International Journal of Advanced Educational Research
www.themultidisciplinaryjournal.com
ISSN: 2455-6157
Received: 02-05-2026, Accepted: 02-06-2026, Published: 17-06-2026
Volume 11, Issue 2, 2026, Page No. 23-30

Requirements analysis for the development of a virtual platform for managing electrical workshops in NCE (Technical) awarding institutions in north-eastern Nigeria

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DOI: https://doi.org/10.66856/educational.2026.11.2.11020

Abstract
The growing emphasis on digital transformation in Technical and Vocational Education and Training (TVET) has increased the need for technology-driven approaches to workshop administration. Despite the critical role of Electrical workshops in developing practical competencies among NCE (Technical) students, many institutions continue to rely on manual methods for managing workshop operations, resulting in inefficiencies in inventory management, scheduling, documentation, maintenance tracking, and safety monitoring. This study was conducted as the requirements analysis phase of a broader Design and Development Research (DDR) project aimed at developing and testing a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria. Guided by the Waterfall Model, the study sought to determine the operational tasks performed by workshop personnel required for inclusion in the proposed platform and identify the essential design features required for its development. A descriptive survey design was adopted. Data were collected using the Virtual Platform Development and Evaluation Questionnaire (VPDEQ). Mean and standard deviation were used to answer the research questions. Findings revealed that operational tasks relating to inventory and resource management, session preparation and student supervision, reporting and documentation, safety management, and maintenance were required for inclusion in the proposed platform. The study further revealed that user interface and navigation, data management and reporting, accessibility and customization, and security and reliability features were essential requirements for platform development. The study concluded that the identified operational tasks and design features provide a comprehensive requirements framework for the development of a virtual platform capable of improving Electrical workshop administration. It was recommended that the identified requirements be incorporated into the subsequent design and development phases of the broader project.

Keywords: Requirements analysis, virtual platform, electrical workshop management, TVET, design and development research, digital transformation

Introduction

Technical and Vocational Education and Training (TVET) is widely recognized as a critical component of national development because of its role in producing skilled manpower for industrial, technological, and economic growth. TVET institutions are expected to equip learners with practical competencies, technical knowledge, and occupational skills required for employment, entrepreneurship, and lifelong learning. In Nigeria, the Nigerian Certificate in Education (Technical) [NCE (Technical)] programme represents one of the major pathways through which technical manpower is developed for the education and industrial sectors.

The effectiveness of technical education programmes depends largely on the quality and management of workshop environments where practical learning activities take place. Electrical workshops, in particular, provide opportunities for students to acquire hands-on competencies in electrical installation, maintenance, testing, troubleshooting, and related technical operations. Consequently, effective workshop management is essential for ensuring the availability of tools, equipment, materials, safety facilities, and instructional resources required for successful practical training.

Workshop management involves a wide range of operational activities, including inventory control, scheduling of practical sessions, supervision of students, documentation of workshop activities, equipment maintenance, safety monitoring, reporting, and resource coordination. Traditionally, many of these activities are managed through manual procedures involving paper-based records, logbooks, spreadsheets, and physical documentation systems. While such approaches have served institutions for many years, they are often characterized by inefficiencies such as poor record management, difficulties in tracking workshop resources, delays in information retrieval, inadequate coordination of activities, and limited accountability.

The emergence of digital technologies has transformed administrative practices across educational institutions worldwide. Digital platforms are increasingly being used to improve information management, communication, decision-making, monitoring, and resource coordination. Within the context of TVET, digital transformation has become a strategic priority aimed at enhancing institutional effectiveness, improving access to information, and supporting technology-enabled educational environments. UNESCO (2022) emphasized that the future of TVET depends significantly on the integration of digital technologies capable of supporting both instructional and administrative functions. Similarly, UNESCO-UNEVOC has identified digital transformation as a key driver for

improving institutional management, resource utilization, monitoring systems, and organizational efficiency within TVET institutions.

Recent developments indicate that digital transformation in TVET extends beyond teaching and learning to include workshop administration, laboratory management, inventory control, maintenance systems, and institutional data management. Digital management platforms are increasingly recognized as effective tools for coordinating operational activities, improving documentation practices, facilitating communication, and supporting evidence-based decision-making. Such systems provide opportunities for institutions to automate routine administrative processes, reduce operational inefficiencies, and enhance accountability.

