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Development, Validation And Testing Of Instrument For Measuring Usage And Acceptance Of Google Classroom Among Vocational And Technology Education Students In Nigerian Universities

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Abstract
Background: *In the current era, numerous online learning platforms have emerged, with ongoing technological advancements aimed at simplifying the learning process. An illustration of such platforms includes Google Classroom, which functions as a Learning Management System (LMS). The purpose of this study is to develop, validate, and test an instrument for measuring the usage and acceptance of Google Classroom among Vocational and Technology Education students in Nigerian universities. This is due to the lack of a well-developed instrument capable of assessing the efficacy of Google Classroom. Therefore, this research aims to address this gap.*
Materials and Methods: *The population of the study is 1,744 students from different departments under the Faculty of Technology Education of the two Federal Universities offering Vocational and Technology Education in North-East, Nigeria during the 2022 and 2023 academic sessions. The methodology for the study is an exploratory sequential mixed methods design that involves two different phases. The sample size was determined using a Taro Yamane statistical formula which is N/(1+N(e)2) because the population is finite. Therefore, the sample size for the qualitative phase was 10 participants using purposive sampling drawn from lecturers of Nigerian Universities whereas the sample size for the quantitative phase was 326. Focus Group Discussion Guide (FGDG) was developed and used as instrument for qualitative data collection. A structured questionnaire consisting of 26 items titled "Students Google Classroom Questionnaire (SGCQ)," and achievement test titled "Test of Students' Knowledge and Ability on Google Classroom (TOSKAOGC)," were developed and used as instruments for data collection for the quantitative phase. Focus Group Discussion was conducted with 10 participants to obtain qualitative data for the first phase. Data were collected for the second phase using pre-training assessment before instructional delivery of the module content and post-training assessment after instructional delivery of the module content at different sessions.*
Results: *The validity of the instruments was determined using expert review, observations, rating, and analyses of distracter and difficulty item index. To establish the reliability of the qualitative instrument member checking and peer debriefing were used. Reliability of the quantitative instrument was determined using Cronbach's alpha which yielded 0.82, 0.88 and 0.72 for the three constructs. The qualitative data collected were analyzed using focus group analyses based on themes and codes. The quantitative data were analyzed using Exploratory Factor Analysis (EFA), Principal Component Analysis (PCA) of Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of Sphericity of 0.843 and 0.000, t-test with a pre-test value of 0.982($p>0.05$) and 0.000($p<0.05$); grand mean of 4.09 and Confirmatory Factor Analysis using Analysis Moment of Structures (AMOS) version 23 with a model value of Composite Reliability (CR) of 0.94 and an Average Variance Extracted (AVE) of 0.52.*
Conclusion: *The results of the study provide evidence of validity and reliability of the instrument, learning improvement and enhanced skill levels of students using Google Classroom platform. This supports the appropriateness of this instrument for measuring Google Classroom activities that were mapped within the Technology Acceptance Model (TAM) and conducted quantitative analysis on the constructs and model developed and tested.*
Keywords:*Google Classroom, Learning Management System, Technology Acceptance Model*

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I. Introduction

The unprecedented evolution of technology has catalyzed a revolution in education, ushering in a new era characterized by innovative learning environments and methodologies. The incorporation of technology into educational settings has become a cornerstone in the ongoing digital transformation of the learning process. Noteworthy, is the paradigm shift of pedagogical approaches by adoption of synchronous and asynchronous teaching and learning delivered through virtual platforms especially Google classroom (Martin & Parker, 2014). This is a means to facilitate seamless communication among students, breaking down barriers of space and time.

Google Classroom stands out as a recently acknowledged and highly innovative online platform designed for both learning and teaching purposes. Introduced in 2014 by Google Al-Maroof and Al-Emran (2018) stated that this application has swiftly gained recognition and acceptance within the educational community, emerging as one of the leading online tools to facilitate the e-learning process. Beyond its initial launch, Google Classroom has proven instrumental in seamlessly integrating technology into traditional classroom settings, thereby transforming the dynamics of education.

One notable aspect of Google Classroom is its capacity to complement face-to-face classes with online learning opportunities (Halverson et al., 2017). Instructors find value in utilizing this platform to augment traditional teaching methods, providing a seamless blend of in-person instruction and digital resources. The Google Classroom application's versatility and adaptability have positioned it as a valuable asset for educators seeking to enhance their teaching methodologies and cater to the evolving needs of today's learners. As educators increasingly recognize the potential of Google Classroom, it continues to serve as a catalyst for the evolution of contemporary educational practices, enabling a seamless fusion of face-to-face and online learning experiences.

