

Perceived Influence of Adoption of Biometric Class Attendance System in Nigerian Universities

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Abstract

This study sought to determine the perceived influence of adoption of biometric class attendance system in Nigerian universities. A mixed research design was adopted for the study. Three research questions and three hypotheses guided the study. Study sample was 546 third year students from the six sampled departments in a large public university in south-east Nigeria. A purposive sampling was used based on the participant's abilities to meet the study requirement in adoption of biometric class attendance system. Also, a semi-structured interview was used to ascertain responses that structured questionnaire could not elicit. The instrument for data collection involved a 5-open ended interview questions, and structured questionnaire. Mean, standard deviation, exploratory factor analysis and analyses of variance (ANOVA) were used to analyze the data collected for the study using NVivo and SPSS. The findings of the study revealed that 94% of the participants considered declarative knowledge of the electronic class attendance monitoring system relevant tool for capturing attendance. Also, lack of confidence owing to anxiety of new technology, inadequate coverage of

institutional Wi-Fi, among others were the challenges limiting students' adoption of the electronic class attendance monitoring system. This study recommends that university administration should urgently take steps to address students' related constraints for ease of use of biometrics class attendance systems.

Keywords: *Biometric Class Attendance System, declarative knowledge, constraints, Strategies, University education.*

Introduction

Biometric technology is primarily applied in identity verification and access management. A wide array of current research efforts is exploring contemporary aspects of this field, including system architectures, recognition algorithms, various biometric traits, and practical evaluations. Recent studies are focusing on biometric applications in education with a view to improving students' attendance to lectures (Rukhiran, Wong-In & Netinant, 2023; Necochea-Chamorro & Nuñez, 2024). This is essential given that in a conventional classroom setting, teachers and students must be present in class to provide a conducive learning atmosphere where they can pursue knowledge and acquire new skills. Due to the low number of students who attend

classes, students may need to use biometric applications in order to increase their attendance to class (Grazina & Sonata, 2020). Nath et al. (2019) assert that marking attendance is one of the most important aspects of any lesson. This is because it serves as the major means of guaranteeing that students are engaged in class activities. Perhaps, why some institutions regulations require that students should have at least 80% class attendance in a particular course to be qualified to take that semester examinations (Hybl, 2023). In institutions of learning majority of class attendances is recorded/captured using manual means like calling of names or signing on paper. Although this form of attendance tracking method has been the bedrock of educational institutions for decades, it appears that it is obsolete and cumbersome (Alves & Lopes, 2019).

Lecturers traditionally take roll calls, relying on handwritten lists or paper sign-in sheets. While these methods served their purpose, students have long been associated with a range of challenges that hinder the educational process (Siti, 2019). According to Siti, it is prone to errors, students may forget to sign in, lecturers may make mistakes in recording attendance, and paper records can be lost or damaged. These inaccuracies can lead to incorrect assessments of students' attendance and participation (Smith, 2019). Also, the manual collection and management of attendance data are time-consuming tasks given that lecturers' use valuable class time for roll call and administrators must process and record this data, thus diverting resources from more valuable educational activities (Johnson & Brown, 2020). As a result of these issues, educators and administrators struggle to make data-driven decisions regarding attendance policies and interventions when they lack access to real-

time data and comprehensive attendance insights (Roberts, 2019). These necessitate the need for the adoption of automated class attendance monitoring system otherwise called biometric class attendance systems in many Nigerian universities.

Today, the implementation of biometrics attendance monitoring systems in universities represents a transformative shift in the administrative processes and learner engagement. Biometric recognition refers to the automatic recognition of persons based on their biological traits, e.g. face, or behavioural characteristics, e.g. keystroke dynamics (Minaee, et al., 2023) effectively developed in recent decades (Utegen & Rakhmetov, 2023). A biometric sample, such as a voice recording or a picture of the face, is obtained in a biometric system when the biometric characteristic of the students is supplied to the capture equipment. The biometric sample's quality is then evaluated, pre-processing, and its characteristics retrieved. The retrieved features are saved as a biometric reference template at the time of enrollment for instance in a database (Núñez & Matamoros, 2023). A second biometric presentation is made during authentication, and a collected probe sample is processed in the same manner to create a probe template. When creating this kind of system, several specifications and factors need to be taken into account such as the total number of students in a class. Thus, biometric technologies have been created as a substitute for recording student attendance in class (Sholanke, 2023). One benefit is that since every person has unique biometric traits, the student cannot falsify or manipulate the class attendance system. Additionally, because attendance is automatically recorded, it increases productivity and lessens the workload of the teacher. Rukhiran, Wong-In, and Netinant (2023) noted that some systems can identify

students' sitting arrangements in addition to recording attendance, while another uses facial cues to classify students' gender (Papić, & Szombathelyi, 2023).

Moreover, biometric class attendance systems often manifest through digital dashboards which streamlines the traditional manual methods of attendance tracking. Universities that embrace these technologies stand to gain in terms of increased efficiency, data accuracy, and real-time accessibility (Gupta & Patel, 2022). For instance, the adoption of attendance monitoring devices eliminates the reliance on outdated paper sign-in sheets, contributing to a more streamlined and technologically advanced educational environment (Smith, 2021). While the adoption of attendance monitoring systems holds promise for efficiency, improved learning engagement and overall learning outcomes, most lecturers are reluctant to its usage perhaps owing to their perceived challenges associated with the system as well as institutional beliefs system (Kee, et al, 2023). Similarly, Yuan, et al (2015) posits that variations in administrative policies, cultural norms, and attitudes towards attendance monitoring across universities contribute to the complexity of the development and usage. Institutional readiness and support for technological innovations play a pivotal role in determining the effectiveness of biometrics class attendance system in Nigerian universities. In the context of this study, a university is an academic community dedicated to the pursuit of knowledge and the holistic development of students (Marginson, 2016). It encompasses diverse academic disciplines, offering a wide range of undergraduate and postgraduate programs.