Despite these developments, many NCE (Technical) awarding institutions in Nigeria continue to rely predominantly on manual methods for managing Electrical workshops. Activities such as inventory management, tool allocation, maintenance tracking, attendance recording, scheduling of practical sessions, and safety monitoring are frequently conducted using traditional methods that limit efficiency and accessibility of information. These challenges often affect resource utilization, workshop coordination, and overall effectiveness of practical instruction.

The successful development of a digital platform for workshop management depends largely on a clear understanding of user requirements. Software engineering literature emphasizes that identifying user needs and system requirements constitutes one of the most critical stages of system development. Within Design and Development Research (DDR), requirements analysis serves as the foundation upon which design, development, validation, and implementation activities are built. Consequently, before developing a virtual platform for managing Electrical workshops, it is necessary to determine the operational tasks performed by workshop personnel and identify the design features required to support those tasks effectively.

It is against this background that this study seeks to determine the operational tasks and essential design features required for the development of a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria.

Statement of the Problem

Electrical workshops constitute an indispensable component of Technical and Vocational Education and Training (TVET) because they provide learners with opportunities to acquire practical competencies necessary for employment, entrepreneurship, and technological advancement. The effectiveness of practical training in Electrical Technology depends not only on the availability of workshop facilities but also on the efficiency with which workshop activities, resources, and personnel are managed.

In many NCE (Technical) awarding institutions in Nigeria, workshop management activities such as inventory control, scheduling of practical sessions, supervision of students, maintenance tracking, documentation, reporting, and safety monitoring are still performed manually. These traditional approaches often result in inadequate documentation, inefficient utilization of workshop resources, delays in information retrieval, poor coordination of activities, and difficulties in monitoring equipment and materials. Such challenges may negatively affect the quality of practical instruction and the overall effectiveness of workshop administration.

The increasing emphasis on digital transformation in educational institutions has led to the adoption of technology-driven systems for managing administrative and operational activities. Digital platforms provide opportunities for automating routine tasks, improving information management, enhancing communication, facilitating monitoring, and supporting evidence-based decision-making. However, despite the growing adoption of digital technologies in education, limited attention has been given to the development of digital management systems specifically designed for Electrical workshops in NCE (Technical) awarding institutions.

Furthermore, the successful development of any digital platform depends on a thorough understanding of user requirements and operational needs. Existing literature provides limited empirical evidence regarding the operational tasks performed by workshop personnel and the design features required for developing a virtual platform capable of supporting Electrical workshop management. Consequently, there is a need to identify the operational tasks and essential design features that should guide the development of a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria.

Purpose of the Study

The purpose of this study is to determine the operational tasks and essential design features required for the development of a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria.

Specifically, the study seeks to:

1. Determine the operational tasks performed by workshop personnel that are required for inclusion in the development of a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria.
2. Determine the essential design features required for the development of a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria.

Research Questions

The following research questions guided the study:

1. What operational tasks performed by workshop personnel are required for inclusion in developing a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria?
2. What design features are essential for developing a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria?

Significance of the Study

The findings of this study are expected to be beneficial to workshop personnel, technical education lecturers, institutional administrators, software developers, researchers, and policymakers involved in technical and vocational education.

For workshop personnel, the study will provide information on operational activities that can be effectively supported

through digital technologies. The findings may contribute to improved workshop administration, enhanced documentation practices, better inventory management, and more efficient coordination of workshop activities.

Technical education lecturers will benefit from the study through insights into the integration of digital technologies for managing practical learning environments. The findings may facilitate improved monitoring of student participation, scheduling of practical activities, and management of instructional resources.

Institutional administrators will benefit from empirical information regarding the requirements for digital workshop management systems. Such information may support planning, resource allocation, and implementation of institutional digital transformation initiatives.

Software developers and educational technology specialists will benefit from the requirements framework generated by the study. The identified operational tasks and design features will provide functional and technical specifications capable of guiding the design and development of virtual workshop management platforms.

Researchers will benefit from the study because it contributes to the growing body of knowledge on digital transformation, workshop management systems, and educational technology in TVET. The study may also serve as a reference for future investigations involving the design, development, validation, and implementation of technology-supported management systems within technical education environments.

Finally, policymakers and educational stakeholders may utilize the findings in formulating strategies aimed at promoting digital transformation and improving the management of practical training facilities within technical education institutions.

