Research Article

Perceived Usefulness and Accessibility of Hypermedia Instructional Resources as Determinants for Teaching Digital Electronics Courses in Nigerian Universities

Abdulaziz Bello[1*] iD **, Ahmad Aliyu Deba**[2] iD **, Paul Shehu Yaduma**[3] iD **, Sa'adatu Abubakar Mohammed**[4] iD

[1]Dept. of Technology and Vocational Education, Faculty of Science and Technology Education, Aliko Dangote University of Science and Technology Wudil, Nigeria
[2,3,4]Dept. of Vocational and Technology Education, Faculty of Technology Education, Abubakar Tafawa Balewa University Bauchi, Bauchi State, Nigeria

Corresponding Author: abdullaziz_bello1980@kustwudil.edu.ng

Abstract— The use of hypermedia as an instructional resource has led to new and exciting opportunities for instructional delivery in institutions of learning. Yet, traditional teaching methods dominated the established academic institutions in Nigeria. This study explores the determinants that will predict the actual use of hypermedia instructional resources for teaching Digital electronics courses in Nigerian universities, an explanatory sequential mixed method was adopted as the research design for the study while Survey research was conducted on 120 electrical and electronics technology education undergraduates' students and lecturers. Structural equation modeling using Smart Partial Least Square-Structural Equation Modelling software was performed to evaluate the proposed hypotheses, and a semi-structured interview was conducted and analyzed through the inherent future of Nvivo11 to support the quantitative data. The results revealed that Perceived Usefulness and Accessibility were significant predictors of using hypermedia instructional resources for teaching digital electronic courses. The paper recommended that the University management, policymakers, and educational technology practitioners consider Perceived Usefulness and Accessibility as factors that predict the actual use of Hypermedia Instructional Resources in teaching digital electronics in Nigerian universities before investing huge amounts of funds in the development of Hypermedia Instructional Resources for teaching and learning.

Keywords— Hypermedia Instructional Resources, Perceived Usefulness, Accessibility, Digital Electronics, Nvivo, Smart PLS-SEM

1. Introduction

Digital electronics is a fundamental core course in the Electrical and Electronic technology education curriculum that requires innovative teaching methods and strategies to facilitate students' understanding of complex and abstractive concepts. Thus, the integration of hypermedia instructional resources in Nigerian Universities of Technology can potentially transform teaching and learning technology and vocational courses, especially in specialized core courses like digital electronics. Hypermedia instructional resources integrate various forms of multimedia such as graphics, texts, images, audio, videos, animations, slideshows, virtual realities, augmented realities, infographics, and interactive simulations into a cohesive educational experience to foster engagement and interactive educational environments to offer non-linear and multi-path access to educational information allowing students to explore contents in line with their educational preferences and needs [1]. Hypermedia instructional resources can enhance students' engagement and

comprehension in different area specializations like technical subjects to create rich, interactive learning environments that can adapt to different learning styles, and support deeper understanding that empowers learners to control their learning self-directed exploration and critical thinking [2]. Thus, literature has revealed that, despite the benefits of hypermedia instructional resources Nigerian university lecturers are not integrating it during their teaching and learning processes as students continue to learn within the four walls of the classroom using chalk and board, chalk and talk, the lecturers dominated the class interaction and been active while the student were passive due to the due to the inappropriate adopted approaches [3]. The reason behind their inability to integrate hypermedia instructional resources, especially in the teaching of digital electronics depends on factors that predict the integration behavior of university lecturers [4]. The paper focuses on the determinant predicting the actual use of hypermedia instructional resources in Nigerian universities. These resources were recognized by several higher education institutions situated in various

developed countries as a way to improve teaching and learning outcomes by making content more engaging and accessible to both students and lecturers [5]. Using hypermedia instructional resources that incorporate interactive multimedia tools like videos, simulations, and animations was shown to improve technically specialized students' understanding and retention of complex concepts [6]. However, the adoption and effectiveness of hypermedia instructional resources in teaching digital electronics courses in Nigerian universities remain unexplored. Effective instructional methods are necessary for students to comprehend the intricate technical details of digital electronics courses, which a foundational and core subjects in engineering and technology programs [6].

In addition, the research paper was prepared and presented as follows, Section 1 contains the introduction of the article that covers the key motivation of the paper concerning the topic under study, Section 2 contains the related work in line with relevant literature that provided the research gap of this work; hence it help to identify the research's outline, Section 3 covers the null hypotheses provided that were tested at 0.05 alpha level, Section 4 describe the design of the research which employs an explanatory sequential mixed-method design to examine and predict the perceived usefulness and accessibility of using hypermedia instructional resources in teaching and learning digital electronics course in Nigerian Universities, section 5 explain the result and discussion of findings for this research work with emphasis on the data analysis about the three null hypotheses in this work. Moreover, the findings obtained from the results were discussed concerning relevant existing literature, Section 6 gives the conclusion and future latitude of this study based on the findings obtained from the research and finally concluded by the recommendations made.

