



Factors Influencing Telemedicine Adoption and Use among University of Ilorin Students

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Abstract

The pandemic severely affected Nigeria's healthcare sector, diminishing its functionality and hampering healthcare services. Telemedicine emerged as a potential solution, promising to alleviate and enhance Nigeria's healthcare system. Despite its potential benefits, there is limited research on the factors influencing students' adoption of telemedicine applications. This study focused on University of Ilorin undergraduate students, representing a significant part of Nigeria's ecosystem. Utilizing a multistage sampling approach with 380 participants, the study employs a conceptual framework based on the Unified Theory of Acceptance and Use of Technology (UTAUT) and Information Decision Process (IDP). The research utilized questionnaires to gather data. Statistical analyses, including correlation, regression, ANOVA, and T-test, were conducted using SPSS. Findings indicate that students were aware of telemedicine, hold a positive perception, and express willingness to adopt it. However, barriers like privacy concerns, economic constraints, and lack of a supportive framework impeded adoption. The study concluded that telemedicine's impact on the health sector was substantial. Recommendations included government consultation on citizen perception for informed policy decisions, university and health organizations promoting telemedicine adoption, and government-led initiatives to educate and train healthcare stakeholders in telemedicine applications.

Keywords: Telemedicine, Adoption, Healthcare, Perceptions, Factors.

1. Introduction

In recent times, technological advancements and the aftermath of COVID-19 have prompted the global healthcare sector to seek efficient alternatives for service delivery. While developed countries successfully adapted, developing nations like Nigeria, grappling with a poor physician-to-patient ratio (1:5,500) [9] and inadequate healthcare infrastructure for a population of over 200 million, struggle to provide effective healthcare services [4].

The term "telemedicine," coined in the 1970s, denotes "healing at a distance." It involves leveraging information and communication

technology (ICT) to improve patient outcomes by enhancing access to care and medical knowledge [16]. Telemedicine offers scheduling flexibility, speed, timeliness, and the convenient delivery of health services through mobile applications and other technological devices, reducing physical contact and associated health risks.

Globally, telemedicine and virtual care technologies have proven beneficial for patients and healthcare professionals, addressing limited healthcare workers and reducing time spent on routine health cases [17]. In Nigeria, with its low doctor-to-patient ratio, telemedicine becomes crucial for improving healthcare delivery [4]. It plays a vital role in addressing the shortage of skilled clinicians in remote regions, transforming medical practices in both developed and developing countries. During the pandemic, telemedicine significantly alleviated the strain

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on the healthcare system, providing timely and efficient healthcare to chronic patients [8] Telemedicine brings various advantages to health insurance companies, healthcare facilities, health workers, and patients by enhancing access, reducing financial constraints, and ensuring higher quality care [2, 3, 15]. It also contributes significantly to a country's revenue generation, as seen in the projected growth of the telemedicine market in the USA from US\$ 70.4 billion in 2021 to an estimated US\$ 300 billion in 2030 [10].

Despite these advantages, telemedicine remains underutilized, especially in developing countries like Nigeria, where adoption hasn't significantly changed before and after the pandemic [1] which can be attributed to challenges such as limited infrastructure, and cultural preferences for traditional healthcare etc. Limited studies on the effectiveness and implementation of telemedicine further underscore the need for exploration. This study aims to access the perception of telemedicine adoption among University of Ilorin students, focusing on their use of telemedicine applications.

1.1 Statement of the Problem

The adoption and perception of telemedicine applications among all students generally, particularly in developing countries like Nigeria, remain understudied [4]. Despite the potential benefits of telemedicine in improving healthcare services, there is limited research and understanding of the factors influencing students' adoption and usage of these applications.

Existing studies indicate the importance of factors such as accessibility, funding, and technological infrastructure among others, but failed to provide a comprehensive insight into students' perception, willingness, and constraints regarding telemedicine adoptions, particularly in Nigerian tertiary institutions. Therefore, there is a need for an in-depth investigation to fill this research gap and shed light on the factors influencing students' adoption and use of telemedicine applications, using UTAUT and the Innovation-Decision Process frameworks.