Literature Review

Concept of Virtual Platforms in Educational Management

A virtual platform refers to a technology-based environment designed to facilitate the management, coordination, communication, storage, retrieval, and monitoring of information and activities within an organization. In educational settings, virtual platforms are increasingly utilized to support academic administration, instructional delivery, student management, communication, and institutional decision-making. The integration of virtual platforms into educational institutions has transformed traditional administrative practices by enabling real-time access to information, automation of routine tasks, and improved coordination among stakeholders.

Recent developments in educational technology indicate that virtual platforms have become indispensable tools for enhancing efficiency, transparency, accountability, and resource management. Within educational institutions, such platforms support data management, communication, reporting, scheduling, monitoring, and documentation activities. UNESCO's TVET transformation agenda emphasizes the growing importance of digital platforms in supporting institutional management and improving the effectiveness of educational systems. Consequently, the adoption of virtual platforms is increasingly viewed as a strategic requirement for institutions seeking to improve administrative performance and operational efficiency.

For the purpose of this study, a virtual platform refers to a digital management system designed to support the administration of Electrical workshops through the integration of operational tasks, information management tools, communication systems, and monitoring mechanisms within a centralized technology-enabled environment.

Electrical Workshop Management in Technical Education

Workshop management refers to the systematic planning, organization, coordination, monitoring, and control of activities, resources, personnel, and facilities within workshop environments. In technical education, workshops constitute the primary environments where learners acquire practical competencies through hands-on experiences. Consequently, effective workshop management is critical for ensuring that practical training objectives are achieved.

Electrical workshops require the management of numerous resources, including tools, equipment, materials, consumables, safety facilities, workshop schedules, maintenance activities, and student practical exercises. Effective administration of these resources contributes significantly to the quality of practical instruction and the achievement of learning outcomes. Conversely, poor workshop management may result in equipment deterioration, inefficient resource utilization, inadequate documentation, safety concerns, and disruptions to practical training activities.

The increasing complexity of workshop operations has created the need for technology-supported management systems capable of facilitating coordination, monitoring, documentation, and decision-making. As institutions continue to embrace digital transformation, the development of virtual platforms for workshop administration has become increasingly relevant within technical education environments.

Operational Tasks in Workshop Administration

Operational tasks refer to the routine activities performed by workshop personnel to ensure the effective functioning of workshop facilities and practical training programmes. These activities constitute the functional requirements that should be incorporated into any workshop management platform.

The operational tasks identified in the present study are grouped into four major categories. The first category is Inventory, Materials, and Resource Management, which involves activities such as inventory control, tool allocation, materials management, monitoring of consumables, and maintenance of inventory databases. Effective management of workshop resources is essential for ensuring the availability and efficient utilization of instructional materials and equipment.

The second category is Session Preparation and Student Supervision. This involves preparing workshops for practical activities, assigning tasks to students, monitoring participation, supervising practical exercises, maintaining attendance records, and coordinating workshop schedules. These activities directly influence the effectiveness of practical instruction and student learning experiences.

The third category comprises Reporting, Documentation, and Administration. Activities within this category include recording workshop operations, maintaining records, reporting equipment faults, documenting maintenance

activities, and coordinating resource sharing. Documentation serves as an important mechanism for accountability, monitoring, and decision-making.

The fourth category is Safety, Maintenance, and Compliance. This includes conducting safety inspections, monitoring compliance with safety procedures, coordinating calibration activities, and organizing safety programmes. These activities contribute to the creation of safe and functional workshop environments.

Collectively, these operational tasks represent the core functional requirements that should guide the development of a virtual platform for managing Electrical workshops.

Design Features of Digital Management Systems

Design features refer to the characteristics and functionalities that determine the effectiveness, usability, reliability, and accessibility of a digital platform. The success of a management system depends not only on the operational activities it supports but also on the quality of its design features.

The design features identified in the present study are grouped into four categories. The first category is User Interface and Navigation, which includes user-friendly interfaces, intuitive navigation structures, dashboards, and visual indicators. These features enhance usability and facilitate user interaction with the system.

The second category is Data Entry, Records, and Performance. Features within this category support efficient data input, record management, reporting, analytics, and system responsiveness. Such capabilities improve information management and facilitate timely access to operational data.

The third category is Accessibility, Roles, and Customization. This category includes support for multiple user roles, mobile accessibility, customization options, offline functionality, and minimal training requirements. These features ensure that the platform can accommodate diverse user needs and operating conditions.