Universities are not only centers for academic instruction but also foster an environment for critical thinking, innovation, and scholarly inquiry (Bok, 2012). It plays a significant role in shaping of the intellectual landscape of a region or country, contributing to societal progress and development (Etzkowitz, 2003). University students, in this context, are individuals enrolled in these higher education institutions, actively participating in academic activities, including attending lectures. They form a crucial part of the focus, as the student dashboard of the biometrics class attendance aims to enhance the monitoring and evaluation of their attendance to lectures. The dynamic nature of these systems allows for timely interventions to support students who may be at risk of disengagement (Akbulut & Sarikan, 2017). The study by Martinez et al. (2020) highlights that attendance dashboards provide educators with insights into attendance patterns, enabling them to identify trends and implement targeted strategies to support struggling students. This proactive approach not only fosters a positive impact on students' academic performance but also contributes to a more supportive learning environment. More so, student's active participation in the adoption of biometrics class attendance monitoring system in Nigerian Universities have been influenced by factors such as gender. There is a serious argument in literature as to establish male and female rate of adoption of technology usually in educational process (Park, et al, 2019; Orser, et al, 2019). It is against this backdrop that this study is set to ascertain the opinions of students, on the usefulness, knowledge, challenges, and strategies influencing the adoption of the biometric class attendance system in Nigerian Universities.

Statement of Problem

At all levels of education, student attendance is crucial to academic achievement (Lukkarinen, et al, 2016). To ensure that this is achieved, traditional class attendance monitoring system such as the use of identification cards, class admission cards, and signed passports, roll calls, etc. are predominantly used to confirm students' identities to class. Unfortunately, this conventional approach to class attendance lacks precision and efficiency, which can result in cheating, truancy, and other gross classroom indiscipline as witnessed in large classes during examinations. More so, student identity is vulnerable to damage, loss, forgery, and obsolescence which could have a detrimental effect on students' cognitive psychology (Alexander & Hicks, 2016). Besides, manual class attendance is not only prone to errors, it is time consuming thus leading to loss of class time, loss of important academic records which may lead to incorrect assessments of students' attendance and class involvement (Smith, 2019). Thus, class admits cards require technological capabilities to guarantee the correctness of student academic records hence the wide adoption of biometrics class attendance monitoring system which provides students and lecturers (as admin) with a unique username and password to log onto the database, confirm and manage their class records with relative ease. In view of this premise, the study sought to determine the perceived teachers and students' awareness level, constraints, and strategies that influence their adoption of the biometric class attendance system in Nigerian Universities.

Research Questions

1. What are the students' declarative knowledge of the biometric class attendance monitoring system in universities in Nigeria?

2. What are the constraints to the effective use of biometric class attendance monitoring system in universities in Nigeria?
3. What are the strategies for effective use of biometric class attendance system in universities in Nigeria?

Hypotheses

1. There is no significant difference in the mean ratings of male and female students on their declarative knowledge of the biometric class attendance monitoring system in Nigerian Universities.
2. There is no significant difference in the mean ratings of male and female students on the perceived constraints to effective use of the biometric class attendance monitoring system in Nigerian Universities.
3. There is no significant difference in the mean ratings of male and female students on the strategies for effective use of the biometric class attendance system in Nigerian Universities.

Literature Review

Overview of Biometric Technology

Access control and identification are the two main uses of biometric technology. There are currently a large number of biometric technology studies in progress covering a range of modern topics, such as algorithms, architectures, modalities, and empirical studies (Marani, et al., 2023; Utegen & Rakhmetov, 2023). There are three main types of biometric research that help in examining the physical traits of the human body such as the face, fingerprints, palm, hand shape, retina, and iris which constitutes physical biometric verification. Human functions including speech, posture, signatures, keyboard dynamics, and other behavioral biometric authentication activities on cellphones are studied by behavioral biometrics (Alsaadi, 2021;

Marani, et al 2023; Utegen & Rakhmetov, 2023). The most significant biometric characteristic is the human face, which is utilized in many different fields such as credit card verification, forensics, security systems, identification of felons, and surveillance systems (North-Samardzic, 2020). Biometric systems can be broadly categorized as either unimodal or multimodal (Abdulrahman & Alhayani, 2023; Bernal-Romero, et al 2023). One biometric source, such as the face, iris, fingerprint, palm, or other human body part, is used by a unimodal system. Multiple human physical traits can be determined by improving the performance of a biometric recognition system called multimodal biometric recognition.