1.2 Aim and Objectives

The study aims to investigate the perception of telemedicine adoption and use of

telemedicine applications among students in Nigerian tertiary institutions.

The specific objectives of this research are:

- i. To assess the awareness of Telemedicine Applications among the University of Ilorin students.
- ii. To assess University of Ilorin students' perceptions, attitudes, and willingness towards the adoption of telemedicine applications.
- iii. To investigate the constraint of adoption and usage of telemedicine applications among University of Ilorin students.
- iv. To identify the various types of telemedicine applications the University of Ilorin students use.
- v. To identify factors influencing the adoption and usage of telemedicine applications among University of Ilorin students.

1.3 Research Questions

- (i) Are Nigerian tertiary students aware of telemedicine and its benefits?
- (ii) What are their perceptions, attitudes, and willingness levels toward the adoption of the technology?
- (iii) What are the constraints faced in adopting and usage of telemedicine applications among the students?
- (iv) What types of telemedicine applications are commonly used by the students?
- (v) What are the factors influencing the adoption and usage of the application among students?

1.4 Hypotheses

The following hypotheses were constructed to derive and empirically confirm the factors influencing the adoption and use of telemedicine applications as a factor for answering the study's research questions.

H₁: Performance Expectancy of telemedicine applications doesn't affect the students' willingness and adoption of the technology.

H₂: Effort Expectancy of telemedicine applications does not affect the students' willingness and adoption of telemedicine applications.

H₃: Social Influences like peer recommendations, and support from family or friends have no significance to the students' willingness to adopt and use the technology.

H₄: Facilitating Conditions like required infrastructure, appropriate training, and network connectivity have no significance to the adoption and use of telemedicine applications by the students.

H₅: There is no significant difference between each of the demographic parameters on the adoption of the technology.

2. Literature Review

There are various pieces of research on telemedicine but very few study students' perception of the adoption and use of telemedicine applications with the limitation of not enough learning data, the review of factors affecting the adoption globally whilst narrowing it down to Nigeria would provide more context.

Ikumapayi, *et.al.* [6] study found that telemedicine application is a successful way to provide medical treatment over long distances. Utilizing biomedical engineering, information technology, communication technologies, and medicine, it is possible to create a system that is specifically designed to facilitate communication and diagnosis between patients and healthcare providers. This strategy can save costs while improving accessibility, utilization, efficiency, and efficacy of healthcare services. He ascertained telemedicine is particularly helpful for screening patients for infectious diseases beforehand, reducing the need for in-person consultations, and enabling expert practitioners to diagnose patients remotely.

In their study, Ekanoye *et al.* [5] highlighted that the lack of a blueprint and structure can lead to the failure of telemedicine implementation in developing countries. They emphasized the importance of addressing key aspects such as finances, location, vision layout, training programs, hierarchy, technological innovation, data security policies, and market to ensure a successful implementation. They also stressed the need to address issues like infrastructure

provisions, reliable internet connectivity, and regular power supply to facilitate a smooth transition and adoption of telemedicine applications.

In Malhotra *et al.* [8], "A study of assessment of knowledge, perception, and attitude of using telehealth services among college-going students of Uttarakhand." posits that there is a lack of familiarity among college students regarding the concept of telemedicine, with 45 to 50 percent of the respondents reported being unfamiliar with telemedicine, while only 15 to 20 percent indicated some degree of familiarity. The study blames the saturation level of telecommunication devices and therefore, encourages telemedicine companies and the government to focus on increasing familiarity through promotion, advertisement, and technological infrastructure as there is a positive mindset toward the adoption of telemedicine among college students in India with approximately 50 percent of the respondents expressing positive intent, agreeing that telemedicine is a viable approach to better healthcare.

However, a study [11] conducted among pharmacy students in Ethiopia about their perceptions of and knowledge of telepharmacy provides a contradicting view as even with high access to technology and electronic devices—of which 81.3 had access to at least one and 57.7 had access to smartphones, the students had little to no knowledge of the practice. However, the survey reveals that despite the saturation of telecommunications devices, students' awareness of telepharmacy was relatively low, with 86.4 percent being completely ignorant of the system nationwide. The study implies that elements like training, internet access, and managerial aids may assist students in becoming more conscious of, accepting, and using technology.