Google Classroom has revolutionized the way students and educators interact in educational settings. In some University in Nigeria students heavily rely on Google Classroom for accessing course materials, submitting assignments, and engaging in discussions with peers and instructors. Its user-friendly interface and seamless integration with other Google applications make it a convenient tool for academic purposes. According to recent statistics, a significant majority of university students across various disciplines actively use Google Classroom to streamline their coursework and enhance collaboration within their academic communities (Farah et al., 2021). This study explores the usage and acceptance of Google Classroom among university students, shedding light on its impact on teaching and learning experiences as well as develop and evaluate instrument for measuring the efficacy of the Google Classroom platform through theoretical and statistical support.

The acceptance of Google Classroom among university students is influenced by factors such as ease of use, perceived usefulness, and institutional support. While many students find value in this digital platform for its organizational features and collaborative functionalities, some have face challenges related to adapting to new technologies or lack of adequate training on using the platform effectively (Rajib, 2023).

To promote greater acceptance and integration of Google Classroom among university students, institutions can provide comprehensive training sessions, offer technical support resources, and solicit feedback from users to continually improve the platform based on student needs and preferences (Al-Maroof & Al-Emran, 2018).

Besides, understanding student perspectives on technology in education is essential for optimizing teaching and learning experiences. By embracing digital tools like Google Classroom thoughtfully and strategically universities can create more engaging educational environments that cater to the diverse needs of today's learners. The findings of this study suggested that Google Classroom proves beneficial in enhancing student performance, with the majority expressing satisfaction with the platform's features implemented in their classes and reliability of the measuring instrument.

Statement of the Problem

Despite the recognition of Google Classroom as online platform for teaching and assessment, there is dearth of theoretical and practical supported instrument that is empirically valid and reliable for measuring its usage and acceptance. Besides, technology integration in education has garnered praise from researchers like Heggart and Yoo (2018), but there remains skepticism among educators, as noted by Pienta (2016) and Henrie et al. (2015), who perceive traditional teaching methods to be superior. Blended learning is proposed as a solution by the authors to foster student-centered environments through a mix of in-class and out-of-class activities. However, concerns raised by Pienta (2016) regarding students' access to resources outside the classroom pose challenges. Similarly, Halverson et al. (2017) highlight issues such as student privacy and discrepancies between student and institutional learning goals, along with potential mismatches in student motivations. Manca and Ranieri (2013) also address the conflict between student and institutional objectives but lament the problem of a valid and reliable instrument for measuring Google Classroom efficacy through its usage and acceptance.

Objectives

The overall objective of this study is to develop, validate, and test the efficacy of an instrument for measuring the use and acceptance of Google Classroom in Nigerian universities. Specifically, the objectives are to:

1. Develop an instrument for measuring three principal constructs of Google Classroom: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Attitudes Towards Using (ATU) among Vocational and Technology Education students in Nigerian universities.
2. Evaluate the exploratory scale of the three principal constructs of Google Classroom: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Attitudes Towards Using (ATU) among Vocational and Technology Education students in Nigerian universities.
3. Validate the developed instrument for measuring the use and acceptance of Google Classroom in Nigerian Universities.
4. Establish the reliability of the developed instrument for measuring the use and acceptance of Google Classroom in Nigerian Universities.
5. Determine the mean score of the Google Classroom training on pre-test and post-test achievements among students of Vocational and Technology Education in Nigerian Universities.
6. Develop a model of the instrument for measuring the use and acceptance of Google Classroom in Nigerian Universities.

Research Questions

The following research questions will guide the study:

1. What are the contents for measuring the three principal constructs of Google Classroom Perceived Usefulness (PU), (Perceived Ease of Use (PEOU) and Attitudes Towards Using (ATU) among Vocational and Technology Education students in Nigerian Universities?
2. What are the exploratory factor analyses of the three principal constructs of Google Classroom Perceived Usefulness (PU), (Perceived Ease of Use (PEOU) and Attitudes Towards Using (ATU) among Vocational and Technology Education students in Nigerian Universities?
3. What is the Validity of the developed instrument for measuring the use and acceptance of Google Classroom in Nigerian Universities?
4. What is the reliability of the developed instrument for measuring the use and acceptance of Google Classroom in Nigerian Universities?
5. What are the mean score of the Google Classroom training on pre-test and post-test achievements among students of Vocational and Technology Education in Nigerian Universities?
6. What is the diagrammatic representation of the developed model of the instrument for measuring the use and acceptance of Google Classroom in Nigerian Universities?