1.1 Statement of the problem

Despite the potential benefit of new technologies around the globe, several researchers have developed technology acceptance models, however, such models were essentially developed to explain the interactions among various observed constructs in the model toward technology acceptance, the previous models are inadequate as traditional lecture method remain the most popular used teaching method in Nigerian universities [7] also revealed that the development of new technologies has not been accompanied by the same growth of its integration in the classroom. Thus, to address the aforementioned concerns, the current study focuses on modeling the determinants that would best predict the actual use of hypermedia in teaching digital electronics.

1.2 Purpose of the research

The purpose of this study is to model the determinants for the actual use of hypermedia instructional resources for teaching digital electronics courses in Nigerian universities, specifically the study intends to:

a) Examine the perceived usefulness of the actual use of the hypermedia instructional resources as a determinant for teaching digital electronics courses among electrical and electronics technology education students and lecturers in Nigerian universities.

b) Find out the perceived access to the actual use of hypermedia instructional resources as a determinant for teaching digital electronics courses among electrical and electronics technology education students and lecturers in Nigerian universities.

c) Determine the extent to which perceived usefulness and accessibility predict the actual use of hypermedia instructional resources among students and lecturers in Nigerian universities.

1.3 Research questions

In tandem with the above-stated specific objectives, the research questions formulated to guide this study were as follows:

1. What are the perceptions of electrical electronics technology education students and lecturers on the impact of the perceived usefulness of hypermedia instructional resources as a determinant for teaching digital electronics courses in Nigerian universities?

2. What are the perceptions of electrical and electronics technology education students and lecturers on the influence of perceived accessibility of hypermedia instructional resources as a determinant for teaching digital electronics courses in Nigerian universities?

3. To what extent do perceived usefulness and accessibility determine the actual use of hypermedia instructional resources in digital electronics courses among electrical and electronics technology education students and lecturers in Nigerian universities?

2. Related Work

Hypermedia instructional resources provide significant evidence of the effectiveness, positive perception, and active participation of students in teaching and learning [8]. The students need to be motivated towards learning because if they do not participate actively, the whole education system using hypermedia will fail. The hypermedia instructional resources should have proper stimuli to make the students participate actively and joyfully. The creation of the hypermedia-based e-module has resulted in extremely valid media that may help students' teaching and learning processes and facilitate their skills, all without compromising the students' cognitive abilities [8]. Also, the student's analytical and transferable skills should be optimized. However, hypermedia is particularly appropriate for producing interactive and exploratory educational applications, where many links and cross-references are provided and the learner can explore his/her interests according to previous experience, background, and perspective [9]. To be effective, hypermedia applications need to be tailored to suit the particular learning tasks planned like digital electronics courses. Apart from these, many other fundamental applications and design issues need addressing.

More difficulties are linked and numerous obstacles may be addressed to make hypermedia class affective and effective. Hypermedia class is researched to have made lectures easy to convey and eased burdens of the professors. The idea that no lecture can be converted into a digital format, that a teacher

cannot add emotion to a lesson, and that lecturers frequently lack the advanced computer skills necessary to incorporate cartoons, animation apps, and graphic designs into PowerPoint slides all of which can negatively impact students' learning was strongly addressed in [10].

The authors also noted that the World Wide Web continuously offers rapid access to information and a virtually limitless number of information resources. Hypermedia technologies thus create particularly favorable conditions for the independent acquisition and quality assimilation of the necessary information, which can be easily integrated into the educational process. People use it more frequently in the educational process when teaching or studying new topics because of its convenience and interactive nature [11]. Many types of hypertext technologies have evolved into a virtual learning environment. The authors also found that they give fresh possibilities for organizing, presenting, customizing, and incorporating modern instructional resources. Furthermore, by fusing previously incompatible elements, hypermedia technologies have significantly advanced education, especially in the area of self-education [11]. Hypermedia is that medium that complements other instructional resources used by lecturers of digital electronics, the use of hypermedia instructional resources in teaching and learning courses like digital electronics provides leverage for lecturers to cover all aspects of digital electronics courses. Hypermedia instructional resources transform the teaching and learning experience by integrating diverse media elements, including text, graphics, audio, and video, in a nonlinear structure [12]. Offering learners, the flexibility to navigate through content based on their preferences, this resource fosters active engagement through interactive features and simulations. The -richness nature of multimedia captures and sustains learners' attention because the adaptability of hypermedia accommodates various teaching and learning styles. Its accessibility anywhere and anytime, coupled with the potential for personalized exploration, makes hypermedia a powerful tool in digital electronics education [13].