2.1 Theoretical Frameworks

Theoretical frameworks offer a disciplined and methodical way of approaching complicated dynamics and phenomena analysis, such as the adoption and use of any technology, in this case, telemedicine applications.

Analyzing the adoption of a technology involves assessing some parameters and constructs and this restricts the framework eligible for this study to quite a few. Knowledge of the technology, Expectations of the technology, Efforts towards using the technology, Social Influence, and other conditions are essential in carrying out this study, hence, Unified Theory of Acceptance and Use of Technology (UTAUT), Innovation-Decision Process (IDP) are evaluated.

2.1.1. The Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a theoretical framework that seeks to explain and forecast how people will accept and use technology in different circumstances. Venkatesh et al. [13] created it as an enhancement to the Technology Acceptance Model (TAM) by combining new elements. According to the UTAUT, four core constructs—performance

expectancy, effort expectancy, social influence, and facilitating conditions—are key drivers of behavioral intention and, ultimately, behavior.

Performance expectancy refers to the user's perception of how using the technology will enhance their performance. Effort expectancy relates to the perceived ease of use and the user's belief that the technology will be effortless to use. Social influence involves the influence of social norms and the opinions of others on the user's acceptance and use of the technology. Facilitating conditions refer to the availability of resources, support, and infrastructure necessary for using the technology [13]. These constructs are, in turn, moderated by factors such as gender, age, experience, and voluntariness of use [14].

This framework would assess the factors of adopting the application, and how students of different ages, genders, fields, and experiences perceive the adoption of telemedicine applications.