There are two subcategories of multimodal biometric recognition systems are multiple modalities, which is the identification of a subject with more than two biometric technologies, like a fingerprint and a face. Ammour, Bazi, and Alajlan (2023) identified users of the system using iris and face recognition while individuals were recognized by Gunasekaran, et al (2024) using iris, fingerprint, and face blending. For example, when two cameras' views are combined, for instance, several sensors use the same inspection pattern. Zhao, et al (2020) used a mobile phone's two cameras to detect things. The authors utilized several methods to extract different features from data or images. For example, utilize the first and second algorithms in tandem with fingerprint extraction. Multiple and recurring instances: employing the same biometrics in recognition processes or using one or more biometric forms, such as left-and right-iris pictures for iris recognition. A succinct summary of deep learning methods for person re-identification was provided by Ye et al. (2019). Additionally, the multimodal biometric technique was

covered in a number of recent research papers. A multi-biometric recognition system for ongoing learner evaluation in e-learning systems was described by Fenu, and Marras (2022).

Students' faces and fingerprints are used by the system to authenticate and approve their admissions. In addition, a framework for an online exam with a multimodal biometric system that makes use of continuous picture capture from a web camera was proposed by Traore, et al (2018). The author maintained that the state of the art of multimodal biometric technologies is covered in paradigm shift which was presented by Chen et al. (2019) in groundbreaking research on Variational Bayesian Extreme Learning Machine (VBELM). Using fingerprint templates and face photos produced from a feature-image matrix, they developed a block. For multimodal biometrics, the suggested method enhanced characterization capabilities, reduced element count, and enhanced correctness by recovering the core layer semantic characteristics of local features.

The VBELM performs better than conventional approaches in terms of generalization, testing accuracy, efficiency, and sustainability. A method for enhancing a multimodal biometric approach was presented by Gomez-Barrero et al. (2018). It is based on the homomorphic encoding technique, which encrypts all database data. The term multimodal biometric fusion describes the integration of decision levels, scores, and features. An online database for fingerprint and signature recognition was used for the trials. The ISO/IEC 24745 is met by the system. The broad range of sectors in which the biometric method finds application is demonstrated by biometric technology. Consequently, instead of using the conventional approach to ascertain a

student's examination attendance, this study concentrated on the applications of unimodal and multimodal biometric recognitions.

Declarative Knowledge of Class Attendance System

Declarative knowledge is defined as information that is kept in memory and is thought to be static. There are other terms mentioned as well, like proposal knowledge and descriptive knowledge. Declarative knowledge information section explains the current state of affairs. The declarative information domain is made up of things, events, and processes, their characteristics, and the connections between these things, events, and processes and their attributes (Watrin, et al., 2023). Declarative representations are helpful for communicating and reasoning about knowledge (meta-knowledge). Declarative information as a broad representation, representation of declarative knowledge has been investigated (Saks, et al., 2021). Recent memories have the power to modify declarative knowledge. Until it is retrieved by cues like questions, declarative knowledge remains unconscious.

One cannot consciously access the retrieval process either; one can only become aware of the outcomes of this process. It is also a highly picky procedure. There will only be a very limited amount of potentially available information retrieved in response to a specific signal. Declarative knowledge expression demands focused attention, whereas skill expression happens naturally (Watson, et al., 2021). The authors maintained that declarative knowledge is actual or suggestive knowledge. It is the knowledge that people talk about and are aware of. It is often referred to as open knowledge. Declarative knowledge is what people can articulate clearly and are aware of (Baumard, et al 2024).

Declarative knowledge is understood to the greatest extent possible based on the possibility of the code; this is accomplished by breaking down the expression into its component parts, applying inductive-deductive cognitive processes, contextualizing the meaning within the implicitly internalized scientific disciplines, and choosing a particular epistemological level (Sikka, 2020). Education is improved when declarative knowledge types are used in tandem (Lemoine, et al, 2023). Additionally, declarative information has been shown to influence original thought (Nousiainen & Koponen, 2020). These forms of knowledge can be created using various approaches and strategies, or they can aid in the creation of various approaches and strategies (Gamero, et al., 2021). This is the reason why various research come to the conclusion that students' experience and knowledge levels are correlated, with more experienced students exhibiting greater knowledge levels (Goyal, 2020; Nousiainen & Koponen, 2020). According to García-Ceberino et al. (2020) and Serra-Olivares et al. (2016), there is need to examine whether students' declarative knowledge levels are influenced by their adoption of a particular technology like biometric attendance system. According to Webster (2016), the authors maintained that male student declarative knowledge on the adoption of biometric attendance system technology. Therefore, the current study examined the gender rate of adoption of biometric attendance management system in the classroom since no known study is yet to establish that.

Constructivist Theory by Bruner

Constructivism was first theorized by Jerome Bruner in 1966. The theory states that learning is an active process in which students build new notions or ideas using what they already know or have learned in

the past. To make sense of what they already know, for example, the learner often a student will organize bits and pieces of their prior knowledge and experiences. They will then base new concepts and problem-solving strategies on a combination of what they have already processed and what they believe needs to be processed next. This approach states that the primary goal of instructional tools should be to support, encourage, and let students discover the fundamental ideas on their own. The four main tenets of Bruner's constructivism theory are a propensity for learning, how a body of knowledge can be organized to best suit the needs of the learner, the efficient ways in which the teacher can impart this knowledge to the students, and the escalation of both rewards and punishments. According to this theoretical viewpoint, educators ought to make an effort to inspire students to come to their conclusions on principles. Active communication between the teacher and the student is required (Socratic learning). The instructor's job is to convert the material to be learnt into a form that fits the student's level of comprehension at that moment. The curriculum ought to be set up in a spiral fashion so that students can keep building on their prior knowledge.

