

# Distributed Database Management System Skills Need for Enhanced Job Performance of System Administrators in Universities in South-South, Nigeria

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Received: 05.05.2026 | Accepted: 31.05.2026 | Published: 03.06.2026

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DOI: [10.5281/zenodo.20530866](https://doi.org/10.5281/zenodo.20530866)

## Abstract

## Original Research

The study investigated the distributed database management system skills required for enhanced job performance of system administrators in universities in Southern Nigeria. Two specific objectives, two research questions, and two null hypotheses guided the study. A descriptive survey research design was adopted. The population of the study comprised 387 lecturers and system administrators drawn from universities in Southern Nigeria. Using the Taro Yamane formula, a sample size of 197 respondents, consisting of 60 system administrators and 137 lecturers, was selected for the study. Data were collected using a structured questionnaire titled *Distributed Database Management System Skills Need Questionnaire (DDMSNQ)*. The instrument was validated by three experts, while a reliability coefficient of 0.714 was obtained using the Cronbach alpha method. Data collected were analyzed using mean and Improvement Need Index (INI) to answer the research questions, while independent t-test statistics were used to test the null hypotheses at a 0.05 level of significance. The findings revealed that database security management and database modeling skills were required by system administrators for enhanced job performance in universities in Southern Nigeria. The study concluded that the acquisition of distributed database management system skills is essential for improving the efficiency and effectiveness of system administrators in universities. Based on the findings, the study recommended that university management should organize regular training and capacity-building programmes to equip system administrators with relevant distributed database management skills for improved job performance.

**Keywords:** Distributed Database Management System, System Administrators, Database Security Management, Database Modeling.

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## Introduction

With rapid advances in information technology and exponential growth in data generation, data management practices in modern organizations have undergone significant transformation, thereby increasing

the importance of distributed database management systems in institutional operations. Researchers observed that distributed database systems reduce system overload, improve performance under heavy workloads, and ensure continuity of operations in the event of node failure (Elmasri and Navathe, 2016). Unlike

centralized systems, distributed database systems enable data storage and processing across multiple interconnected locations while maintaining a unified database environment (Alfred et al., 2022; Özsu and Valduriez, 2020). Consequently, these systems enhance scalability, fault tolerance, data availability, security, and operational efficiency.

The growing need for reliable, flexible, and large-capacity data management systems has increased the adoption of distributed database systems in universities, where academic, administrative, and research data are generated across multiple departments and campuses. In universities, distributed database systems support student records management, financial administration, research data storage, report generation, and online learning services. Hoffer et al. (2016) emphasized that distributed systems provide the scalability and flexibility required for managing increasing volumes of educational data. Similarly, Coronel and Morris (2016) noted that these systems facilitate real-time data integration and accessibility in decentralized institutional environments. Sharma and Sharma (2019) further observed that integrated distributed systems improve collaboration, distance education, and overall institutional efficiency. However, the increasing dependence on distributed and cloud-based infrastructures has also heightened concerns regarding data security, system reliability, and uninterrupted service delivery.

Effective management of distributed database systems therefore requires specialized competencies in database security management and data modeling. Database security management skills are essential for protecting institutional data against unauthorized access, cyber threats, and data breaches, while data modeling skills support efficient database design, scalability, data integrity, and system performance. Competencies in data encryption are particularly important for safeguarding sensitive institutional information (Whitman and Mattord, 2021). In addition, effective data modeling techniques improve database scalability, system reliability, and operational efficiency (Waybhasse and Adakane, 2022). Despite the increasing adoption of distributed

and cloud-based database infrastructures in university administration, concerns persist regarding the adequacy of the competencies possessed by system administrators responsible for managing these environments, particularly in universities in South-South Nigeria. Deficiencies in database security management and data modeling skills have been associated with poor system performance, data inconsistencies, operational inefficiencies, prolonged system downtime, and increased vulnerability to information security breaches (Ajah and Chigozie-Okwum, 2019; Musa and Shu'aibu, 2025). These challenges suggest the existence of competency gaps among system administrators involved in distributed database management.

Although previous studies have examined technological developments and administrative effectiveness in higher education institutions, limited empirical attention has been given to the specific competencies required for effective management of distributed database systems by system administrators in universities in South-South Nigeria. In particular, insufficient attention has been paid to database security management skills and data modeling skills required for efficient administration of distributed database environments. Furthermore, the continuous evolution of distributed and cloud-based technologies has increased the demand for advanced technical competencies in database administration. The present study therefore seeks to identify competency gaps in database security management and data modeling among system administrators in universities in South-South Nigeria and propose strategies for improving professional capacity in distributed database management.