The hypermedia-based e-module is designed to accommodate various learning styles of students with Comprehensive and flexible characteristics. One of its complete advantages is its ability to be used in various learning models, both face-to-face and online, as well as facilitating students' skills development and understanding such as creative thinking and argumentation. Moreover, this module features communicative elements. On the other hand, its flexible advantage refers to the adaptability of the module's content and features to match the learning needs of students [14].

Perceived usefulness (PU) is a foundational concept within the Technology Acceptance Model (TAM), introduced by [15]. It is defined as "the degree to which a person believes that using a particular system would enhance their job performance." Numerous studies have supported PU's role in predicting user acceptance and continued use of technology [16]. For instance, research by [17] has consistently shown that PU is a strong predictor of technology adoption across various domains, including e-

learning and online platforms. The consistent relationship between PU and user acceptance showed its importance in evaluating the success of technological innovations. In the context of e-learning, perceived usefulness has been identified as a crucial factor influencing students' acceptance and continued use of online educational tools. [18] Found that when students perceive e-learning platforms as useful, they are more likely to be satisfied with their learning experience and continue using these platforms. Similarly, moreover [18] demonstrated that PU significantly affects students' overall satisfaction and success in online courses. These studies highlight the significance of perceived usefulness (PU) in the planning and execution of online education systems by indicating that improving the perceived usefulness of e-learning technologies can improve engagement and learning results. Perceived usefulness is equally critical in the adoption and effectiveness of hypermedia instructional resources. Hypermedia integrates text, images, audio, video, and interactive elements, offering a rich learning environment. Studies like those by [19] have shown that students who perceive hypermedia resources as useful are more likely to engage with the material and achieve better learning outcomes. Furthermore, research by [19] indicated that PU influences students' willingness to explore and utilize hypermedia resources, which in turn enhances their learning experience. The perceived usefulness of hypermedia instructional resources plays a significant role in determining their success in educational settings, particularly in fostering self-directed learning and critical thinking.

Perceived accessibility refers to the extent to which users believe they can easily access and use digital content, including websites and online platforms. Research by [20] showed that perceived accessibility is influenced by both the design of digital interfaces and the availability of assistive technologies, such as screen readers and voice recognition software. Studies show that when users perceive digital content as accessible, they are more likely to engage with it and have a positive user experience. For instance, in a study by [21] users with disabilities reported higher levels of satisfaction and engagement with websites that adhered to accessibility standards, emphasizing the importance of perceived accessibility in digital environments. In the context of e-learning, perceived accessibility plays a critical role in determining how students, particularly those with disabilities, engage with online educational tools. Additionally, [21] found that when hypermedia instructional resources are perceived as accessible, they not only serve students and lecturers with disabilities but also enhance the general learning experience for all users. This implies that the effective use of hypermedia instructional resources in educational settings depends on perceived usefulness and accessibility.

2.1 Research Outline

A research outline exploring the determinants that will predict the actual use of hypermedia instructional resources for teaching Digital electronics courses in Nigerian universities (see Fig. 1), Based on the theoretical perspective, Perceived accessibility, involves students' and

lecturers' beliefs about how easy or difficult hypermedia instructional resources is to interact with a particular technology. When they find a system easy to use, they are more likely to perceive it as accessible as previously reviewed TAM, Perceived Accessibility as a Mediator: While TAM traditionally focuses on ease of use and usefulness, perceived accessibility can be seen as a mediating factor between these constructs and the students' and lecturers' acceptance and satisfaction with the actual use of technology. For instance, if a hypermedia instructional resource is perceived as accessible, it may enhance its perceived ease of use and general usefulness. In the context of web content, and hypermedia instructional resources, TAM can explain how perceived ease of use (linked to accessibility features) influences the perceived usefulness of these technologies. As students and lecturers perceive these platforms to be more accessible, their intention to use them and general satisfaction increases [22]. Accessibility The author further supports the understanding of how social and facilitating conditions impact perceived accessibility, which in turn affects technology adoption and user engagement [22]. By using TAM and UTAUT, it was analyzed that perceived accessibility influences user acceptance and engagement with various technologies, including hypermedia instructional resources.
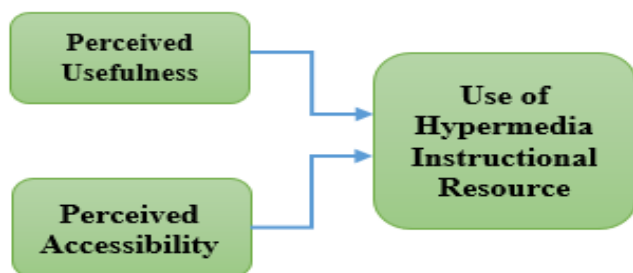