This approach promotes curiosity, exploration, and creativity in addition to group projects, independent study, and self-discovery during the learning process. Since the goal of this study is to ascertain perceived influence of adoption of biometric class attendance system in Nigerian universities. The foundation of adoption of biometric class attendance system is the idea that self-directed learning, and self-discovery are all supported by Bruner's research.

Method

The study design was a mixed research method. Jonker and Pennink (2010) defined

the mixed research method as a methodology that focuses on the collection and analysis of both qualitative and quantitative data in a study. Specifically, concurrent triangulation type of mixed research was adopted. Concurrent triangulation is the process of gathering and analyzing both quantitative and qualitative data concurrently, with the results combining to provide a comprehensive solution to a main research topic (Wisdom & Cresswell, 2013; Creswell, 2015; Ivankova, et al, 2020). This design was considered suitable because it enabled the researchers to elicit responses from the students and lecturers on the use of biometric class attendance using structured questionnaire and interview to provide more adequate research results (Jonker, & Pennink, 2010; Usman, 2010). Research assistants helped in the sharing and retrieval of the questionnaire from the respondents (Coppe, et al, 2023).

This study was carried out in the south-east Nigerian University with available biometric class attendance system facilities. The eligibility criteria adopted for the selection of participants are: Lecturers engaged in full-time teaching in a government own institution, and using biometric class attendance system. Also, this study was approved by the Ethics Committee and faculties and departments in the selected schools. The participants also signed a consent form.

The study population was about 8000 students from eighteen faculty in the University of Nigeria. The study sampled 3 faculties with six sampled departments in a large public university in south-east Nigeria. The sample size was 546 third year students from the STATA software was used to determine the sample size. The effect size of $F = 0.28$, effect power ($1 - \beta = 0.82$) and

alpha ($\alpha = 0.05$) their magnitude respectively (Faul et al., 2007). It was also shown that the effect and power size obtained are enough for a sample of 546 students for the study. The participants comprised of 155 from Electrical and Computer Engineering, 18 from Computer Education, 101 from Mechanical Engineering, 105 from Psychology, 38 from Business Education, and 129 from Sociology, all in study population (see Table 1). A purposive sampling was used based on the participant's abilities to meet the study requirement in adoption of biometric class attendance system. The reason for the study sample is that those study participants adopt biometric

class attendance system. Participants signed a consent form after the approval was granted from the faculty with which the authors were affiliated. Written permission was obtained from the Dean of the Faculties and students also obtained writing permission. To manage and analyze the data, the researchers used SPSS version 23. For demographic variables, simple percentages were employed, whereas mean and standard deviation were used to answer research question two. The cut-off point for the mean score of 2.50 and above was regarded as “agreed” while below 2.50 was regarded as “disagreed”.

Table 1: Descriptive characteristics of Sampled Department

S/n	Department	Number	Percentage
1	Electrical and Electronics Engineering	155	28.4
2	Computer & Robotics Education	18	3.3
3	Mechanical Engineering	101	18.5
4	Psychology	105	19.2
5	Business Education	38	7.0
6	Sociology	129	23.6

Key: BCAS: biometric class attendance system ECE: electrical engineering, COMP: Computer education
BUS: Business education N = Sample size,

Instrument

The instrument used for this study was a structured questionnaire designed by the researchers titled “Biometric Class Attendance System Questionnaire” (BCAS). The questionnaire had four sections labelled A to D. Section A is the demographic variable meant to elicit personal information of the study participants such as age, gender, and biometric class attendance system adoption among others. Section B is made up of 12-item questionnaire items adopted (Chi & Ohlsson 2005; Stürmer, et. Al., 2013) used to elicit declarative knowledge biometric class attendance system adoption. An example of an item is “I understand the goal of having biometric class attendance monitor”. Section C is a 15-item questionnaire adopted (Shoewu & Idowu,

2012; Mittal, et al., 2015; Okokpujie, et al., 2017) to identify Constraints influencing effective utilization of biometric Class Attendance System. It has 4 options which are strongly Disagree (SD) = 1, Disagree (D) =2, agree (A) = 3 and strongly agree (SA) = 4. An example of an item in this cluster is the “Inadequate biometric class attendance systems in my school”. Section D has 8-item questionnaire that elicited information on the constraints influencing strategies for effective use of biometric class attendance, (Sawhney, et al., 2019; Hoo & Ibrahim, 2019). It has 4 options ranging from total disagreement = 1 to agreement = 4. An example of an item in the questionnaire is “providing each classroom with a biometric class attendance system”.

Five experts from the faculty of engineering, education and social science from university ascertained the validity of the instruments used for the study. The reliability was carried out in Nnamdi Azikwe University Awaka. The reliability was calculated using Cronbach's alpha. The overall coefficients obtained is $\alpha = 0.83$. $\alpha = 0.82$ for declarative knowledge, and $\alpha = 0.86$ for Constraints influencing effective utilization of biometric Class Attendance System, $\alpha = 0.83$ for the strategies for effective use of biometric class attendance system. The researcher coordinated the data collection process, coding and analyzing the data with the aid of six research assistants in the administration of the instrument through a face-to-face contact.