This study is anchored on the Dreyfus Model of Skill Acquisition developed by Hubert Dreyfus and Stuart Dreyfus. The theory explains how individuals acquire skills progressively through experience and practice, moving through the stages of novice, advanced beginner, competent, proficient, and expert. According to the theory, competence develops gradually as individuals gain practical exposure and experiential understanding in a given field. The theory is relevant to this study because it provides a framework for assessing the

competency levels of System Administrators in distributed database management environments. It also explains the existence of competency gaps and highlights the importance of continuous professional development, mentoring, and practical experience in enhancing database management competencies among System Administrators in universities.

Several studies have emphasized the importance of database security management competencies in modern organizations. Ibrahim et al. (2024) reported that database management and information security competencies are essential for administrators responsible for managing electronic records and digital information systems. Similarly, Kolo et al. (2022) found that security management competencies are critical professional skills required for effective administrative and information management in technology-driven organizations. Studies have also highlighted the importance of database modeling competencies in enhancing organizational efficiency. George (2017) emphasized the need to align workplace competency requirements with practical professional skill development in order to address performance deficiencies. In the same vein, Sunday (2017) observed that database modeling competencies contribute significantly to professional effectiveness, innovation, and organizational productivity.

### Statement of the Problem

Determining the distributed database management competencies required of system administrators in federal universities in southern Nigeria was the primary objective of the present work, in response to a paucity of empirical research on this topic despite widespread use of distributed database technologies. Use of digital technologies for academic and administrative operations in Nigerian universities accelerated adoption of distributed database management systems to achieve efficient storage, access, scalability and reliability of information at multiple locations. However, the complexity of these systems required that system administrators have specialized skills for effective management and maintenance. Concerns about the adequacy of training in

distributed database management for system administrators in southern Nigerian federal universities developed in parallel with rapid technological progress.

Absence of competence in areas of database configuration, replication management, security administration, backup and recovery and optimization of system performance would result in reduced efficiency, increased periods of system failure and greater risk of data breaches. These concerns were supported by results of empirical studies (Alfred et al., 2022; Adenekan and Jimoh, 2024; Adekunle and Bello, 2021) in which we demonstrated that limitations of specialized training and of programs for professional development severely impaired the quality of care for distributed database management systems in Nigerian universities. Consequently, performance of systems and security of data remained substantially suboptimal. Finally, our continuing inability to obtain complete data on the skill requirements for management of distributed database systems in southern Nigeria reflects the continuing need for additional empirical research on this topic in the face of widespread application of distributed database technologies to operations in these institutions.

### Purpose of the Study

The main purpose of the study was to determine the distributed database management system skills need of system administrators in universities in South-South, Nigeria. The specific objectives of the study will be to:

1. Determine Database Security Management Skills need for enhance the job performance of System Administrators and Experts (Lecturers) in Universities in South-South Nigeria.
2. Determine Data Modeling Skills need for enhance the job performance of System Administrators and Experts (Lecturers) in Universities in South-South Nigeria.

### Research Questions

The following research questions was

raised to guide the study:

1. What is Database Security Management skills needed to enhance the job performance of System Administrators and Experts (Lecturers) in Universities in South-South Nigeria?
2. What is Data Modeling Skills need for enhance the job performance of System Administrators and Experts (Lecturers) in Universities in South-South Nigeria?

### Research Hypotheses

The following null hypotheses was formulated to guide the study and was tested at 0.05 alpha level of significant:

- H<sub>01</sub>: There is no significant difference in the mean responses of System Administrators and Experts (Lecturers) in Database Security Management Skills need for enhance job performance in Universities in South-South Nigeria.
- H<sub>02</sub>: There is no significant difference in the mean response of System Administrators and Experts (Lecturers) in Data Modeling Skills need for enhance job performance in Universities in South-South Nigeria.