Figure 1. Research Framework

An explanatory sequential mixed method research design was adopted while Survey research was conducted on 120 undergraduate electrical and electronics technology education students and lecturers. Structural equation modeling using Smart PLS-SEM software is performed (see Fig. 2) to evaluate the proposed hypotheses, and a semi-structured interview was conducted and analyzed through the inherent future of Nvivo11 to support the quantitative data, while both quantitative and qualitative findings will be integrated via meta-inference.
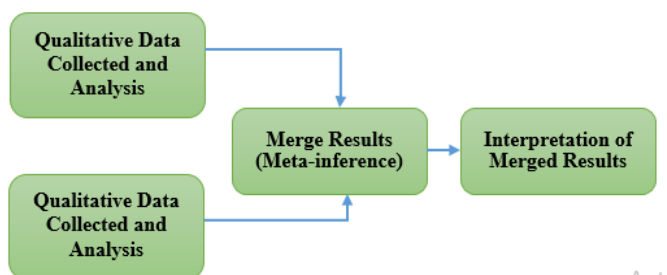

Figure 2. Explanatory sequential mixed method

The study employed an explanatory sequential mixed-method design to examine the perceived usefulness and accessibility of hypermedia instructional resources in teaching and learning digital electronics courses in Nigerian Universities [23]. The research design triangulated quantitative and qualitative results via meta-inference to provide a comprehensive understanding of factors that predict the actual usage of hypermedia instructional resources for teaching Digital electronics courses in Nigerian universities. In the quantitative phase, a survey was conducted to collect data from lecturers and students, it aimed to measure their perceptions of the usefulness and accessibility of the actual use of hypermedia instructional resources in teaching digital electronics courses. The quantitative data were analyzed using Smart PLS-SEM software to assess the structural relationships between the observed and latent constructs, while the qualitative phase followed the quantitative phase by conducting semi-structured interviews to examine in-depth follow-up experiences and perceptions of Electrical and Electronics students and lecturers regarding the actual use of hypermedia instructional resources in teaching digital electronics course. The qualitative data were analyzed via Nvivo software to identify themes, subthemes, and patterns of the collected.

3 Research Hypotheses

The following hypotheses were formulated in line with research questions while tested at a 0.05 Confidence level:

H_{01}: Perceived usefulness of hypermedia instructional resources is not a significant determinant to predict its usage in teaching and learning of digital electronics courses among electrical and electronics technology education students and lecturers in Nigerian Universities.

H_{02}: Accessibility to hypermedia instructional resources is not a significant determinant to predict its usage in teaching and learning of digital electronics courses among electrical and electronics technology education students and lecturers in Nigerian universities.

4. Result

4.1 Quantitative Data

Refer to Cronbach's alpha Table 1 displays the findings from the constructs' validity and reliability assessments. The Cronbach's alpha reliability coefficient typically falls between 0 and 1. A good scale is defined as greater or equal to 0.80, an acceptable scale as 0.70, and an exploratory scale as 0.60, according to [24]. Accessibility (AC) is 0.936 and Usefulness (U) is 0.937, according to the current study's Cronbach's alpha results. These showed outstanding dependability.

Table 1. Reliability test for the constructs

Construct	Factor Loadings	Cronbach' Alpha	Composite Reliability (rho_a)	Average Variance Extracted (AVE)
AC	0.802	0.936	0.943	0.647
U	0.804	0.937	0.938	0.633
AUOH	0.857	0.939	0.941	0.627

Keys:
 AC – Accessibility
 U – Usefulness
 AUOH – Actual Use of Hypermedia

4.2 Composite reliability

When evaluating convergent validity in a reflective model, composite reliability is favored over Cronbach's alpha. The reason for its preference as a reliability metric could be that Cronbach's alpha tends to overestimate or underestimate scale reliability. A composite reliability score of one indicates flawless estimated reliability. Composite reliabilities of a model suitable for exploratory research should be equal to or more than 0.6 [25], while a model suitable for confirmatory research should have reliabilities equal to or greater than 0.80 [25]. As a consequence, all observed variables received good internal consistency reliability, as evidenced by the composite reliability values of (AC) = 0.948, (U) = 0.945, and (AUOH) = 0.938.

4.3 Average variance extracted from the Constructs

Convergent and divergent validity is tested using average variance extracted, or AVE. In a reflective model, AVE represents the average communality for each latent factor. A suitable model should have an AVE of more than 0.5 and greater than the cross-loadings, meaning that the components should account for at least half of the variation in each of the indicators. Error variance surpasses explained variance when the AVE is less than 0.50.