Method of Data Analysis

Also, the interview sections were conducted and properly recorded with the help of a smart tape recorder. The participants' responses were analyzed, and transcribed into a word document. NVivo 10 was used for coding and identification of themes from

the collected data. The themes from the interview responses were noted and the open code method was used for categorizing the themes (Fink, 2000). The similarity of the interview responses was categorized and coded numerically by the researchers for data analysis. Opinions across interview responses were noted including the difference and similarities between the students from different faculty. Fink (2000) opines that qualitative and quantitative data aid researchers to focus on the identification and categorization of data and making meaning out of the data collected. The author maintained that appropriate data and proper analysis methods meet the objectives of the study and subsequently addressed the research questions. More so, the NVivo project was created titled adoption of biometric class attendance interview, was used to collate the data for the interview and the responses were categorized into 3 key sections namely codes section, source section and classification section.

Results

Table 2: Summary of ANOVA statistic of male and female students on their declarative knowledge of biometrics class attendance monitoring system in Nigerian Universities

Cluster A	knowledge generation	M (n275) M± SD	F (n270) M± SD	df	F	Sig	FL
KG1	Students are encouraged to learn and clock in using biometric attendance	2.30±1.33	2.56±1.42	543	2.59	0.07	0.69
KG2	Students are encouraged to make recommendation on biometric attendance	2.68±1.29	2.80±1.32	543	0.56	0.57	0.69
KG3	Students are involved in knowledge generation processes in using biometric attendance	2.81±1.27	2.86±1.28	543	0.09	0.91	0.80
Knowledge sharing							
KS1	I give a special emphasis on knowledge sharing with our fellow students about biometric attendance	2.71±1.17	2.85±1.28	543	0.06	0.84	0.75
KS2	e-mails, mobile applications are effectively used to share knowledge among students about biometric attendance	2.94±1.30	2.76±1.34	543	1.18	0.30	0.71
KS3	I have effective communication with students about biometric attendance	2.95±1.25	2.91±1.30	543	0.41	0.65	0.67
Knowledge capture							
KC1	information related to student's bio-date	2.89±1.28	3.00±1.27	543	0.86	0.42	0.71

	are effectively captured and stored in biometric attendance							
KC2	Biometric attendance machine keeps up-to-date (relevant) information about student's bio-data	3.02±1.35	2.90±1.36	543	0.80	0.44	0.68	
KC3	Biometric attendance has up-to-date (relevant) information about our fellow students	3.05±1.33	2.91±1.30	543	0.72	0.48	.75	
	Knowledge utilization							
KU1	students have accurate and effective decision-making process about biometric attendance	2.91±1.32	2.87±1.36	543	0.38	0.68	.80	
KU2	my university can utilize its knowledge base of biometric attendance	2.86±1.33	2.95±1.31	543	0.33	0.71	.69	
KU3	Students are encouraged to implement what we know in our studies related activities about biometric attendance	2.90±1.31	2.91±1.26	543	0.00	0.99	.77	

Key: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree, 1 – Strongly Disagree, m-male, F-female, FL

Factor loading

Do you have declarative knowledge of biometrics class attendance monitoring system in Nigerian Universities..... Yes/No

s/n	Yes/No	NUMBER	Percentage
1	Yes	45	90%
2	No	5	10%

Yes: response from students who said Yes to declarative knowledge of biometrics class attendance monitoring system with following characteristics Electrical and Computer Engineering, Computer education, Mechanic Engineering, Psychology, business education and sociology all in university.

What is your experience of use of biometrics class attendance monitoring system in your teaching practices?

Interviewee A: In my view, using biometric class attendance system is an effective tool for preventing falsification of student records by lecturers and this has encouraged me to continue using it.

Interviewee B: I see the use of biometric class attendance system as a worthwhile technology for taking class attendance given its flexibility of use by the students and teachers

Interviewee C: I encourage the use of biometric class attendance system by lecturers because it is timely ad faster.

Interviewee D: Biometric class attendance system reduces truancy and cheating given that students have different bio-data unique for each student.

Interviewee E: I perceive biometric class attendance system suitable and in line with global practice.

No: response from students who said no to declarative knowledge of biometrics class attendance monitoring system with following characteristics Electrical and Computer Engineering, Computer education, Mechanic Engineering, Psychology, business education and sociology all in university.

Interviewee A: I do not like the use of biometric class attendance system. I prefer the manual method of paper and pen because it does not require light and special knowledge to take attendance

The result in Table 2 shows the students' declarative knowledge of electronic class attendance monitoring

system in university. The responses for both males and females ranged between 2.53 to 2.98 which shows that the items fall in the category of agree while the SD ranged from 0.27 to 0.38. The low value of SD shows that responses clustered around the mean. The mean value in Table 2 shows that the students' declarative knowledge of electronic class attendance monitoring system in university is important. Thus, it is inferred that students have similar opinions on the declarative knowledge of electronic

class attendance monitoring system. Also, only item KG3 and KG1 revealed a significant difference with respect to gender while other items in declarative knowledge of biometrics class attendance monitoring system in Nigerian Universities revealed that no significant gender difference exist for all the items. From the Interview Guide semi structured-interview, participants' statements show a positive perception on the adoption of biometric class attendance system in Nigerian universities

Table 3: Summary of ANOVA statistic of male and female students on the perceived constraints to effective use of biometrics class attendance monitoring system in Nigerian Universities