### Research Methods

A descriptive survey design was adopted for this study. The study was conducted in universities in South-South, Nigeria. The population for this study comprised 387 lecturers and system administrators across universities in South-South Nigeria. A sample of 197 respondents was selected, consisting of 60 system administrators and 137 lecturers using random sampling technique to ensure

representation across disciplines. The researcher developed twenty (20) items research instrument titled: "Distributed Database Management System Skills Need (DDMSN)" for data collection for this study. The instrument was face validated by three experts, while reliability testing using Cronbach's alpha yielded a coefficient of 0.714, indicating high internal consistency. The questionnaire was administered to the respondents by the researcher together with one research assistant. Mean and the Improvement Need Index (INI) was used to answer the two research questions while the independent sample t-Test was used to test null hypotheses at 0.5 level of significance. The value of Performance Gap (PG) was used as a decision rule for the research questions as indicated in the following order:

- a. Positive Performance Gap (PG) indicates a skill need because the required skill level is higher than the System Administrators' performance level.
- b. Negative PG indicates no skill need because the administrators' performance level is higher than the required level.
- c. Zero PG indicates no skill need because the required skill level is equal to the administrators' performance level.

In order to test the null hypotheses, if the p-value was less or equal to 0.05 ( $p \leq 0.05$ ), the null hypothesis was rejected. Notwithstanding, where p-value was greater than 0.05 ( $p > 0.05$ ), then the null hypothesis was retained.

### Result and Discussion

**Research Question 1:** What is Database Security Managements Skills need for enhance job performance of System Administrators in Universities in South-South Nigeria?

**Table 1: Performance Gap Analysis on Database Security Managements Skills need. (n=183)**

S/N	Items	$\bar{X}_N$	$\bar{X}_P$	$PG(\bar{X}_N - \bar{X}_P)$	Remark
1	Implement authentication mechanism.	4.80	3.00	1.80	Needed
2	Create reliable backup procedures.	4.70	3.00	1.70	Needed
3	Regularly scan the database for	3.80	4.00	-0.20	Not

	potential vulnerability.				Needed
4	Continuously monitor database activity for suspicious behavior.	3.70	3.90	-0.20	Not Needed
5	Understand emerging threats trends.	5.85	2.90	1.95	Needed
6	Mask sensitive data to protect privacy.	4.75	2.90	1.85	Needed
7	Stay updated with the latest security patches.	3.75	3.95	-0.20	Not Needed
8	Test data restoration capabilities to prevent data lobes.	3.60	3.80	-0.20	Not Needed
9	Restrict database access to trusted IPs using firewalls.	4.90	2.90	2.00	Needed
10	Disable unnecessary services to minimize attack surfaces.	4.70	3.00	1.70	Needed
	<b>Cluster Mean</b>	<b>4.46</b>	<b>3.34</b>	<b>1.02</b>	<b>Needed</b>

Source: Field Survey (2025)

The data presented in Table 1 indicated that six identified items (1, 2, 5, 6, 9, 10) on Database Security Management Skills have their mean difference to be positive values (1.70 to 2.00), indicates that System Administrators skill level is below what is needed. Four identified items (3, 4, 7, 8) with negative values have mean difference of negative values (-0.20) also indicates no skill need. The cluster mean gap was

1.12 which implies that System Administrators need skills on all the identified Database Security Managements Skills for enhance job performance.

**Research Question 2:** What is Data Modeling Skills need for enhance job performance of System Administrators in Universities in South-South Nigeria

Table 2: Performance Gap Analysis on Data Modeling Skills need (n=183)

S/N	Items	$\bar{X}_N$	$\bar{X}_P$	$PG(\bar{X}_N - \bar{X}_P)$	Remark
1	Create relationships between two entities.	5.12	3.48	1.64	Needed
2	Determine the entities needed when designing the database.	4.87	3.76	1.11	Needed
3	Link two tables together using foreign keys.	3.91	4.15	-0.24	Not Needed
4	Move data between systems using Extract, Transform, Load (ETL) techniques.	5.05	3.59	1.46	Needed
5	Determine the structure of the tables.	4.20	4.41	-0.21	Not Needed
6	Determine the data type of every attributes in an entity.	4.88	3.81	1.07	Needed
7	Represent entities using appropriate shapes.	4.33	4.50	-0.17	Not Needed
8	Represent attributes using appropriate shapes.	5.00	2.52	2.48	Needed
9	Represent relationship using appropriate shapes.	4.95	3.22	1.73	Needed



<b>10</b>	Manage non-relational databases.	5.10	3.55	1.55	Needed
<b>Cluster Mean</b>		<b>4.74</b>	<b>3.69</b>	<b>1.04</b>	<b>Needed</b>

Source: Field Survey (2025)

The data presented in Table 2 indicated that seven identified items (1, 2, 4, 6, 8, 9,10) on Data Modeling Skills have mean difference to be positive values (1.11 to 1.64), indicates that System Administrators skill level is below what is needed. Three identified items (3, 5, 7,) with negative values have mean difference of negative values (-0.17 to -0.24) also indicates no skill need. The cluster mean gap was 1.04. This result implies that System Administrators need skills

on all the identified Data Modeling Skills for enhance job performance.