II. Literature Review

Theoretical Framework

The Technology Acceptance Model (TAM)

Davis (1989) initially formulated the Technology Acceptance Model (TAM) to explore the adoption of information technology. Derived from the Theory of Reasoned Action (TRA) elucidated by Fishbein and Ajzen (1975), TAM, depicted in Figure 1, is a versatile model centered on technology acceptance, comprising three principal constructs: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Attitudes Towards Using (ATU).

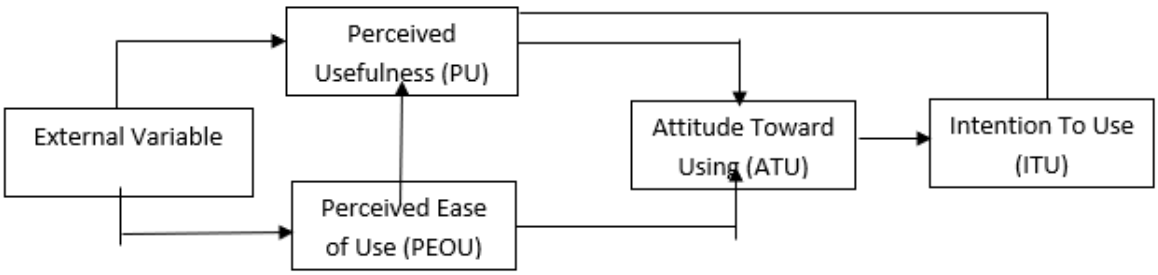

Fig. 1: Technology Acceptance Model (Davis, 1989)

The Technology Acceptance Model (TAM) is a widely recognized and applied theoretical framework for understanding user acceptance of technology. Developed by Fred Davis in the late 1980s, TAM seeks to

explain how users come to accept and use technology based on their perceptions of its usefulness and ease of use (Rajib, 2023). TAM consists of two key components: Perceived Usefulness and Perceived Ease of Use. Perceived Usefulness refers to the degree to which a person believes that using a particular technology would enhance their performance or make their work easier. In contrast, Perceived Ease of Use relates to the extent to which an individual perceives that using the technology would be free from effort (Rajib, 2023).

Research studies have extensively applied TAM in various contexts to assess user acceptance of different technologies. For example, a study by Venkatesh et al., (2012) applied TAM to understand individuals' acceptance of e-commerce technologies, and the findings indicated that perceived usefulness significantly influenced users' attitudes towards e-commerce platforms. Another study by Rofi'i et al. (2023) utilized TAM to evaluate user acceptance of mobile banking services, and the results showed that both perceived usefulness and perceived ease of use were significant factors affecting users' intentions to adopt mobile banking.

Despite its widespread application and utility, TAM has not been without criticisms and limitations as highlighted in scholarly literature. One critique is its narrow focus on only two key determinants: perceived usefulness and perceived ease of use. Some researchers argue that additional variables, such as subjective norms, facilitating conditions, or social influence, should also be considered for a more comprehensive understanding of technology acceptance. Furthermore, critics point out that TAM may oversimplify the complex nature of human behavior towards technology adoption. People's decisions regarding technology usage are influenced by various intrinsic and extrinsic factors beyond just perceived usefulness and ease of use, such as trust, habits, personal values, or system compatibility (Fakhmul, 2022). According to recent statistics, a significant majority of university students across various disciplines actively use Google Classroom to streamline their coursework and enhance collaboration within their academic environment (Al-Maroof & Al-Emran, 2018).

Perceived Usefulness (PU)

Perceived Utility (PU) refers to the extent to which an individual perceives that employing a particular system will enhance their work productivity (Davis, 1989). This concept is influenced by Perceived Ease of Use (PEOU), which ultimately dictates the effectiveness of the utilized information technology.

Perceived Ease of Use (PEOU)

Perceived Ease of Use (PEOU) refers to the extent to which an individual perceives that utilizing a specific system within an organizational setting would be effortless (Davis, 1989). This concept highlights the system's ability to enable users to expedite their tasks, enhance productivity, and operate efficiently with minimal exertion (Munoz, 2017).

Attitude Towards Using (ATU)

According to Davis (1989), the TAM model's Attitude Towards Using (ATU) is influenced by two primary factors: Perceived Ease of Use (PEOU) and Perceived Usefulness (PU).