4.4 Fit structural equation model for the study

The PLS-SEM algorithm is integrated into SMART PLS-SEM software to enable researchers to estimate and analyze complex structural equation models, handle smaller sample sizes and non-normal data, focus on exploratory and predictive modeling, and utilize a user-friendly interface for specifying models and interpreting results, While Bootstrapping is used to provide a method for assessing the stability and reliability of parameter estimates by generating multiple resamples of the data, re-estimating the model for each sample, and deriving empirical distributions, which offer confidence intervals and significance levels for the path coefficients and other parameters. However, the current study model was used to test the relationship between perceived usefulness and accessibility as determinants for predicting the actual use of hypermedia instructional resources in teaching digital electronics courses. See Figure 3.
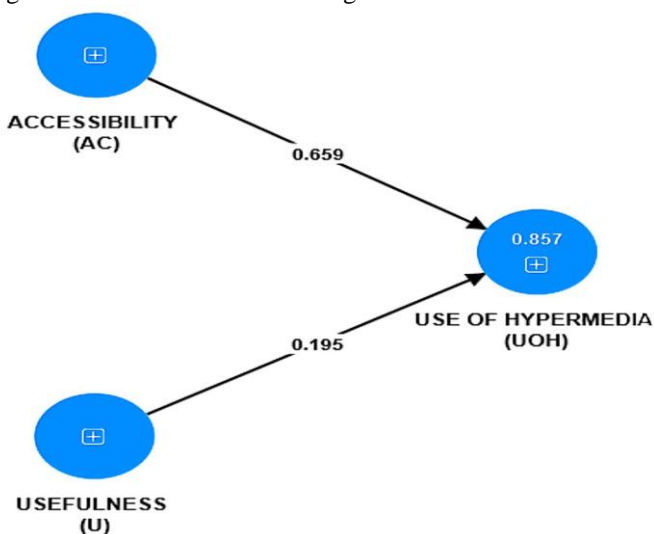

Figure 3. Structural equation model (PLS-SEM Algorithm)

Figure 3 illustrates the use of the Smart PLS-SEM technique in a structural equation model (SEM) to investigate the relationship between two observed variables: perceived usefulness (PU) and perceived accessibility (PA) and latent variable use of hypermedia instructional resources (HOU). The strength of the association between PA and PU was evaluated by computing path coefficients, R2 values (see Table 2), and significance levels using the PLS-SEM technique. The model illustrates the direct relationship between PA and PU, showing that higher perceptions of accessibility also translate into higher perceptions of utility. The model's validity (Average Variance Extracted) and reliability (Composite reliability) were validated by the outer loadings for both variables (see Table 1, which demonstrates strong construct correlations). The results validate the premise that PA has a major influence on PU. Refer to Table 3.

4.5 Quantitative Findings

a) Perceived Usefulness: A significant positive relationship with the actual use of hypermedia in digital electronics (β = 0.45, t = 0.512, p < 0.05) see Table 3
b) Accessibility: A significant positive relationship with the actual use of hypermedia in digital electronics (β = 0.38, t = 0.465, p < 0.05) see Table 3

Model fit indices (Goodness of fit) "GoF" suggested sufficient Goodness of fit on actual use of hypermedia instructional resources as follows, see Table 2.

Table 2. R^2 Value for the AUOH

Latent Constructs	R^2	R2 (Adjusted)
Actual Use of Hypermedia Instructional Resources	0.857	0.838

To determine the Goodness of fit of the model to determine the actual use of hypermedia instructional resources,

$$R^2 = 0.857$$

$$Average\ AVE = \frac{0.674 + 0.633}{2}$$
$$= \frac{1.307}{2} = 0.654$$

Based on the formula earlier presented of GoF, the research obtained a GoF value of

$$GoF = \sqrt{AVE \times R^2}$$
$$GoF = \sqrt{0.654 \times 0.857} = \mathbf{0.749}$$

The obtained goodness of fit value of 0.749 [24] indicated a strong and acceptable degree of model fit, indicating that the model can be trusted for prediction purposes in this specific context and that it explains a considerable amount of the variance in the data.

Table 3: Structural Model Assessment

Path	Coefficient (β)	t-Value	p-Value
Usefulness → Actual Use of Hypermedia	0.45	5.12	0.005
Accessibility → Actual Use of Hypermedia	0.38	4.65	0.005

The software used to create the structural models for this study is shown in Figures 1 and 2, respectively. R2 is a measure of the value of any endogenous and predicted latent variable. The dependent variable's (DV) R2 is 0857. To test research hypotheses, the bootstrapping technique with 5000 samples was used to analyze the structural model and determine the statistical significance of the path coefficient. The results indicate that the two independent variables, AC and U, fairly explain 85.7% of the variance in (DV). The t-values in this study are calculated from the structural equation model as shown in Figure 2; for more, see Table 3.