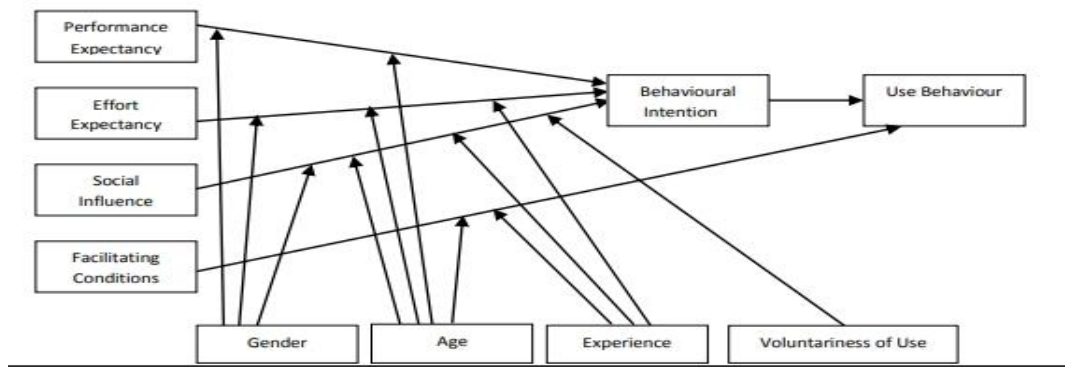


Figure 1. UTAUT model

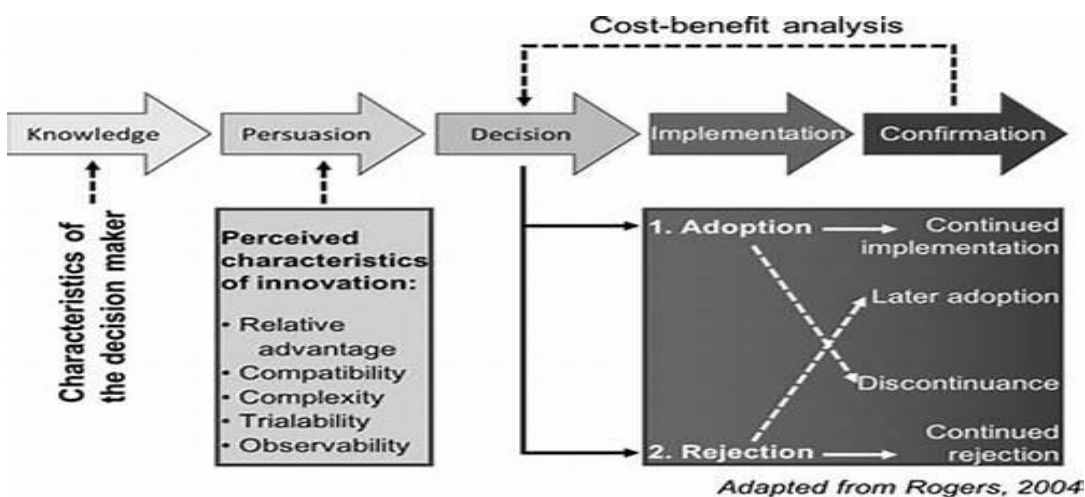


Figure 2: IDP model

2.1.2. Innovation-Decision Process (IDP)

The Innovation-Decision Process (IDP) model describes the stages through which individuals and organizations progress when adopting and implementing innovations. The model was initially proposed by Everett Rogers in his book "Diffusion of Innovations" in 1962 and has since been widely used in the study of technology adoption, organizational change, and innovation diffusion.

The IDP model is divided into five major phases:

- **Knowledge:** During this stage, people or organizations learn about an innovation's existence as well as its features, advantages, and prospective applications. They look for information and amass basic knowledge about the innovation.
- **Persuasion:** In the persuasion stage, people or organizations assess the innovation's potential value and applicability to their needs or goals. They compare the advantages to the expenses, dangers, and uncertainties related to implementing the invention. Internal deliberations, the soliciting of outside counsel, and consideration of issues affecting the decision-making process are all components of persuasion.
- **Decision:** The decision stage involves committing to adopt or reject the innovation. Assessing the innovation's compatibility with current resources, systems, and values is done by individuals or organizations. Depending on their assessment and how well the invention fits their needs, they decide whether to use a formal or informal approach.
- **Implementation:** The innovation is put into effect during this phase. The required resources are acquired by people or organizations, the staff is trained, and the innovation is integrated into the systems or processes already in place. They might run into problems, change the idea, or look for assistance to make sure it is implemented successfully.
- **Confirmation:** The confirmation stage entails assessing the results of the invention and its effects on specific people or groups as well as the overall system. Users evaluate the advantages, disadvantages, and level of satisfaction with the innovation. While unpleasant experiences may lead to the innovation's abandonment or modification, positive experiences, and outcomes may encourage wider adoption.

The IDP knowledge phase will confirm and evaluate the awareness and knowledge of students when it comes to the existence of telemedicine and the services it could offer.

2.2 Conceptual Framework

The UTAUT and the IDP model were adapted for this study. The conceptual framework is shown in figure 3. The UTAUT factors (performance expectancy, effort expectancy, social influence, facilitating condition and mediating variables gender, age and genotype) provided insights into the factors influencing the adoption and use of Telemedicine applications. While IDP (Knowledge, perception and willingness) focuses on the role of intentions and goal-directed behavior that suggests that an individual's intention to use technology is influenced by their knowledge, perception and willingness.