The Google Classroom Environment

Google Classroom (GC) serves as a central hub for the convergence of teaching and learning activities. It provides a comprehensive platform with various user-friendly functionalities, enabling educators to effectively manage, assess, and enhance the teaching-learning process (Moid, 2022). This virtual environment facilitates the organization of assignments, promotes collaborative efforts among teachers and students, and enables seamless communication both within and beyond traditional classroom settings. Continuously evolving, Google Classroom regularly introduces new features to meet evolving educational needs. Integrated within the broader framework of Google Suite for Education, it seamlessly interacts with a variety of other applications, including Google Docs, Google Forms, Google Drive, Google Slides, and Gmail. The platform boasts numerous features designed to optimize the educational experience.

III. Materials And Methods

The study was carried out on lecturers and students from different departments of Vocational and Technology Education at universities in North-East Nigeria during the 2022 and 2023 academic sessions. A total of 10 lecturers (experts) and 326 students served as respondents for the study.

Study Design: A sequential exploratory mixed method design was adopted for this study, involving focus group discussions, a close-ended questionnaire, and a Google Classroom achievement test administered to respondents drawn from Vocational and Technology Education students at universities in North-East, Nigeria.

Study Location: The study was carried out in North-East, Nigeria using the two federal universities that are offering Vocational and Technology Education programme.

Study Duration: The study was carried out from the second quarter of 2023 to the first quarter of 2024.

Sample Size: The sample size of the study was 10 lecturers for the focus group discussion that the qualitative phase and 326 students for the quantitative phase.
Sample Size Calculation: Purposive sampling was used for the qualitative phase while Taro Yamane formular for sample size calculation was used for the quantitative phase because the population is finite which is 1,744. The formular is N/(1+N(e)2) where: N - is the population size and e – is the margin of error given:
Population size N = 1,744 and margin of error e = 0.05 plugging in the values:
$N = 1{,}744/1+1{,}744 \times (0.05)^2$
$N = 1{,}744/1+1{,}744 \times 0.0025$
$N = 1{,}744/1+4.36$
$N = 1{,}744/5.36$
$N \approx 325.37$
Rounding up, the sample size is approximately N =326

So, using the Taro Yamane formula, the required sample size for a population of 1,744 with a margin of error of 0.05 is approximately 326.

Subject and Selection Method: The subjects of the study were drawn from lecturers (experts) of vocational and technology education, selected using purposive and snowball sampling for the qualitative phase, and students of vocational and technology education, selected using random sampling for the quantitative phase.

Procedure Methodology

The first phase of data collection in this study involved the use of a Focus Group Discussion Guide (FGDG), which included an introduction, a brief background of the study, stated study objectives, FGD objectives, instructions to the moderator/note-taker, consent, an ice-breaker exercise, warm-up questions, and focus group questions. The second phase of data collection involved the use of a close-ended questionnaire and a Google Classroom achievement test. Moreover, in the absence of an existing instrument explicitly for measuring Google Classroom usage and acceptance, items were generated from a comprehensive literature review and focus group discussions as explained earlier. A total of 326 questionnaires were distributed, of which 316 were returned and analyzed.

Statistical Analysis

The first phase of data collection from this study, which is qualitative, used FGDG and was analyzed thematically using matrix coding. This involved coding, sorting, and clustering respondents' opinions. A total of 10 experts with experience using Google Classroom participated in the focus group discussion. The second phase of data collection, which is quantitative, was analyzed using the Statistical Package for Social Science (SPSS) version 21 for descriptive statistics which involve mean, exploratory factor analysis, and t-tests. The confirmatory factor analysis was conducted to develop a model using Analysis Moment of Structures (AMOS) version 23. All the analyses were conducted to empirically evaluate the validity and reliability of the developed constructs.

IV. Result

Focus Group Analyses

Perceived Usefulness (PU) of Google Classroom

"Participants 1, 3, and 7 highlighted the ease of understanding and navigating Google Classroom.

Participants find it easy to access information and materials (Participants 2 and 5). Participant 2 noted an improved quality of learning using Google Classroom. Participant 4 expressed the ability to participate in lectures from any location. Participants 5 and 6 emphasized the ease of submitting assignments and responding to tests, indicating flexibility in learning activities. Participant 8 mentioned that instructions on activities in Google Classroom are easily understood. Participant 9 found feedback provided by lecturers in Google Classroom to be useful. Participant 10 highlighted the ability to track learning progress through the use of Google Classroom, indicating the importance of feedback and assessment features."

Perceived Ease of Use (PEOU) of Google Classroom

"Participants were asked to express their views on the perceived ease of use of Google classroom which after the matrix coding, the focus group analysis shows that participants 1, 2, 3 and 4 opined that they

can easily sign into Google Classroom and access course materials, they can easily navigate in the Google Classroom indicating positive perceptions of the platform's usability. These repetitive statements contribute to the usability theme, highlighting user-friendly interface design.