4.6 Qualitative Findings
The researcher adopted and employed member checking to enhance the credibility and validity of the qualitative research instrument used in the study [27] by returning the themes to the participants to verify the accuracy of the findings and interpretations, summaries, or thematic analyses and to ensure that their experiences and perspectives have been accurately captured and represented. The themes are as follows:
a) Themes identified include "ease of use," "engagement enhancement," "resource availability," and "technical challenges."
b) Participants emphasized the need for institutional support to improve accessibility.

Table 4. Themes from Qualitative Analysis

Construct	Theme	Description
Usefulness	Simplicity	Hypermedia instructional resources are user-friendly and intuitive
	Engagement Enhancement	Resources enhance student engagement and interest.
Accessibility	Resource Availability	Limited availability of hypermedia instructional resources in some institutions
	Technical Challenges	Issues with internet access and technical support

4.7 Integration of Findings
a) Both quantitative and qualitative findings validate the significant impact of perceived usefulness and accessibility on the prediction of actual use of hypermedia resources in teaching digital electronics.
b) Meta-inference presents the relationship between individual perceptions and institutional factors.

5. Discussion

5.1 Analysis of Results
The findings of the study were presented based on the analyses of data related to the aforementioned two null hypotheses as follows:

Hypothesis One: The perceived usefulness of hypermedia instructional resources is not a significant determinant to predict its usage in teaching and learning of digital electronics courses among electrical and electronics technology education students and lecturers in Nigerian Universities.

Table 5. Results and Integration of Findings

Aspect	Quantitative Findings	Qualitative Findings	Meta-inference of Findings
Perceived Usefulness	Significant positive relationship with teaching effectiveness ($\beta = 0.45$, $p < 0.05$)	Hypermedia instructional resources enhance understanding and engagement	Both data sets indicate that perceived usefulness was a critical factor influencing prediction.

Table 5 above shows the result of the emphasis on significant roles of perceived usefulness in the prediction of actual use of hypermedia instructional resources for teaching digital electronics courses in Nigerian Universities. The quantitative analysis, conducted using Smart PLS-SEM, revealed that the perceived usefulness obtained path coefficient of ($\beta = 0.45$, $p < 0.05$) is a strong predictor of teaching and learning digital electronics courses in Nigerian Universities. These results were consistent with the existing literature that presents the importance of these factors in technology adoption [28].

H_{02}: Accessibility to hypermedia instructional resources is not a significant determinant to predict its usage in teaching and learning of digital electronics courses among electrical and electronics technology education students and lecturers in Nigerian universities.

Table 6. Results and Integration of Findings

Aspect	Quantitative Findings	Qualitative Findings	Meta-inference of Findings
Accessibility	Significant positive relationship with teaching effectiveness ($\beta = 0.38$, $p < 0.05$)	Challenges include limited infrastructure and support	Accessibility issues need to be addressed for effective adoption.

The result in Table 1 above shows the emphasis on the significant roles of perceived accessibility in the prediction of the actual use of hypermedia instructional resources for teaching digital electronics courses in Nigerian Universities. The quantitative analysis, conducted using Smart PLS-SEM, revealed that perceived accessibility obtained path coefficient of ($\beta = 0.38$, $p < 0.05$) is a strong predictor of teaching and learning digital electronics courses in Nigerian Universities. These results were consistent with the existing literature that presents the importance of these factors in technology adoption [29].

The reliability and validity assessments showed satisfactory results. This indicates that the quantitative instrument's items were both reliable and valid for measuring the observed constructs under study. The qualitative findings analyzed using Nvivo, provided deeper perceptions of the practical experiences and challenges faced by lecturers and students. Themes such as "Perceived usefulness" and "Accessibility" were consistently presented, suggesting that hypermedia instructional resources indeed make learning more interactive and engaging [30].

The integration of quantitative and qualitative data through meta-inference provided a comprehensive understanding of the factors influencing hypermedia instructional resource

adoption. It was evident that while individual perceptions of usefulness and accessibility are crucial, institutional support and readiness may also play a significant role. This suggests that efforts to enhance the adoption of hypermedia instructional resources should include improving institutional infrastructure and providing adequate technical support [31], 32].

Thus, the study presents that Perceived Usefulness and Accessibility were significant predictors of using hypermedia instructional resources for teaching digital electronic courses. Future studies should investigate the effects of these resources on student learning outcomes in digital electronics courses and devise methods to address issues that have been found.