**Research Hypothesis (Ho<sub>1</sub>):** There is no significant difference in the mean responses of System Administrators and Lecturers in Database Security Management Skills need for enhance job performance in Universities in South-South Nigeria.

**Table 3: t-test Analysis of the Mean Responses of System Administrators and Lecturers in Database Security Management Skills Need.**

S/N	Items	Groups	N	Mean	t-values	p-values	Decision
1	Implement authentication mechanism.	Lecturers System Administrators	123 60	4.80 3.00	36.0	0.00	Sig.
2	Create reliable backup procedures.	Lecturers System Administrators	123 60	4.70 3.00	34.0	0.00	Sig.
3	Regularly scan the database for potential vulnerability.	Lecturers System Administrators	123 60	3.80 4.00	1.00	0.32	Not Sig.
4	Continuously monitor database activity for suspicious behavior.	Lecturers System Administrators	123 60	3.70 3.90	-4.00	0.00	Sig
5	Understand emerging threats trends.	Lecturers System Administrators	123 60	5.85 2.90	39.0	0.00	Sig.
6	Mask sensitive data to protect privacy.	Lecturers System Administrators	123 60	4.75 2.90	37.0	0.00	Sig.
7	Stay updated with the latest security patches.	Lecturers System Administrators	123 60	3.75 3.95	0.60	0.55	Not Sig.

8	Test data restoration capabilities to prevent data lobes.	Lecturers	123	3.60	-4.0	0.00	Sig
		System Administrators	60	3.80			
9	Restrict database access to trusted IPs using firewalls.	Lecturers	123	4.90	40.0	0.00	Sig.
		System Administrators	60	2.90			
10	Disable unnecessary services to minimize attack surfaces.	Lecturers	123	4.70	34.0	0.00	Sig.
		System Administrators	60	3.00			

Sig. = Significant, df=181, Sig@ p< .05

Source: Field Survey (2025)

Table 3 gives the summary of the t-test analysis comparing the difference in the mean responses of System Administrators and Lecturers in Database Security Management Skills need for enhance job performance in Universities in South-South, Nigeria. The result shows that out of the ten items assessed on Database Security Management Skills, eight items (1, 2, 4, 5, 6, 8, 9,10) yielded statistically significant difference in mean scores between the two groups, with p- values less than the conventional alpha level of 0.05. Conversely, items 3 and 4 showed no statistically significant difference as evidence by the p-values exceeding

0.05. This implies that there is a significant difference in the mean response of System Administrators and Lecturers in Database Security Management Skills need for enhance job performance. The null hypothesis was rejected.

**Research Hypothesis (Ho2):** There is no significant difference in the mean response of System Administrators and Lecturers in Data Modeling Skills need for enhance job performance in Universities in South-South Nigeria.

**Table 4: t-test Analysis of the Mean Responses of System Administrators and Lecturers in Database Modeling Skills Need**

S/N	Items	Groups	N	Mean	t-values	p-values	Decision
1	Create relationships between two entities.	Lecturers	123	5.12	15.77	0.00	Sig.
		System Administrators	60	3.48			
2	Determine the entities needed when designing the database.	Lecturers	123	4.87	0.88	0.38	Not Sig.
		System Administrators	60	3.76			
3	Link two tables together using foreign keys.	Lecturers	123	3.91	-4.21	0.00	Sig.
		System Administrators	60	4.15			

4	Move data between systems using Extract, Transform, Load (ETL) techniques.	Lecturers System Administrators	123 60	5.05 3.59	11.61	0.00	Sig.
5	Determine the structure of the tables.	Lecturers System Administrators	123 60	4.20 4.41	-0.35	0.73	Not Sig.
6	Determine the data type of every attributes in an entity.	Lecturers System Administrators	123 60	4.88 3.81	18.77	0.00	Sig.
7	Represent entities using appropriate shapes.	Lecturers System Administrators	123 60	4.33 4.50	-0.88	0.38	Not Sig.
8	Represent attributes using appropriate shapes.	Lecturers System Administrators	123 60	5.00 2.52	12.96	0.00	Sig.
9	Represent relationship using appropriate shapes.	Lecturers System Administrators	123 60	4.95 3.22	14.68	.001	Sig.
10	Manage non-relational databases.	Lecturers System Administrators	123 60	3.73 2.05	12.19	0.00	Sig.