Participants 5, 6 and 7 expressed satisfaction in terms of functionality of the Google classroom based on these repetitive statements in terms of joining classrooms, participating in live lectures, submitting assignments, and responding to tests, viewing scores and grades within Google Classroom. The participants 8, 9 and 10 expressed satisfaction with the platform's functionality, ease of navigation within Google Classroom is a recurring theme, with participants mentioning the ability to easily find their way around the platform and the theme highlights the importance of features related to task management and performance evaluation within the platform".

Attitude Towards Using (ATU) Google Classroom

"Participants 1, 3, 4, 5 express that Google Classroom arouses their interest in learning, indicating a positive impact on motivation and engagement. Participants 6, 7 and 8 expressed their view on uploading materials in Google Classroom helps participants prepare for meaningful interaction during class activities, suggesting that the platform supports pre-class preparation and active engagement, instant feedback on tests and assignments within Google Classroom helps participants understand their mistakes quickly, highlighting the importance of timely feedback for learning comprehension. Participants 2, 9 and 10 mention that Google Classroom lectures assist them in learning individually, indicating that the platform supports personalized learning experiences tailored to individual needs and pace".

Based on the focus group analyses, items generated, and the questionnaire developed and administered, about twenty-six items were extracted and considered fit for further analysis using Exploratory Factor Analysis. This included Principal Component Factoring (PCF) and Principal Axis Factoring (PAF) conducted among all the proposed twenty-six items: Perceived Usefulness (PU) of Google Classroom (09 items), Perceived Ease of Use (PEOU) of Google Classroom (10 items), and Attitude Towards Using (ATU) Google Classroom (07 items). The results of the factor analysis revealed a three-factor solution as presented in Table 1. This is because only the first three factors had initial eigenvalues reaching one after eliminating cross-loading and negative items. As a result, only three factors were retained for further analyses, in line with the proposed three constructs of the instrument according to the Technology Acceptance Model.

Table 1 shows the fitness of the factorability and unidimensionality of the data for running factor analysis. The results indicate a one factor solution for each construct instead of the proposed two. This is because only the first factors of each construct have eigenvalues reaching one. The first construct Perceived Usefulness has total eigenvalue of 1.436, the second construct Perceived Ease of Use has total eigenvalue of 1.914 and the third construct Attitude Towards Using has total eigenvalue of 1.057. The other eigenvalues of the factors fall short of one which indicate only one factor solution for each construct.

Table no. 1: Assessment of Factorability and Unidimensionality

Constructs	**Total Variance Explained**			
	Components	**Total Eigenvalues**	**% of Variance**	**Cumulative %**
Perceived Usefulness	1	1.436	20.513	62.956
	2	0.705	10.069	75.276
Perceived Ease of Use	1	1.914	27.347	50.347
	2	0.862	12.319	47.86
Attitude Towards Using	1	1.057	15.096	85.345
	2	0.592	8.456	93.801
	3	0.434	6.199	100.00

Extraction Method: Principal Component Analysis

Table no. 2 shows the results of both the Kaiser-Meyer-Olkin (KMO) which measure the sampling adequacy (.843) as well as Bartlette's tests of sphericity (.000) which is statistically significant and therefore met the requirement for the factorability of the data (Hair *et al*., 2019).

Table no. 2: KMO and Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.843
Bartlett's Test of Sphericity	Approx. Chi-Square	5651.770
	Df	183
	Sig.	.000

Figure 1 is a scree plot displaying the eigenvalues of the factors against their respective factor numbers, sorted in ascending order. The "elbow" of the scree plot represents the point where the eigenvalues or the number of factors stop, indicating a potential cut-off point for retaining factors.