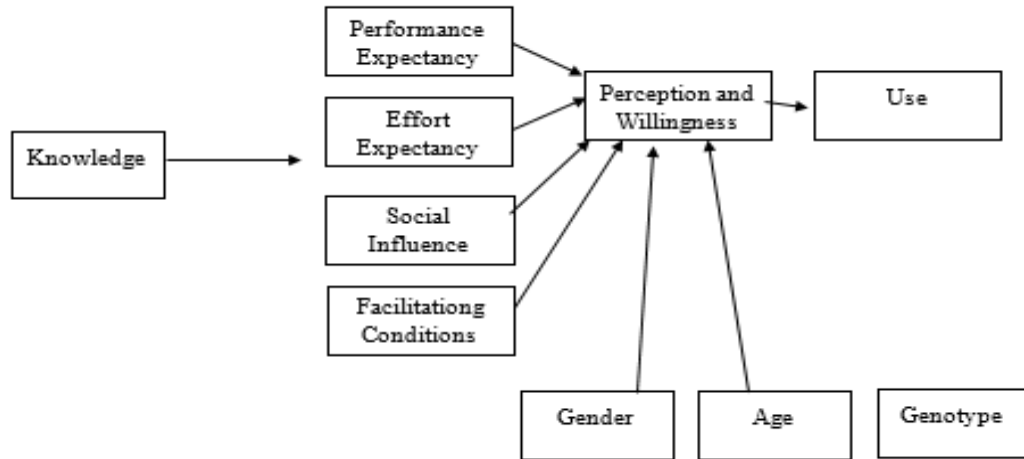


Figure 3: Conceptual Framework

3. Research Methodology

A descriptive survey design was adopted for this study. This study was carried out in Ilorin, Kwara State where University of Ilorin is located. The population of this study was Undergraduate students 'of University of Ilorin. According to the [12], the university The University has over 48,000 undergraduate students studying 90 academic programs across 15 faculties. A multistage sampling procedure was used in this study. In the first stage, a total enumeration method was used to select all the faculties. This is to ensure that the all are well represented in the sample. However, only few faculties were used as other faculties left declined to release the information needed. Therefore, the sample consists of Ten (10) faculties, which made up of Thirty- one thousand seven hundred and ninety four (31,794) undergraduate students.

According to Krejcie and Morgan [7], if a population is within 30000 and 40000, a sample size of three hundred and sixty four (379) is enough for the study. Proportionate sampling was used in selecting samples from the faculties so that the same proportion of samples were selected from each of the faculties. The members of the sample were then selected from each faculties using convenience sampling. This enabled the

researcher to select undergraduate students that were available and easily accessible as members of the sample. The data collection method used was a questionnaire-based approach.

A close ended questionnaire was used as a data collection instrument. Face validity of the instrument was carried out by the project supervisor. The instrument was examined in terms of clarity of the instruction to the respondents, proper wording of the items, and adequacy of the items. Reliability of the instrument was determined by conducting a pilot test on the instrument. This was conducted by using a simple random sampling of thirty (30) respondents from the undergraduate students in the faculties which were not part of those selected for the main study. Cronbach Alpha for each of the variables was ran. The data collected were analysed using SPSS (Statistical Package for Social Science). The data collected were analysed statistically with the use of descriptive statistics and inferential statistics.

The research questions were analysed using frequency distribution and percentages while the research hypotheses were analysed using independent sample T-Test, One way ANOVA, and Pearson correlation analyses.

4. Result Presentation and Discussion

4.1 Demographic Characteristics of Respondent

Table 1: Demographic Characteristics of Respondent

		Frequency	Percentage %
Age	15-19	123	32.4
	20-24	233	61.3
	25-29	24	6.3
Gender	Male	192	50.5
	Female	188	49.5
Religion	Christianity	187	49.2
	Islam	193	50.8
Genotype	AA	300	78.9
	AS	70	18.4
	AC	9	2.4
	SC	0	.0
	SS	1	.3
Faculty	Arts	15	3.9
	Communication and Information Sciences	28	7.4
	Education	128	33.7
	Engineering	37	9.7
	Environmental Sciences	13	3.4
	Law	14	3.7
	Life Sciences	49	12.9
	Physical Sciences	35	9.2
	Social Sciences	43	11.3
	Veterinary Medicine	18	4.7

Table 2 Shows that most students are aware of the technology and agree with the benefits-like cost reduction, quality of healthcare received increase in the accessibility of healthcare services especially in remote areas and improvement of the working conditions of the nation's health workers if fully

integrated. However, only 48.2% have personally employed its services. This contradicts [8] findings, which posited that most of the students are not aware of the term "telemedicine", hence, was a major reason for the setback in adoption.

4.2 Research Question 1: Are the students aware of telemedicine and its benefits?

Table 2: Awareness of Telemedicine Application and its Benefits

Awareness of Telemedicine and its Benefits	Agree (%)	Disagree (%)
Telemedicine is a familiar concept and tool for accessing healthcare services among students	301 (79.2%)	79 (20.8%)
I'm very conversant with telemedicine applications and the benefits it provided	243 (64%)	137 (36.1%)
I've employed telemedicine application services for a medical consultation or treatment	183 (48.2%)	197 (51.8%)
Telemedicine reduces the cost of accessing health care in Nigeria	290 (76.3%)	90 (23.7%)
Telemedicine can improve the quality of healthcare services delivered in Nigeria	338 (88.9%)	42 (11.1%)
Telemedicine can increase access to healthcare services for individuals living in remote or underserved areas.	336 (88.4%)	44 (11.6%)
Telemedicine if integrated fully can lessen the workload of our healthcare providers	350 (92.1%)	30 (7.9%)

4.2.1 Research Question 2: What are the perceptions, attitudes, and willingness levels of the student toward the adoption of the technology?

