outcomes.

Table 3.7: Model Summary

R	R^2	Adj. R^2	Std. Error
0.932	0.868	0.863	0.324

Table 3.8: ANOVA

F	Sig.
159.581	0.000

Table 3.9: Coefficients

Variable	Beta	t	Sig.
Availability	0.018	0.399	0.691
Utilisation	0.188	3.272	0.001
Effectiveness	0.776	15.112	0.000
Constraints	−0.037	−0.942	0.349

V. DISCUSSION, CONCLUSION, AND RECOMMENDATION

5.1 Discussion and Conclusion

The findings of this study which examines the integration and effectiveness of digital tools in secondary schools in FCT, Abuja based on the parameters of availability, utilisation, constraints and supervision outcomes provide a comprehensive overview of the current situation and reveal an important insight: availability alone is not sufficient to guarantee effectiveness. Rather, how the digital tools are utilised and perceived their effectiveness will determine how impactful they are on supervisory tasks and outcomes.

It is worthy to note that despite a high level of availability of digital tools in the schools sampled, its utilisation is moderate and fragmented across certain functions as opposed to others. The high frequency of usage in tasks like reporting and monitoring and moderate to low usage for data management and communication reiterates previous research stating that access alone is not enough to achieve effective integration when other critical factors such as strong institutional support and adequate user capacity are limited [7], [9]. The results suggest that the uptake of technology is progressive as users are more likely to adopt basic functions of digital tools before progressing to more complex functions such as advanced data management [10].

The high and significant positive correlation between perceived effectiveness and supervisory outcomes ($r = 0.918$), along with the same relationship with utilisation ($r = 0.746$), as well as the strongest prediction by perceived effectiveness (β=0.776) and second by utilisation (β=0.188) affirms the fundamental claims of TAM model which states that users must believe in the usefulness of the technology in order to utilise it and DeLone and McLean model of Information Systems Success Model [11], which correlates system use and perceived value to outcomes. The significance of these variables to the predictor variables proves that their usage is only beneficial if the user sees them as effective, and the most effective are the ones that positively impact on their

supervisory activities. The lack of significant relationship between constraints and outcomes confirms it works on users' behaviour indirectly, that is, constraints reduce utilisation of the tool thereby impacting the outcome indirectly.

It is also crucial to note the disparity in the level of perceived effectiveness between public (Mean=2.9922) and private (Mean=3.2980) schools in the sampled FCT schools ($t = -2.043$, $p = 0.044$). This may be because private schools have better administrative policies, organisational flexibility, and resource allocation which contribute positively to the uptake and user perception. Studies have been conducted showing higher and quicker adoption rate of technologies in private sector than in the public sector, due to reduced bureaucracy and higher flexibility [12]. This confirms that there is an unequal environment in the FCT which should be corrected with specific interventions aimed at improving the perceived effectiveness of digital tools in public secondary schools.

These findings underscore the argument that digital integration goes beyond merely providing infrastructure to improving the human dimension, such as user capacity and institutional support, and so, the research advocates that in order for digital tools to be effectively utilised in supervision, schools and relevant authorities must invest in both physical technology and human capital as well as create policies and a conducive environment for them to thrive in.

The conclusions of the study are that utilisation, followed closely by perceived effectiveness, significantly influences the effectiveness of digital tools for supervisory functions; with perceived effectiveness acting as a more critical predictor, even over utilisation, while the role of constraints appears to limit utilisation which indirectly affect the outcome.

5.2 Recommendations

1. Targeted training programs on digital tools for both school administrators and government supervisors to improve ICT competencies should be a priority.
2. In addition, enhanced investment and upgrading of Internet infrastructure across the six Area Councils in the FCT should be done in a consistent manner so as to enable the seamless operation of digital tools.
3. Once more, schools should be encouraged and supported to integrate digital platforms to enhance seamless monitoring, data management, and communication.
4. Efforts to improve digital supervision should not be limited to just providing tools but should focus more on sustained use, engagement, and the resultant effectiveness in the long run.
5. Finally, specific programs and support should be introduced in public schools to reduce the disparities in the utilisation and effectiveness of digital tools as was observed in the research (they recorded lower levels than their private counterparts).

5.3 Limitations and Future Research

The cross-sectional nature of this research, means that its results may not infer causal relationships since the responses were self-reported and could have been influenced by social desirability bias. Future research could utilise qualitative approaches like interviews and classroom observation to provide deeper insights into user experiences. A longitudinal study could also be used to investigate the impact and sustainability of digital tools in supervision over time and further research can explore digital supervision at various levels of the education system.

Acknowledgments

The authors acknowledge all participants in this study and the institutions that facilitated data collection.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest

The authors declare no conflict of interest.

Ethics Approval

All participants provided informed consent prior to participation. Anonymity and confidentiality of respondents were maintained throughout the study in accordance with institutional ethical standards.

Data and Code Availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions (CRediT)
Conceptualization, methodology, investigation, data curation, writing—original draft, writing—review & editing: All authors contributed equally.

AI-Use Disclosure
No generative AI tools were used in the preparation of this manuscript. All content and conclusions were authored and verified by the authors.

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