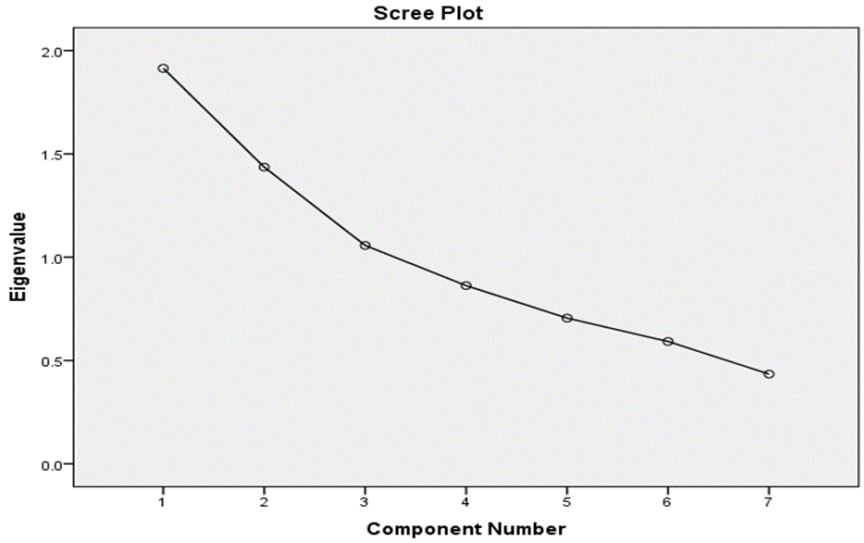

Figure 1: Scree plot suggested three factor solution, the curve of the line ends at the third factor

Table no. 3 shows the construct validity determined using factor loadings, eigenvalues, cumulative % of variance and mean item scores. Nine items were loaded onto factor 1 (Perceived Usefulness (PU) of Google Classroom), ten items were loaded onto factor 2 (Perceived Ease of Use (PEOU) of Google Classroom), and seven items were loaded onto factor 3 (Attitude Towards Using (ATU) Google Classroom). All items were retained as they yielded loadings above 0.50 on their primary factors, indicating a strong relationship with their parent factors. Moreover, all loadings in the three constructs exceeded the minimum cut-off load of 0.50, indicating statistical significance. Additionally, all constructs had a cumulative % of variance above 50 percent. The mean item scores indicated the average level of agreement with each item by the respondents. The mean indices were used to determine the relative importance of the items as perceived by the respondents. The responses indicated a high rate of agreement among the respondents on the constructs and items developed for measuring the usage and acceptance of Google Classroom among students of vocational and technology education in Nigerian universities. The means of all the statements were above the decision rule of 2.50 on a 4-point Likert scale with a grand mean of 4.09, confirming that students had a positive attitude towards the use and acceptance of the Google Classroom platform. This also confirms the instrument's efficiency in measuring the efficacy of Google Classroom, highlighting its positive impact on university students' learning and assessment.

Table no. 3: Factor Loadings, Eigen Values, Cumulative % of Variances and Mean

Variable	Construct/Factor Groupings	Factor Loadings	Eigen Values	Cumulative % of Variance	Mean
Factor 1	**Perceived Usefulness (PU) of Google Classroom**		**1.436**	**62.956**	
PU1	Google classroom application is easy to understand and navigate	0.881			3.33
PU2	There is improved quality of learning using Google classroom	0.918			4.17
PU3	Information and materials can easily and quickly be accessed	0.944			4.54
PU4	I can participate in lectures irrespective of location	0.929			4.20
PU5	I can submit my assignment on time	0.890			4.59
PU6	I can respond to tests quickly	0.726			4.09
PU7	Instructions on activities in the Google classroom are easily understood	0.897			4.25
PU8	Feedback provided by lecturers in Google classroom is useful	0.702			4.53
PU9	I can track my learning progress through the use of Google classroom	0.891			3.60
Factor 2	**Perceived Ease of Use (PEOU) of Google Classroom**		**1.914**	**50.347**	

PEOU10	I can easily sign into the Google classroom	0.914			4.11
PEOU11	I can join the Google classroom without difficulties	0.925			4.61
PEOU12	I can access course materials from the Google classroom	0.924			2.74
PEOU13	I can participate in live lecture in the Google classroom	0.927			3.97
PEOU14	I can view and post information in the Google classroom	0.915			4.57
PEOU15	I can receive assignment given in the Google classroom	0.925			3.67
PEOU16	I can submit my assignment in the Google classroom	0.675			4.55
PEOU17	I can respond to multiple choice tests in Google Classroom	0.913			3.48
PEOU18	I can view my scores and grades in the Google classroom	0.948			4.10
PEOU19	I can easily navigate in the Google classroom	0.913			4.53
Factor 3	**Attitude Towards Using (ATU) Google Classroom**		**1.057**	**85.345**	
ATU20	Google classroom always arouse my interest in learning	0.875			3.69
ATU21	Viewing uploaded materials in the Google classroom help me to prepare for meaningful interaction during class activities	0.865			4.54
ATU22	Instant feedback of tests and assignments help me to understand my mistakes	0.870			4.62
ATU23	Easy understanding of explanations and questions designed in the Google classroom	0.880			4.57
ATU24	Google classroom lecture assist me to learn individually	0.903			3.81
ATU25	Google classroom facilitate active learning	0.862			3.76
ATU26	Google classroom always boost my morale in class participation and activities	0.874			3.97
	GRAND MEAN				**4.09**

Table no. 4 shows the results of the construct reliability indicates good internal consistency as well as clear factor structure with the reliability coefficients of 0.82 for Perceived Usefulness, 0.88 forPerceived Ease of Use and 0.76 for Attitude Towards Using.