Table 3: Perceptions, attitudes, and willingness levels of the student toward the adoption of the Technology

Perception of Telemedicine Application	Agree (%)	Disagree (%)
I have a positive attitude towards using telemedicine applications in handling my healthcare needs	325(85.6%)	55(14.4%)
Telemedicine applications will be a common practice among students in the future	347(91.3%)	33(8.4%)
I am confident in the security and privacy of my personal information while using telemedicine applications.	290(76.3%)	90(23.7%)
I believe telemedicine applications save time and effort compared to traditional in-person consultations	342(90%)	38(10%)

Telemedicine applications improve the quality and experience of accessing healthcare services as a student in Nigeria.	339(89.2%)	41(10.8%)
I am open to using telemedicine applications as an alternative to traditional healthcare methods.	315(82.9)	65(17.1%)

It was deduced from the finding regarding the perception and willingness of use of telemedicine applications among University of Ilorin students that majority of the students (85.6%) have positive attitude towards adopting telemedicine applications and are willing to adopt the technology. With a staggering 91.3% of the students envisioning that the technology will become a norm among students in the future.

4.2.2. *Research Question 3: What are the constraints faced in adopting and usage of telemedicine applications among the students?*

It was gathered that even with the high level of awareness and willingness to adopt the technology from the students; there are quite a few constraints that hinders the adoption and use of telemedicine applications. The respondents blame lack of awareness of telemedicine applications and its benefits to the general public, absence of a technological framework, economics and financial constraints are the major cause of the hindrance which further supported [4] who also stated that the aforementioned are the factors that hinder telemedicine advancement in Nigeria.

Table 4: Constraint of adoption and usage of telemedicine application

Constraint to Telemedicine Application Adoption	Agree (%)	Disagree (%)
Lack of awareness about available telemedicine services is a constraint to telemedicine adoption	358(94.2%)	22(5.8%)
The absence of a technological framework (e.g. internet services, smartphones) prevents the use of telemedicine applications	341(89.7%)	39(10.3%)
The current economy limits my financial resources and makes it difficult to afford data tariffs associated with the usage	311(81.8%)	69(18.2%)
Cultural and religious beliefs favor traditional healthcare methods and influence my willingness to use telemedicine application	253(66.6%)	127(33.4%)
Insufficient training and education of both students and healthcare workers about the technology restricts its adoption	330(86.8%)	50(13.2%)
Security and privacy concerns about personal medical information deter me from using telemedicine applications	295(77.6%)	85(22.4%)
Lack of pressure from family and peers reduces my motivation to use telemedicine application	231(60.8%)	149(39.2%)

4.2.3 *Research Question 4: What types of telemedicine applications are commonly used by the students?*

Table 5: Commonly used telemedicine applications

Telemedicine Applications	Frequency	Percentage (%)
My Calendar	196	48.6
My Tracker	148	36.7
Flo	118	29.3
MyChart	72	17.9
BioTelemetry	52	12.9
Health Tap	90	22.3
Doctor on Demand	74	18.4
Doctor 247	84	20.8
MDLIVE	23	5.7
Talkspace	46	11.4
betterMe	50	12.5
Hemobox	24	6
CancerCare	56	13.9
None	41	10.8
Samsung Health	1	0.2
Ohealth	1	0.2
Ada: check your health	1	0.2

The frequency distribution performed on the commonly used telemedicine application among the students indicated that My Calendar, My Tracker, Flo, Health Tap are the most used telemedicine among the students. It important to note that the applications mention earlier are mostly female-dedicated telemedicine applications, and about 10.8% of the respondents use none of the applications.