S/N	Item	M (n275) M± SD	F(n270) M± SD	Df	F	Sig	F L
CB 9	Inadequate biometric class attendance systems in my school	3.00±1.45	3.15±1.31	543	0.89	0.41	.76
CB10	Lack of biometric class attendance systems for use in my school	3.17±1.42	3.36±1.35	543	1.31	0.27	.62
CB11	Delay in reading/recognizing students' fingerprints	3.06±1.26	3.14±1.20	543	0.28	0.75	.64
CB12	Unstable power supply in using the biometric systems	3.17±1.34	3.35±1.31	543	1.17	0.31	.70
CB13	Lack of alternative power supply required to use the systems	3.04±1.44	3.21±1.37	543	1.09	0.34	.73
CB14	Low bandwidth and unstable internet in my school	3.03±1.42	3.25±1.38	543	1.71	0.18	.75
CB15	Fear of damaging the system during usage	3.07±1.41	3.18±1.31	543	0.41	0.67	.70
CB16	Inadequate support services to maintain the systems	3.17±1.32	3.27±1.30	543	0.34	0.71	.70
CB17	Lack of confidence owing to anxiety	2.94±1.31	3.07±1.30	543	0.66	0.52	.56
CB18	Loss of personal data due to hacking	3.00±1.30	3.12±1.31	543	0.63	0.53	.65
CB19	Low bandwidth and unstable internet	3.08±1.37	3.36±1.41	543	2.84	0.05	.62
CB20	Poor commitment among staff in using the biometric systems	3.10±1.38	3.12±1.24	543	0.03	0.97	.71
CB21	Absence of institutional policy for using biometric class attendance systems	3.11±1.33	3.20±1.17	543	0.39	0.67	.67
CB22	Stress associated with queuing up for data capture	3.23±1.36	3.46±1.37	543	1.95	0.14	.73
CB23	Resistance to change by some lecturers in adopting new technology	2.98±1.39	3.25±1.26	543	2.65	0.07	.65

Key: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree, 1 – Strongly Disagree

The result in Table 3 shows the constraints to effective use of electronic class attendance monitoring system in university. The responses in the constraints to effective use of electronic class attendance

monitoring system from the respondents ranged from 3.01 to 3.34 which show that the items fall in the category of agreed while the standard deviation (SD) ranged from 0.23 to 0.41 indicating that their responses

clustered around the mean. The low value of SD shows that responses clustered around the mean. It can be deduced that 15 items are constraints to effective use of electronic class attendance monitoring system. Thus, it can be inferred that students have similar opinions on the constraints to effective use of electronic class attendance monitoring system. Also, only item CB20 revealed a significant differ with respect to gender while other items t-test analysis of the

responses of male and female students on their perceived constraints to effective use of biometrics class attendance monitoring system in Nigerian Universities revealed that no significant gender difference exists for all the items.

Do you perceive any constraints to effective use of biometrics class attendance monitoring system in Nigerian Universities Yes/No

s/n	Yes/No	NUMBER	Percentage
1	Yes	40	80%
2	No	10	20%

Yes: response from students who said Yes to perceived constraints to effective use of biometrics class attendance monitoring system in Nigerian Universities system with following characteristics Electrical and Computer Engineering, Computer education, Mechanic Engineering, Psychology, business education and sociology all in university.

Interviewee D: I experience stress associated with queuing up for data capture for the use of biometric class attendance system in classroom.

Interviewee A: In my experience using biometric class attendance system in the classroom technology there is delay in reading/recognizing students' fingerprints.

Interviewee E: Absence of institutional policy for using biometric class attendance systems affected the adoption

Interviewee B: I see the use of biometric class attendance system in the classroom as worthwhile technology but Low bandwidth affected the adoption

No: response from students who said no to perceived constraints to effective use of biometrics class attendance monitoring system in Nigerian Universities system with following characteristics Electrical and Computer Engineering, Computer education, Mechanic Engineering, Psychology, business education and sociology all in university.

Interviewee C: I encourage the use biometric class attendance system in classroom because is it do not damage finger print.

Interviewee A: I do not see any constraints on the adoption of biometric class attendance system in the classroom. I would prefer total adoption on the in the classroom and examination verification.

Table 4: Summary of ANOVA statistic of male and female students on the strategies for effective use of biometric class attendance system in Nigerian Universities

S/N	Strategies for effective Use of Biometric Class Attendance System	M(n27) M± SD	F(n270) M± SD	df	F	Sig	FL
SB24	Providing each classroom with a biometric class attendance system	2.83±1.45	2.82±1.49	543	0.02	0.91	.82
SB25	Providing every auditorium with a biometric class attendance system	2.96±1.39	2.80±1.39	543	1.59	0.44	.71
SB26	Encouraging lecturers to ensure its compliance	2.80±1.42	2.78±1.33	543	0.05	0.97	.77
SB27	Restricting access to students' data capture after 20minutes of scheduled lecture time	2.68±1.39	2.65±1.34	543	0.11	0.94	.55

SB28	Establishing strict rules to guide the use of biometrics	2.73±1.34	2.81±1.35	543	0.47	0.77	.75
SB29	Restricting students' access to admin log so as to avoid manipulating the system	3.06±1.36	3.00±1.39	543	0.32	0.98	.69
SB30	Establishing strict rules for all students to enroll using biometric system and enforce its adherence by students and lecturers.	3.01±1.28	3.00±1.31	543	0.26	0.85	.69
SB31	Rewarding effective usage, adherence to rules and punctuality to group engagements	3.06±1.41	3.04±1.45	543	0.03	0.98	.67