The fourth category is Support, Security, and Reliability. Features such as user authentication, backup systems, notifications, help support, and access control mechanisms contribute to system security, reliability, and sustainability. These features are essential for protecting institutional information and ensuring continuous system operation.

Digital Transformation in TVET

Digital transformation refers to the integration of digital technologies into organizational processes, systems, and practices with the aim of improving efficiency, effectiveness, innovation, and service delivery. Within Technical and Vocational Education and Training (TVET), digital transformation has emerged as a strategic priority due to increasing technological advancements and changing workforce requirements.

UNESCO's Strategy for TVET (2022–2029) emphasizes the need for TVET institutions to embrace digital technologies capable of supporting teaching, learning, administration, and institutional management. Digital transformation within TVET extends beyond instructional delivery to include information management, monitoring systems, resource coordination, communication infrastructures, and decision-support systems.

Recent international developments indicate that digital technologies are increasingly being utilized to support workshop management, equipment monitoring, inventory control, and institutional planning. Consequently, digital transformation provides opportunities for improving workshop administration through technology-enabled systems capable of supporting operational efficiency and accountability.

For NCE (Technical) awarding institutions, the development of a virtual platform for managing Electrical workshops aligns with broader efforts aimed at modernizing technical education and promoting technology-supported management practices.

Review of Related Empirical Studies

Empirical studies on digital transformation in education consistently report positive outcomes associated with the adoption of technology-supported management systems. Previous studies have shown that digital platforms improve information management, communication, documentation, monitoring, and resource coordination within educational institutions.

Research on educational management systems indicates that user requirements constitute a critical determinant of system effectiveness. Studies have demonstrated that platforms developed without adequate consideration of user needs often experience implementation challenges and limited acceptance among intended users. Consequently, requirements analysis is increasingly recognized as an essential phase of educational technology development.

Similarly, studies focusing on technical and vocational education emphasize the need for digital systems capable of supporting practical training environments. Existing investigations have highlighted challenges associated with workshop administration, including inventory management, maintenance tracking, documentation, scheduling, and safety monitoring. However, limited empirical attention has been devoted to identifying the specific operational tasks and design features required for developing virtual workshop management platforms within NCE (Technical) institutions.

Research Gap

The review of literature indicates that considerable attention has been devoted to digital transformation, educational technology, learning management systems, and institutional information systems. Similarly, previous studies have examined the integration of digital technologies into teaching, learning, and educational administration.

However, limited empirical evidence exists regarding the operational tasks performed by workshop personnel and the design features required for developing a virtual platform specifically tailored to the management of Electrical workshops in NCE (Technical) awarding institutions in Nigeria. Existing studies focus predominantly on instructional technologies and general educational management systems, with relatively little attention devoted to workshop administration requirements.

Therefore, the present study seeks to fill this gap by identifying the operational tasks and essential design features required for the development of a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria.

Conceptual Framework

The conceptual framework for this study is based on the relationship between operational tasks, design features, and

virtual platform development for Electrical workshop management.

The framework assumes that effective development of a virtual platform depends on the identification of two major categories of requirements: operational requirements and design requirements. Operational requirements represent the activities performed by workshop personnel that the platform should support, while design requirements represent the system characteristics necessary for effective functionality, usability, accessibility, and security.

Operational requirements comprise Inventory, Materials and Resource Management; Session Preparation and Student Supervision; Reporting, Documentation and Administration; and Safety, Maintenance and Compliance. These requirements constitute the functional components of the proposed platform.

Design requirements comprise User Interface and Navigation; Data Entry, Records and Performance; Accessibility, Roles and Customization; and Support, Security and Reliability. These requirements constitute the technical and usability components of the platform.

The interaction between operational requirements and design requirements provides the foundation for the development of a virtual platform capable of supporting workshop administration within NCE (Technical) awarding institutions.

Conceptually, the study assumes that the identification of appropriate operational tasks and essential design features will result in the development of a more effective, user-centred, and sustainable virtual workshop management platform.

Theoretical Framework

This study is anchored on the Waterfall Model and Design and Development Research (DDR).

Waterfall Model

The Waterfall Model was originally proposed as a sequential software development model in which development activities are performed in a structured and systematic manner. The model consists of several stages including requirements analysis, system design, development, testing, implementation, and maintenance.