Sig. = Significant, df=181, Sig@ p< .05

**Source: Field Survey (2025)**

Table 4 gives the summary of the t-test analysis comparing the difference in the mean responses of System Administrators and Lecturers in Database Modeling Skills need for enhance job performance in Universities in South-South, Nigeria. The result shows that out of the ten items assessed on Database Modeling Skills seven items (1, 3, 4, 6, 8, 9, 10) yielded statistically significant difference in mean scores between the two groups, with p- values less than the conventional alpha level of 0.05. Conversely, items 2, 5 and 7 showed no statistically significant difference as evidence by the p-values exceeding 0.05. This implies that there is a

significant difference in the mean response of System Administrators and Lecturers in Database Modeling Skills need for enhance job performance. The null hypothesis was rejected.

### Discussion of Finding

The findings of the study revealed a noticeable gap between the current performance level of System Administrators and the expected level of competency in database security management skills in universities in South-South Nigeria. The result of the t-test analysis further indicated a statistically significant difference in



the mean responses of System Administrators and Lecturers regarding the database security management skills required for effective job performance. This suggests that although the importance of database security management is widely acknowledged within the university system, the existing competencies of many System Administrators remain inadequate for addressing the increasing security demands associated with distributed database environments. The implication of this finding is that deficiencies in critical security competencies such as data protection, authentication protocols, access control, encryption, and vulnerability management may undermine the efficiency, reliability, and security of institutional database systems. This finding corroborates the position of Ibrahim et al. (2024), who emphasized that database management and information security competencies are indispensable for administrators responsible for managing electronic records and digital information systems. Similarly, Kolo et al. (2022) affirmed that security management competencies constitute essential professional skills required for effective administrative and information management functions across technology-driven organizations. The finding therefore underscores the urgent need for continuous professional development programmes and specialized training initiatives aimed at strengthening database security management competencies among System Administrators in universities.

The study also revealed a significant gap between the current and expected performance levels of System Administrators in database modeling skills. The t-test analysis showed a statistically significant difference in the mean ratings of System Administrators and Lecturers on the database modeling skills required for enhanced job performance in universities in South-South Nigeria. This finding indicates that although database modeling is fundamental to effective database design, organization, integration, and management, many System Administrators in the study area have not attained the required level of proficiency in this competency area. Inadequate database modeling skills may adversely affect database structure, data integrity, system scalability, and overall operational efficiency within university database

systems. The finding is consistent with George (2017), who emphasized the importance of aligning workplace competency requirements with practical and professional skill development in order to address identified performance gaps. The result also supports the assertion of Sunday (2017), who noted that database modeling skills extend beyond technical relevance to influence broader professional effectiveness, innovation, and organizational productivity. The implication of this finding is that universities may experience persistent inefficiencies in database administration and information management unless deliberate efforts are made to enhance the database modeling competencies of System Administrators through targeted training, curriculum improvement, and capacity-building programmes.

## Conclusion

Significant gaps were observed between expected levels of competency and actual skills possessed by System Administrators in universities throughout south-south Nigeria. Deficiencies in skills related to database modeling and security management were among the major limitations identified. To provide effective management of modern distributed database systems and achieve optimum performance, greater competence in these areas is required of System Administrators, as clearly demonstrated by our results. Consequently, programs of specialized training, continuous professional development and capacity-building are required to achieve optimal performance in modern university settings.

## Recommendations

Based on the findings of the study, the following recommendations are made:

1. Policies requiring continuous professional development and certification of system administrators should be implemented by university administrators and regulatory authorities such as the NUC to achieve systematic closure of identified skill gaps.
2. Sufficient infrastructure for servers, cloud-based computing and reliable connectivity

should be provided to enable effective use of distributed database systems in Nigerian universities.

3. Technical capacity, system administrators should be supported by their institutions to participate in training programs, meetings and courses of certification in technologies of distributed databases, both nationally and internationally, and thereby increase their expertise.
4. Regular training sessions, workshops and meetings on the management of distributed database systems should also be provided by institutions to increase experience with aspects of database security and modeling. This will provide continuous improvement of competencies of system administrators.
5. Curricula for courses in ICT at tertiary institutions should be expanded to provide adequate instruction in concepts and applications of distributed database systems. As a result, graduates will be well prepared for future careers as system administrators and will receive the necessary experience with theoretical principles and practical applications of these technologies.

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