Key: 5 – Strongly Agree, 4 – Agree, 3 – Undecided, 2 – Disagree, 1 – Strongly Disagree

The result in Table 4 shows the strategies for effective use of biometric class attendance system in university. The responses in for effective use of biometric class attendance monitoring system from the respondents ranged from 2.66 to 3.05 which show that the items fall in the category of agreed while the standard deviation (SD) ranged from 0.30 to 0.47 indicating that their responses clustered around the mean. The low value of SD shows that responses clustered around the mean. It can be deduced that 10 items are effective use of electronic class attendance monitoring system. Thus, it can

be inferred that students have similar opinions on the effective use of electronic class attendance monitoring system. The t-test analysis was adopted to test responses of male and female students on their strategies for effective use of biometric class attendance system in Nigerian Universities. The result revealed that no significant gender difference exists for items SB25, SB27, SB28, SB29 and SB 30. Also, items SB24, SB26 and SB31 revealed a significant difference with respect to male and female responses.

Do you have any perceived strategies for effective use of biometric class attendance system in Nigerian Universities Yes/No

s/n	Yes/No	NUMBER	Percentage
1	Yes	49	98%
2	No	1	2%

Yes: response from students who said Yes to any perceived strategies for effective use of biometric class attendance system in Nigerian Universities with following characteristics Electrical and Computer Engineering, Computer education, Mechanic Engineering, Psychology, business education and sociology all in university.

Interviewee A: In my experience using biometric class attendance system in the classroom, I suggest that providing each classroom with a biometric class attendance system

Interviewee B: I suggest that the use of biometric class attendance system in the

classroom is encouraged for both lecturers and students to ensure its compliance

Interviewee C: I suggest that access to admin log so as to avoid manipulating the biometric class attendance system in classroom

Interviewee D: I experience punctuality to group engagements in classroom as biometric class attendance system was introduced.

Interviewee E: I suggest of institutional policy for using biometric class attendance systems

No: response from students who said no to perceived strategies to effective use of biometrics class attendance monitoring system in Nigerian Universities system with

following characteristics Electrical and Computer Engineering, Computer education, Mechanic Engineering, Psychology, business education and sociology all in university.

Interviewee A: I do not see any perceived strategies on the adoption of biometric class attendance system in the classroom.

Table 5: t-test analysis of the responses of male and female students on their declarative knowledge of biometrics class attendance monitoring system in Nigerian Universities

Hypothesis	Group	number	M	SD	95% CI	T	sig
Ho ₁ : declarative knowledge	Male	275	2.61	1.32	2.3014–2.7298	-2.15	.216
	Female	270	2.72	1.41	2.3014–2.7298	.131	.651

Table 5 shows the study outcomes for the male participants compared to the female participants. The t-test analysis of the responses of male and female students on their declarative knowledge of biometrics

class attendance monitoring system in Nigerian Universities revealed that no significant gender difference exists for all the items $t(545) = -2.15, p = .131$.

Table 6: t-test analysis of the responses of male and female students on their perceived constraints to effective use of biometrics class attendance monitoring system in Nigerian Universities

Hypothesis	Group	Number	M	SD	95% CI	T	sig
Ho ₂ : constraints	Male	275	3.00	1.40	3.4140–3.5123	-3.01	.312
	Female	270	3.12	1.31	3.32314–3.9091	.210	.853

Table 5 shows the study outcomes for the male participants compared to the female participants. The t-test analysis of the responses of male and female students on their perceived constraints to effective use of

biometrics class attendance monitoring system in Nigerian Universities revealed that no significant gender difference exists for all the items $t(545) = -3.01, p = .210$.

Table 7: The t-test analysis of the responses of male and female students on their strategies for effective use of biometric class attendance system in Nigerian Universities

Hypothesis	Group	number	M	SD	95% CI	t	sig
Ho ₃ : constraints	Male	275	2.80	1.31	2.3014–3.7778	-4.23	.204
	Female	270	3.10	1.42	3.3014–3.7248	.331	.710

Table 5 shows the study outcomes for the male participants compared to the female participants. The t-test analysis of the responses of male and female students on their strategies for effective use of biometric class attendance system in Nigerian Universities revealed that no significant gender difference exists for all the items $t(545) = -4.23, p = .331$.

to understanding the constraints and strategies for its effective utilization. Findings of the study showed that biometric class attendance system is been adopted in Nigerian universities. Also, the result showed that declarative knowledge of electronic class attendance monitoring system as indicated by 94% of participants who considered it a very relevant tool for capturing class attendance. Also, knowledge generation of biometric class attendance system was considered essential as it helps the students to clock in using biometric

Discussion

This study examined perceived influence of adoption of biometric class attendance system in Nigerian Universities with a view

attendance, and in the process encourages them to be punctual to lectures. Furthermore, the t-test analysis of the responses of male and female students on their declarative knowledge of biometrics class attendance monitoring system in Nigerian Universities as shown in Table 5 revealed that no significant gender difference exist for all the items $t(545) = -2.15, p = .131$. This is in line with Ohanu and Chukwuone (2019) who assert that the use of biometric attendance in universities has grown in the last five years and that different educational institutions are adopting it. Moreover, this finding contradicted the findings of Okeke, et al (2013) who found that students' utilization of facial recognition attendant system is significantly low in developing countries. Similarly, Joo, et al (2016) asserted that student's continuous use of various technologies in the teaching and learning process aids in completion of learning tasks (Azmi & Mohamed, 2018). Also, studies by Strobel, et al. (2022) has shown that students continue to use various platform to share information that they perceived useful to their academic process. Biometric attendance machine keeps up-to-date (relevant) information about student's bio-data that aligned with Christensen and Knezek (2017) who noted that students employee's bio-data is easily retrieved using the biometric attendance system. Therefore, students' early exposure to biometrics attendance system and the subsequent application of the knowledge acquired while schooling will no doubt aid them in developing good work habits required by labour market.