The first stage of the Waterfall Model is requirements analysis, which involves identifying user needs, operational requirements, and system specifications. This stage is critical because it establishes the foundation upon which subsequent design and development activities are based.

The present study focuses specifically on this requirements-analysis stage. Before a virtual platform can be designed and developed, it is necessary to identify the operational activities performed by workshop personnel and determine the design features required to support those activities. Consequently, the Waterfall Model provides an appropriate theoretical basis for the study because it emphasizes systematic identification of requirements prior to system development.

The relevance of the Waterfall Model to the study lies in its structured approach to software development and its recognition of requirements analysis as the foundation for successful system design.

Design and Development Research (DDR)

Design and Development Research (DDR) is an educational technology research approach concerned with the systematic study of design, development, and evaluation processes for educational products and systems. DDR emphasizes the generation of practical solutions to identified problems through systematic investigation and evidence-based development activities.

According to DDR principles, product development should begin with a needs assessment or requirements-analysis phase aimed at identifying user needs and contextual requirements. Information obtained during this phase serves as the basis for subsequent design, development, validation, implementation, and evaluation activities.

The present study represents the requirements-analysis phase of a broader DDR project titled “Development and Testing of a Virtual Platform for Managing Electrical Workshops in NCE (Technical) Awarding Institutions in North-Eastern Nigeria.” The study therefore aligns with DDR by identifying the operational tasks and design features that will guide the subsequent development of the proposed platform.

The relevance of DDR to the study lies in its emphasis on systematic requirements identification as a prerequisite for educational technology development. The study therefore contributes to the first phase of the broader design and development process.

Methodology

Research Design

The study adopted a descriptive survey design within the requirements-analysis phase of Design and Development Research (DDR). The survey design was considered appropriate because it enabled the researcher to obtain information from respondents regarding the operational tasks and design features required for the development of the proposed virtual platform.

Area of the Study

The study was conducted in North-Eastern Nigeria. The region comprises six states, namely Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe. The area was selected because it contains NCE (Technical) awarding institutions offering Electrical Technology programmes and possessing workshop facilities relevant to the study.

Population of the Study

The population of the study comprise of 63 Electrical Workshop personnel, including 40 Lecturers and 23 Technologists across the eight NCE (Technical) awarding institutions. These individuals are directly involved in the management, training, and supervision of electrical workshop activities.

Sample and Sampling Technique

This study employed a census sampling technique (CST), which involved the inclusion of all members of the population. The choice of this technique was informed by the relatively small and well-defined population of workshop personnel directly involved in the training of NCE Technical students in Electrical workshops across NCE-awarding institutions in North-Eastern Nigeria. Consequently, all the 63 identified participants were included in the study to ensure that every relevant perspective and experience was adequately represented.

Instrument for Data Collection

Data were collected using the Virtual Platform Development and Evaluation Questionnaire (VPDEQ).

Section A: Required Operational Tasks
Section A contained twenty (20) items designed to determine the operational tasks required for inclusion in the proposed virtual platform. The items were grouped into four dimensions:

1. Inventory, Materials and Resource Management;
2. Session Preparation and Student Supervision;
3. Reporting, Documentation and Administration;
4. Safety, Maintenance and Compliance.

Responses were rated on a five-point scale of:

- Highly Required (5)
- Required (4)
- Moderately Required (3)
- Partially Required (2)
- Slightly Required (1)

Section B: Essential Design Features
Section B contained twenty (20) items designed to determine the design features required for platform development. The items were grouped into four dimensions:

1. User Interface and Navigation;
2. Data Entry, Records and Performance;
3. Accessibility, Roles and Customization;
4. Support, Security and Reliability.

Responses were rated on a five-point scale of:

- Highly Essential (5)
- Essential (4)
- Moderately Essential (3)
- Partially Essential (2)
- Slightly Essential (1)

Validation of Instrument
The instrument was subjected to face and content validation by experts in Technical Education, Educational Technology, and Software Development. Their observations and recommendations were used to improve the clarity, relevance, and adequacy of the questionnaire items before administration.

Method of Data Collection
Copies of the questionnaire were administered directly to respondents with the assistance of trained research assistants where necessary.

Method of Data Analysis
Mean and standard deviation were used to answer the research questions.
The decision rule was based on a criterion mean of 3.50.
Any item with a mean score of 3.50 and above was regarded as required or Essential, while items with mean scores below 3.50 were regarded as Not required or Not Essential.