Table no. 4: Reliability of the Constructs/Factors

Constructs/Factors	Cronbach's Alpha Coefficient
Perceived Usefulness	**0.82**
Perceived Ease of Use	**0.88**
Attitude Towards Using	**0.76**

Table no. 5 shows the scores obtained by both the experimental and control group which were downloaded and compared using the t-test statistics. The results indicate that, there is no significant difference between the experimental and control group in their pre-test mean scores. This is because the p-value of 0.982 ($p>0.05$) was greater than the alpha value of 0.05 ($p>0.05$). This means that the students of both the groups were equal in terms of their prior knowledge on the use of Google Classroom. Besides, the students of Vocational and Technology Education in the Universities in the North-East, Nigeria were used for both the experimental and control groups during the Goggle Classroom training and subjected to a pre-test which was automatically scored and saved in the Google classroom environment.

Table no. 5: Comparison of the mean academic achievement scores of the pre-test for the experiment and control groups

Groups	N	Mean	Std. Deviation	Alpha (α)	t	Df	p-value	Mean Difference	Decision
Experimental	46	4.12	.578	0.05	0.022	90	0.982	0.01	Not Significant
Control	46	4.11	.594						

There is statistically no significant difference at $P \geq 0.05$; df = 90

Table no. 6 shows the post-test mean scores of both the experimental and control groups which were compared using t-test statistics. The experimental group had a higher mean score of 7.15 compared to the control group's mean score of 5.13. Additionally, the p-value of 0.000 indicates a statistically significant difference between the two groups. The result also indicates a significant difference between the two groups in terms of their mean academic achievement scores in the post-test.

Table no. 6: Comparison of the post-test mean scores of the experimental and control groups

Groups	N	Mean	Std. Deviation	Alpha (α)	T	df	p-value	Mean Difference	Decision
Experimental	46	7.15	1.862	0.05	3.123	90	0.000	2.02	Significant
Control	46	5.13	1.432						

There is statistically significant difference at $P \leq 0.05$; df = 90

Model Testing

The exploratory factor analysis conducted based on the item analysis supports a three-factor solution. Confirmatory Factor Analysis (CFA), using Analysis Moment of Structures (AMOS) software Version 23, was utilized to develop a three-factor model as shown in Figure 2. The three factors were labeled as Perceived Usefulness (PU), which consists of nine items; Perceived Ease of Use (PEOU), which consists of ten items; and Attitude Towards Using (ATU), which consists of seven items. The variances e1 to e26 consist of latent and observed variables connected by paths. To validate the model based on the relationship of the three constructs, the results show that the model has an overall Composite Reliability (CR) of 0.94 and an Average Variance Extracted (AVE) of 0.52, which are within the acceptable threshold limits for validity and reliability of the model.