Similarly, the result indicated that the majority of students agreed that all the items suggested are the constraints to effective use of electronic class attendance monitoring system in Nigerian Universities. Majorly, some factors such as delay in reading and recognizing students' fingerprints, low bandwidth and unstable internet in my school,

lack of confidence owing to anxiety, inadequate coverage of institutional Wi-Fi, loss of personal data due to hacking, among others are challenges limiting the adoption of electronic class attendance monitoring systems. Similarly, the t-test analysis of the responses of male and female students on their perceived constraints to effective use of biometrics class attendance monitoring system in Nigerian Universities also revealed that no significant gender difference exists for all the items $t(545) = -3.01, p = .210$. This finding is also in line with the findings of Christensen and Knezek (2017) who opined that students' readiness for electronic class attendance monitoring system in the classroom is on the increase. The authors assert that factors such as inadequate professional development, lack of time for lecturers' training, and inadequate IT infrastructure affect lecturers' perception towards promoting usage of students' electronic class attendance monitoring system. Regardless of the safety records captured by the technology, other issues that influence its adoption are inability to steal/and destroy the class attendance records, harassment and bullying, among others tend to encourage students from using the electronic class attendance monitoring system towards attaining good educational experiences.

Furthermore, the result also indicated that the majority of students agreed that all the items suggested are the strategies for effective use of biometric class attendance system. Majorly, some factors such as strict rules guiding the use of biometrics and restricting students' access to admin log so as to avoid manipulation of the system, restricting access to students' data captured after 20minutes of scheduled lecture time among others are strategies for effective adoption of biometric class attendance monitoring system. Also, the t-test analysis of the responses of male and female students on their strategies for effective use of biometric class attendance system in

Nigerian Universities as shown in Table 7 revealed that no significant gender difference existed for all the items $t(545) = -4.23, p = .331$. This is also in line with the studies of Christensen and Knezek (2017) who opined that employees' readiness for electronic attendance monitoring system in the work place is on the increase while the adoption in the educational process is still low. The authors assert that students and educational organizations should be encouraged to adopt biometric class attendance monitoring system. Also, designers of the biometric class attendance monitoring system should tailor a peculiar system for educational process. Also, regardless of providing each classroom with a biometric class attendance system, other incentives including rewarding effective usage, adherence to rules and punctuality to group engagements for adopting electronic class attendance monitoring system is essential for maximizing the potential of technology in classroom situation.

Conclusion

The result of this study has shown that students' declarative knowledge on the adoption of biometric class attendance system in Nigerian Universities is high; as students consider biometric class attendance system as a very relevant tool for capturing attendance to lectures. Also, given the knowledge generation of biometric class attendance system, students are expected to learn how to use it and clock in on daily basis while using mails, and other mobile applications to effectively share knowledge gained in the learning process. Students also maintained that information related to student's bio-data are effectively captured and stored in biometric attendance are accurate. Therefore, effective decision-making process about biometric attendance adoption is encouraged and implemented. However, the study also outlined potential issues influencing poor usage of biometrics class attendance systems such as fear of damaging the system during usage,

inadequate support services to maintain the systems, loss of personal data due to hacking, poor commitment to institutional policies and goals among staff, stress associated with queuing up for data capture leading to loss of class time, unstable power supply in using the biometric systems, rewarding systems for its effective usage, among others. University administration needs to adopt these sustainable strategies to reduce the challenges associated with the use of biometric class attendance system.

Limitations of the Study

It's important to note that the author's goal in this study was to gauge the opinions of students on the perceived influence of adoption of biometric class attendance system in Nigerian Universities. The population of the study is one of the study's limitations, as the generalizability of the findings is hampered by the study's participant population drawn from a particular region. Therefore, we recommend future research to study the effect of biometric class attendance system on part-time students while taking cognizance of public and private schools from the six geopolitical zones of Nigeria. Lastly, to confirm the results of this study, future research can include more perception-related larger sample size and locations from developing countries.

Recommendations

Based on the findings of this study the following recommendations were made:

1. University administration should urgently take steps to address students' related constraints negatively influencing poor usage of biometrics class attendance systems like unstable poor supply, loss of data, and poor internet connectivity in Nigerian Universities.
2. There is need for regular advocacy campaign by the university administration with a view to getting faculty members

to queue into institutional goals and policies regarding mobile learning, virtual learning and e-assessments usage which is the demand of the present knowledge-based economy.

Compliance with Ethical Standards

***Disclosure of Potential Conflicts of interests:**

The authors have no competing interests to declare that are relevant to the content of this article.

***Research Approval:**

Approval was obtained from the ethics research committee. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

***Informed Consent:**

Informed consent was obtained from all individual participants included in the study.

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