6. Conclusion and Future Scope

This study explores the determinants that predict the actual use of hypermedia instructional resources for teaching Digital electronics courses in Nigerian universities. The study investigated the perceived usefulness and accessibility of hypermedia instructional resources as determinants of their adoption for teaching and learning digital electronics in Nigerian Universities. The findings indicate that both perceived usefulness and accessibility significantly influence the effectiveness of these resources in enhancing teaching and learning. Quantitative analysis using Smart PLS-SEM revealed that perceived usefulness ($\beta = 0.45$, $p < 0.05$) and accessibility ($\beta = 0.38$, $p < 0.05$) are strong predictors of teaching effectiveness. Reliability and validity assessments confirmed that the survey instruments were robust and reliable.

Qualitative perceptions, derived from semi-structured interviews and analyzed using Nvivo, identified key themes such as ease of use, engagement enhancement, resource availability, and technical challenges. These findings provide a nuanced understanding of the practical experiences and challenges faced by educators and students in using hypermedia resources. The integration of quantitative and qualitative data through meta-inference further presented the interplay between individual perceptions and institutional factors.

The current study recommended that the University management and educational technology practitioners consider Perceived Usefulness and Accessibility as factors that predict the actual use of Hypermedia Instructional Resources in teaching digital electronics in Nigerian universities before investing huge amounts of funds in the development of Hypermedia Instructional Resources for teaching and learning. Future research should build on these findings by exploring the long-term impact of hypermedia instructional resources on student learning outcomes and identifying best practices for their integration into the curriculum.

Data Availability
Data generated based on the Statistical analyses made were presented in four ways to guide the readers of this article

particularly the future researchers that may likely refer to this research work. The availability of the data was based on ascertaining the reliability coefficient of the research instrument, determining the objectives in the main study, answering the research questions, and testing the research hypotheses earlier postulated in the main study.

Table 7. Item-Total Statistics

Items	Scale Mean	Scale Variance	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
AC1	243.78	1673.242	.791	.992
AC2	243.67	1692.471	.615	.992
AC3	243.61	1671.546	.811	.992
AC4	243.50	1686.029	.774	.992
AC5	243.56	1667.203	.887	.991
AC6	243.50	1670.147	.852	.991
AC7	243.67	1670.941	.818	.992
AC8	243.44	1690.379	.708	.992
AC9	243.67	1669.294	.845	.991
AC10	243.61	1669.428	.845	.991
U1	243.56	1671.203	.823	.992
U2	243.78	1673.242	.791	.992
U3	243.61	1689.546	.676	.992
U4	243.56	1668.379	.868	.991
U5	243.56	1672.144	.808	.992
U6	243.78	1670.889	.828	.992
U7	243.61	1673.899	.774	.992
U8	243.56	1668.850	.861	.991
U9	243.72	1692.801	.611	.992
U10	243.78	1673.948	.779	.992
UH1	243.56	1672.144	.808	.992
UH2	243.78	1670.889	.828	.992
UH3	243.61	1673.899	.774	.992
UH4	243.56	1668.850	.861	.991
UH5	243.72	1692.801	.611	.992
UH6	243.78	1673.948	.779	.992
UH7	243.50	1686.029	.774	.992
UH8	243.78	1675.595	.753	.992
UH9	243.67	1670.000	.833	.991
UH10	243.78	1674.183	.776	.992

Reliability Statistics

Cronbach's Alpha	N of Items
.992	30

Cronbach's alpha is a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1. The closer the value is to 1, the greater the reliability of the instrument. For educational and social science research, an alpha value of 0.70 or higher is generally considered acceptable. Below is the analysis of each research question based on its Cronbach's alpha value:

1. Research Question 1 ($\alpha = 0.93$) A Cronbach's alpha of 0.93 indicates excellent internal consistency among the items measuring this research question. It suggests that the items are highly correlated and measure the same underlying construct. Since the value is well above 0.70, it is accepted as the items demonstrate very high reliability, indicating the instrument is consistent and dependable for this question.

2. Research Question 2 ($\alpha = 0.76$) A Cronbach's alpha of 0.76 reflects acceptable internal consistency. The items are reasonably correlated, providing a reliable measurement of the construct. Although lower than other values, 0.76 still meets the minimum threshold of 0.70, making it

acceptable. The items are sufficiently reliable for conclusion.

3. Research Question ($\alpha = 0.85$) A Cronbach's alpha of 0.85 indicates good internal consistency. The items are well correlated and measure the construct reliably. This value, being above 0.80, signifies good reliability, and therefore, the items are accepted as they meet the required standard for consistent measurement.