Results
The results are presented according to the research questions that guided the study.

Research Question 1
What operational tasks performed by workshop personnel are required for inclusion in developing a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria?

Table 1: Mean Ratings of Respondents on Operational Tasks Required for Inclusion in the Virtual Platform

S/N	Operational Tasks	Mean	SD	Decision
1	Managing inventory of workshop tools, equipment, and materials	4.63	0.58	Required
2	Managing the requisition of workshop tools and materials	4.51	0.67	Required
3	Managing the issuance and return of tools and materials	4.59	0.63	Required
4	Tracking consumable stock levels	4.44	0.71	Required
5	Monitoring utilization of workshop materials and energy resources	4.36	0.76	Required
6	Maintaining an up-to-date inventory database	4.68	0.52	Required
7	Coordinating workshop preparation before practical sessions	4.47	0.68	Required
8	Assigning practical tasks to students	4.39	0.73	Required
9	Supervising students during practical activities	4.54	0.62	Required
10	Monitoring students' participation in practical sessions	4.42	0.71	Required
11	Maintaining records of workshop attendance	4.49	0.69	Required
12	Managing workshop schedules and timetables	4.58	0.61	Required
13	Recording daily workshop activities	4.43	0.70	Required
14	Maintaining workshop records and documentation	4.56	0.60	Required
15	Reporting equipment faults and initiating repair processes	4.61	0.57	Required
16	Coordinating resource sharing among departments and units	4.35	0.78	Required
17	Conducting safety inspections and compliance checks	4.57	0.60	Required
18	Coordinating calibration and testing of workshop instruments	4.41	0.72	Required
19	Monitoring compliance with the use of personal protective equipment	4.52	0.64	Required
20	Organizing workshop safety drills and training programmes	4.38	0.74	Required

Grand Mean = 4.50

The results presented in Table 1 indicate that all the operational tasks recorded mean ratings above the criterion mean of 3.50. This suggests that respondents considered all twenty operational tasks required for inclusion in the proposed virtual platform for managing Electrical workshops.
For ease of interpretation, the operational tasks were grouped into four dimensions:

Operational Task Dimension	Mean
Inventory, Materials and Resource Management	4.54
Session Preparation and Student Supervision	4.48
Reporting, Documentation and Administration	4.49
Safety, Maintenance and Compliance	4.47

Inventory, Materials and Resource Management recorded the highest mean rating, indicating its perceived importance among respondents.

Research Question 2

What design features are essential for developing a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria?

Table 2: Mean Ratings of Respondents on Essential Design Features Required for Platform Development

S/N	Design Features	Mean	SD	Decision
1	User-friendly interface	4.72	0.49	Essential
2	Intuitive system interface	4.66	0.54	Essential
3	Easy navigation structure	4.61	0.58	Essential
4	Dashboard for activities and system updates	4.55	0.63	Essential
5	Visual indicators and colour-coded alerts	4.42	0.70	Essential
6	Easy uploading and retrieval of records	4.71	0.51	Essential
7	Easy data entry for attendance, inventory and reports	4.65	0.56	Essential
8	Use of drop-down menus, auto-fill options and check boxes	4.49	0.69	Essential
9	Fast system loading and responsiveness	4.68	0.52	Essential
10	Real-time reporting and analytics	4.62	0.59	Essential
11	Support for multiple user roles	4.58	0.62	Essential
12	Mobile and desktop accessibility	4.73	0.47	Essential
13	Customization of user settings and preferences	4.45	0.71	Essential
14	Minimal user training requirements	4.54	0.64	Essential
15	Offline access capability	4.37	0.77	Essential
16	Integrated user guide and help support	4.43	0.72	Essential
17	Automated notifications and alerts	4.57	0.63	Essential
18	Secure user authentication and role-based access control	4.79	0.41	Essential
19	Multi-language support	4.21	0.86	Essential
20	Data backup and recovery features	4.76	0.44	Essential

Grand Mean = 4.58

The results presented in Table 2 indicate that all the design features recorded mean ratings above the criterion mean of 3.50. This implies that respondents considered all twenty design features essential for developing the proposed virtual platform.