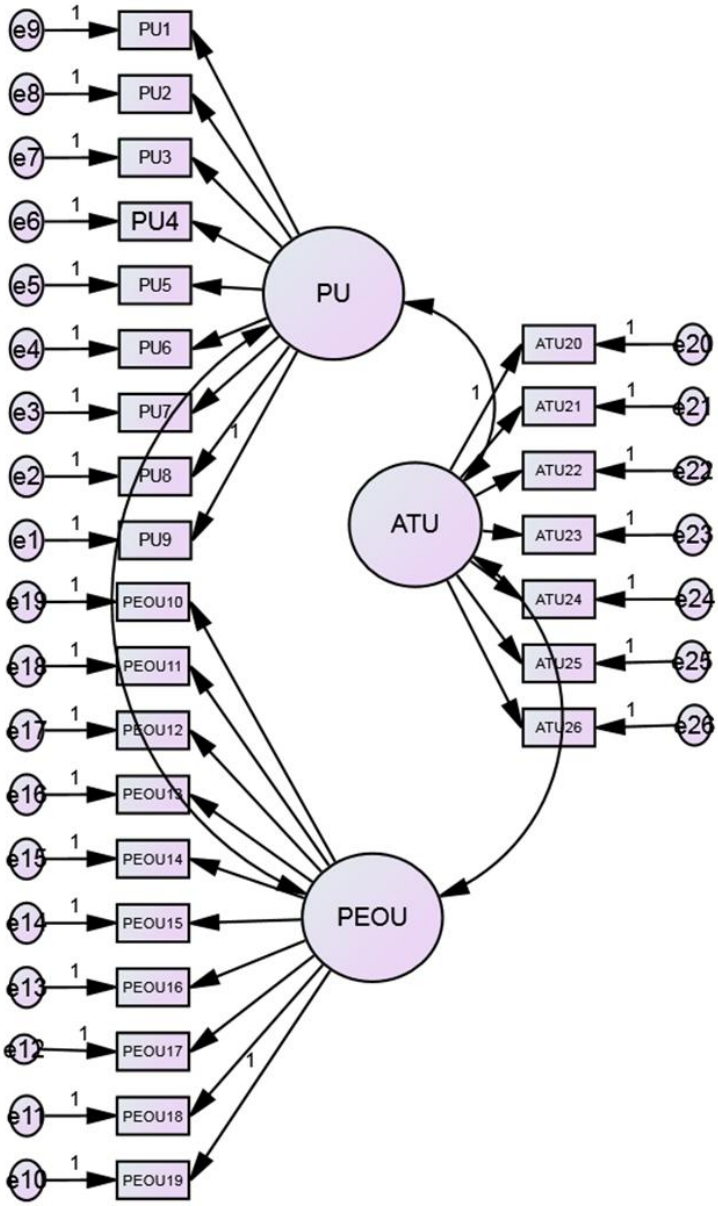

Figure 2: Modeling the Variables by Confirmatory Factor Analysis using Analysis Moment of Structures (AMOS)

V. Discussion

The focus group analysis conducted with experienced lecturers helps bridge the gap between literature and theoretical concepts with the opinions of experts, thereby exploring the phenomenon under study and generalizing the qualitative findings on a larger scale. This process paved the way for the development of the instrument (questionnaire). Exploratory Factor Analysis revealed absolute factorability and unidimensionality in line with the Kaiser Criterion. Based on the percentage of variance explained, all three constructs accounted for over 50% of the variance, further supporting the suitability of one-factor solutions for each. The factor loadings, reliability, and factor structure were used to examine convergent validity (Hair et al., 2019). All three constructs exceeded the minimum cut-off load of 0.5, indicating statistical significance and corresponding to the theoretical structure. The reliability analysis showed high internal consistency, with the Cronbach's alpha value of each domain or construct over 0.60. The Cronbach's alpha values between 0.7 and 0.9 are considered good (Latif, 2018). Additionally, all items had mean values ranging from 2.74 to 4.64, which are above the cut-off point of 2.50. Regarding nomological validity, the constructs demonstrated strong relationships among them based on their covariances, which aligns with the TAM theory. This is consistent with Rajib (2023), who stated that TAM explains how users accept the use of technology based on their perceptions of its usefulness and ease of use. These assertions were also supported by Venkatesh et al. (2012), who applied TAM in various contexts to assess user acceptance of different technologies.

Therefore, based on the focus group analysis, the results of the exploratory factor analysis, and the pre-test and post-test achievement scores, the developed model indicated that the instrument is reliable and valid. It is feasible for use in collecting data to measure the use and acceptance of Google Classroom in higher education institutions. This finding aligns with Al-Maroof and Al-Emran (2018), who found that the majority of university students across various disciplines actively use Google Classroom frequently in their classroom activities.

VI. Conclusion

In conclusion, the focus group discussions and questionnaires used for data collection improved the quality of the research by transforming raw data into easily understandable information. This process led to the development of an instrument for measuring the usage and acceptance of the Google Classroom platform's efficacy. Despite some critiques and limitations of the Technology Acceptance Model (TAM) theory, it proves to be a valuable framework for studying user acceptance of technology due to its simplicity and effectiveness in predicting user behavior. This theory was tested through Confirmatory Factor Analysis using AMOS. Besides, the aforementioned analyses provide strong evidence supporting the efficiency, effectiveness and appropriateness of deploying and using the three domains/constructs as a standard instrument for measuring the usage and acceptance of Google Classroom in tertiary institutions of learning, especially Universities in Nigeria. This is because all necessary procedures for developing the instrument were strictly followed, ranging from planning and item generation to validation, quantitative evaluation, such as assessment of factorability and unidimensionality, sampling adequacy, scree plot, construct validity, mean scores of pre and post-test achievement, and development and testing of a model fit, followed by the development of the final instrument.

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