Conflict of Interest

All the authors confirm that no clash of interest emerged.

Authors' Contributions

All the Authors participated in one way or another but in specific the first, second, and third Authors conceptualized the research work, came up with draft/validated research instruments for (quantitative and qualitative data) and performed data collection with the help of research assistants. The fourth Author carried out the data collection and proceeded to write the article together to its logical conclusions.

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AUTHOR'S PROFILE

Abdulaziz Bello has a Nigerian Certificate in Education (Technical) from Federal College of Education (Technical), Bichi in 2001; Nigeria, Bachelor Degree (B.Tech.) Ed. In Industrial and Technology Education (Electronics) from the Federal University of Technology Minna, Nigeria in 2009, and a Master's Degree (M.Engr.) in Electrical Engineering in 2010 from Liaoning University of Technology Jinzhou, China. He is now a Ph.D student at the Department of Technology and Vocational Education, Faculty of Technology Education, Abubakar Tafawa Balewa University Bauchi; Nigeria, and a Lecturer 1 at Aliko Dangote University of Science and Technology Wudil; Nigeria. He is a life member of TEPAN and TRCN. He authored about 12 journal and conference papers in National and International journals. His research focuses on experiential learning, ICT, and methods in technical and vocational Education. He has 16 years of teaching and research experience. The Author is the serving Departmental examination officer, Technology and Vocational Education, Aliko Dangote University of Science and Technology Wudil; Nigeria.

Ahmad Aliyu Deba has a Nigerian Certificate in Education (Technical) from the Federal College of Education (Technical), Gombe; Nigeria, a Bachelor's Degree (B.Tech.) in Electrical Electronics Technology Education in 2002 and a Master's Degree (M.Tech) in Electrical Electronics Technology Education in 2009 from Abubakar Tafawa Balewa University, Bauchi; Nigeria, and Doctorate Degree (Ph.D) in. Technical and Vocational Education from Universiti Teknologi Malaysia in 2015. He is now a Professor of Technical and Vocational Education in the Department of Vocational and Technology Education of Abubakar Tafawa Balewa University, Bauchi; Nigeria. He is a life member of TEPAN, TRCN, NAVTED, IRDI and APEHER. He has authored more than 50 journal and conference papers in both National and International journals including Elsevier Scopus available online and authored book chapters. His research work mainly focuses on experiential learning, ICT, policy, and methods in technical and vocational Education. He has 20 years of teaching and research experience. The Author is the serving Head of the Department, of Vocational and Technology Education, Abubakar Tafawa Balewa University, Bauchi, Bauchi State – Nigeria.

Paul Shehu Yaduma has a Nigerian Certificate in Education (Technical) from Ahmadu Bello University, Zaria in 1987; a Nigeria, Bachelor's Degree (B.Tech.) in Building Technology Education from Ahmadu Bello University, Zaria in 1992; and a Master Degree (M.Tech.) in Building Technology Education from University of Nigeria Nsukka in 2002; Nigeria, and a Doctorate Degree (Ph.D) in. Technology education (Building Construction) from Abubakar Tafawa Balewa University, Bauchi, Nigeria in 2008. He is now a Professor of Building Construction Technology at the Department of Vocational and Technology Education of Abubakar Tafawa Balewa University, Bauchi; Nigeria. He is an Editor of JOSTE, JOTER, JRP, and NVAJ Academic Journal and Assistant Editor of NIVTE and TSUJ academic journals. He is a life member of TEPAN, TRCN, NAVTED, MLRN, MAPQEN and AVTEN. He has authored more than 71 journal and conference papers in both National and International journals including Elsevier Scopus available online and authored book chapters. His research mainly focuses on experiential learning, building technology, maintenance and repair, policy and methods in technology, and vocational Education. He has 37 years of teaching and research experience.

Sa'adatu Abubakar Mohammed has a Bachelor's Degree (B.Sc.) Ed. in Physics Education from Ahmadu Bello University Zaria; Nigeria, a Master's Degree (M.Tech.) Ed. in Physics, and a Doctorate Degree (Ph.D) in Science Education from Abubakar Tafawa Balewa University, Bauchi; Nigeria. She is now a Professor of Science Education in the Department of Science Education of Abubakar Tafawa Balewa University, Bauchi; Nigeria. She is a life member of the Nigerian Institute of Physics (NIP) and the Science Teacher's Association of Nigeria (STAN). She has authored more than 50 journal and conference papers in both National and International journals including Elsevier Scopus available online and authored book chapters. Her research work mainly focuses on problem-solving in science education. Her current research explores the development of students' metacognitive skills, aiming to enhance their learning processes and problem-solving abilities in science. She has 20 years of teaching and research experience.