The design features were further grouped into four dimensions:

Design Feature Dimension	Mean
User Interface and Navigation	4.59
Data Entry, Records and Performance	4.63
Accessibility, Roles and Customization	4.53
Support, Security and Reliability	4.56

Data Entry, Records and Performance recorded the highest mean rating among the four dimensions.

Contribution to Knowledge

This study contributes to knowledge in three major ways.

First, the study provides an empirically derived requirements framework consisting of operational-task requirements necessary for the development of a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions. The framework identifies four major operational-task dimensions, namely Inventory, Materials and Resource Management; Session Preparation and Student Supervision; Reporting, Documentation and Administration; and Safety, Maintenance and Compliance.

Second, the study establishes a design-feature framework comprising User Interface and Navigation; Data Entry, Records and Performance; Accessibility, Roles and Customization; and Support, Security and Reliability. These dimensions provide technical specifications capable of guiding the design and development of the proposed platform.

Third, the study extends the application of Design and Development Research (DDR) and the Waterfall Model to workshop management within Technical and Vocational Education and Training (TVET) institutions. The study therefore contributes to the growing body of literature on digital transformation and technology-supported management systems in technical education.

Conclusion

This study was conducted as the requirements-analysis phase of a broader Design and Development Research project aimed at developing and testing a virtual platform for managing Electrical workshops in NCE (Technical) awarding institutions in North-Eastern Nigeria.

The findings revealed that all twenty operational tasks investigated were required for inclusion in the proposed virtual platform. These operational tasks were grouped into four dimensions: Inventory, Materials and Resource Management; Session Preparation and Student Supervision; Reporting, Documentation and Administration; and Safety, Maintenance and Compliance.

The findings further revealed that all twenty design features investigated were essential for the development of the proposed platform. The identified design features were grouped into four dimensions: User Interface and Navigation; Data Entry, Records and Performance; Accessibility, Roles and Customization; and Support, Security and Reliability.

The study therefore concludes that the identified operational tasks and design features constitute the functional and technical requirements necessary for developing a virtual

platform capable of improving Electrical workshop administration. The findings provide an empirical foundation for the subsequent design, development, validation, and testing phases of the broader research project.

Recommendations

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

1. The identified operational tasks should be incorporated into the functional specifications of the proposed virtual platform for managing Electrical workshops.
2. The identified design features should guide the software architecture, interface design, security mechanisms, and database structure of the proposed platform.
3. NCE (Technical) awarding institutions should encourage the adoption of digital management systems for improving workshop administration and resource management.
4. Educational administrators should provide the necessary technological infrastructure required for implementing digital workshop management platforms.
5. Researchers should extend the present study by developing, validating, and testing the proposed virtual platform using the requirements identified in this study.

Suggestions for Further Research

Future studies should focus on:

1. Development of the virtual platform based on the identified operational tasks and design features.
2. Expert validation of the developed platform.
3. Usability testing of the developed platform among workshop personnel.
4. Evaluation of the effectiveness of the platform in improving workshop administration and resource management.
5. Adaptation of the platform for other technical workshop environments such as Mechanical Technology, Automobile Technology, Building Technology, and Metalwork Technology.

References

1. Richey RC, Klein JD. Design and development research: Methods, strategies, and issues. Lawrence Erlbaum Associates, 2007.
2. Richey RC, Klein JD. Design and development research. In Spector JM, Merrill MD, Elen J, Bishop MJ (Eds.), Handbook of research on educational communications and technology (4th ed.). Springer, 2014, 141-150.
3. Pressman RS, Maxim BR. Software engineering: A practitioner's approach (9th ed.). McGraw-Hill Education, 2020.
4. Sommerville I. Software engineering (10th ed.). Pearson Education, 2016.
5. UNESCO. Transforming technical and vocational education and training for successful and just transitions: UNESCO strategy for TVET 2022–2029. UNESCO, 2022.
6. UNESCO-UNEVOC. Digital transformation in TVET. UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training, 2023.
7. Okorie JU. Developing Nigeria's workforce through vocational and technical education. Cheston Agency Ltd, 2010.
8. Adedoyin OB, Soykan E. Covid-19 pandemic and online learning: The challenges and opportunities of digital transformation in education. Education and Information Technologies,2021:26(6):6923-6947.
9. Wang C, Chen X, Yu T, Liu Y, Jing Y. Education reform and change driven by digital technology: A bibliometric study from a global perspective. Humanities and Social Sciences Communications,2024:11:256.