4.3 Test of Hypotheses

The results of the hypotheses testing are summarized in table 6

Table 6: Test Summary of Hypotheses

Null Hypothesis H ₀		Correlation / Regression Coefficients	Sig	Decision on the Null Hypothesis
Performance Expectancy of telemedicine applications doesn't affect the students' willingness and adoption of the technology		.578	.000	Rejected
Effort Expectancy of telemedicine applications has no effect on the students' willingness and adoption of telemedicine applications		.530	.000	Rejected
Social Influences like peer recommendations, and support from family or friends have no significance to the students' willingness to adopt and use the technology		.392	.000	Rejected
Facilitating Conditions like required infrastructure, appropriate training, and network connectivity has no significance to the adoption and use of telemedicine applications by the students		.302	.000	Rejected
There is no significant difference between each of the demographic parameters on the adoption of the technology".	Gender		.083	Rejected
	Age		.634	Accepted
	Genotype		.952	Accepted

Hypothesis 1: Performance Expectancy of telemedicine applications does not affect the students' willingness and adoption of the technology. The Pearson correlation used to evaluate the analysis conform with the study which reveals that the performance expectancy of the students from telemedicine application like accessing quality and efficient healthcare services regardless of their school work schedule is of great significant to Perception and willingness to use Telemedicine Applications.

Hypothesis 2: Effort Expectancy of telemedicine applications has no effect on the students' willing and adoption of telemedicine applications. A Pearson correlation was also used to evaluate this hypothesis, it reveals that the effort expectancy of the students from telemedicine application like the ease of use and effort or training required to efficiently utilize telemedicine applications is of a strong

significance to Perception and willingness to use Telemedicine Applications.

Hypothesis 3: Social Influences like peer recommendations, supports from family or friends has no significance to the students' willingness to adopt and use the technology. However, most of the respondents (students) follow social trends, recommendations from respectable institutions, social influencers, peers, and family in the adoption and usage of telemedicine applications. The test reveals that Social Influence has a positive significant impact on the adoption of the technology.

Hypothesis 4: Facilitating Conditions like required infrastructure, appropriate training, and network connectivity has no significance to the adoption and use of telemedicine applications by the students. The dependent variable Perception and willingness to use Telemedicine applications were regressed on predicting variable Facilitating Conditions

like infrastructure, Internet connectivity, Power supply, etc. to test the hypothesis, which indicated that Facilitating Conditions play a significant role or has a positive significant impact on the adoption and use of telemedicine applications.

Hypothesis 5: There is no significant difference between each of the demographic parameters on the adoption of the technology. The results from the analysis showed that there was no positive significant impact from demographic characteristics like Age or Genotype on the adoption of telemedicine applications among the students of the University of Ilorin. However, Gender alone was the only demographic characteristic recorded to have a significant impact on the adoption of the technology. This means that the Adoption and Use of telemedicine applications among University of Ilorin students are majorly influenced by their Gender, while Age and Genotype don't influence its adoption and use.

5. Conclusion

Based on the findings from the research, the following conclusions are reached; the majority of the students are aware of telemedicine application in various applications (e.g. teleconsultation, telemonitoring etc.), that Gender has a significant impact on the adoption of telemedicine applications, that there are significant relationship between the adoption and use of telemedicine applications and Performance expectancy and Effort Expectancy of the students, that Social Influences and recommendation from trusted and certified organization or persons, family and friends, social media also influences the adoption of telemedicine application among students, that facilitating conditions i.e. activities surrounding the use of the technology also influences its adoption.

The study therefore recommended that the government should ensure that adequate research is done regarding technology adoption and policy-making to understand the citizens' perceptions, expectations, and situations before structuring the framework to support the technology. This will guide the government in making informed decisions to maximize the efficient and effective use of

the technology. Also, telemedicine applications should be advertised and integrated fully into the public health system as the majority of the students showed positive perceptions and are willing to accept. Similarly, the University management, reputable health organizations, and individuals should be encouraged and tasked with recommending and adopting telemedicine applications in the delivery of healthcare services. In addition, students and Healthcare stakeholders should be trained and sensitized about the benefits and usage of telemedicine applications.

Future research should explore the perceptions of various stakeholders beyond students, address challenges in adoption and usage, and examine administrative perspectives from government and investors.

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