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Enablers of the Use of Virtual Assistants by Students at a Nigerian University

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Abstract:

Virtual assistants are emerging technologies that are gaining prominence with the advancement in Artificial Intelligence and Human-Computer Interaction. The widespread acceptance and use of technology depend on the willingness of users to use the technology and on several other factors. This study was designed to investigate the enablers of the use of virtual assistants (VAs) by students at a Nigerian University. The study was anchored on three theories - Uses and Gratifications Theory, the Media Richness Theory and the Extended Unified Theory of Acceptance and Use of Technology (UTAUT2). A structured questionnaire was used to collect data from 368 students who used VAs. Findings showed that the enablers (utilitarian benefits, hedonic motivation, multiple cues, personal focus, use of natural language and hedonic motivation) have a strong positive correlation (r = 0.754, 0.681, 0.614, 0.667, 0.581 and 0.686 respectively) and significant relationship (p=0.00< 0.05) with the use of VAs. There was a joint influence of the enablers on the use of VAs (F = 209.861, R2 = 0.773, p= 0.000< 0.005), showing that these enablers accounted for 77.3% of the variance in the use of VAs. The findings provide a better understanding of the determinants of VA adoption and use for educational purposes and which enablers need to be promoted to increase adoption and use.

Keywords: *Hedonic Motivation, Immediate Feedback, Utilitarian Benefit, Use of Natural Language, Virtual Assistants.*

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Introduction

Technologies are designed and built for human use and are created to minimise human workload. Technology has increasingly become an integral part of human lives, reshaping the way many tasks and activities are performed across all spheres of life, including education. Undoubtedly, technology is one of the world's greatest assets, enabling its users to perform various tasks with ease. Technology is so ingrained in daily life that humans often overlook how it simplifies various activities, including transportation, communication, entertainment, and education. Studies suggest that humans have become increasingly dependent on technology and may encounter difficulties in functioning without it (Hoehe & Thibaut, 2020).

Leveraging breakthroughs in Artificial Intelligence (AI), Internet of Things (IoT), and cloud computing, cutting-edge voice technology is revolutionising personal and societal dynamics, and continually enhancing user interactions and transforming the people live, work, and interact, bringing profound impacts on various aspects of human lives (Pham Thi & Duong, 2022; Ossadnik et al., 2023). A notable example of this AI technology is the digital assistants or virtual assistants (VAs). The advancements in human-computer interaction, natural language processing and other emerging technologies have propelled smart technologies or intelligent tools such as VAs into everyday use by all age groups (Turow, 2021; Calahorra-Candao & Martín-de Hoyos, 2024). The inclusion of VAs in smartphones and other devices makes them a useful digital companion. Studies project that by 2024, the global number of VAs will exceed the human population, reaching 8.4 billion by 2024, underlining their growing relevance across age groups and disciplines (Juniper Research, 2021).

VAs enable people to use voices to correspond with Internet-enabled smartphones and smart home devices. These AI-driven systems, capable of mimicking human behaviour, have matured into integral components of smart learning environments (McLean and Osei-Frimpong, 2019; Pantano and Pizzi, 2020). Virtual Assistants like Siri, Google Assistant, and Alexa now play critical roles in supporting digital pedagogy by facilitating learning on demand, streamlining academic workflows, and enabling more personalized, student-centred experiences (Armstrong, 2021). VAs can manage many organisational tasks, such as email management, appointment scheduling, research and development, and even providing emotional support, which makes them easy and readily available assistants at any time and day.

Voice-enabled technologies such as VAs are reinventing the way students learn and interact with learning platforms. VAs have the capacity to enrich digital pedagogy because of their socially interactive roles (Mirghaderi, Srizon & Hildt, 2022; Roca et al., 2024). Hence, they are increasingly viewed as digital learning companions, capable not only of administrative support, such as email reminders and schedule management, but also of providing educational assistance and even emotional support in high-stress academic contexts. VAs enable learners to manage academic schedules, conduct research, and interact with conversational educative interfaces, thus reducing mental and information processing workload and task complexity. It has been noted that the integration of VAs into mobile devices and smart classrooms provides a seamless multimodal learning experience, aligning with pedagogical goals of accessibility, inclusivity, integration, learners' autonomy and inquiry-based learning (Noskova & Pavlova, 2021; Omirzak et al., 2022).

Understanding the way humans utilise and interact with technology, and how technology, in turn, shapes the synergistic relationship between people and their environment, assumes foremost importance not only for the developers of new technological advancements but also for the individuals and organisations that rely on these technologies in both personal and professional contexts (Cascio & Montealegre, 2016). In the context of digital pedagogy, technology represents not merely a tool but an important enabler of modern teaching and learning activities; hence, when technology is integrated into pedagogy, it becomes a useful asset for educators and learners, helping to simplify processes such as communication, collaboration and knowledge acquisition. The universality of technology in daily academic lives, ranging from mobile learning apps to virtual learning environments, often leads to an underappreciation of its role in reshaping how education is delivered and experienced (Criollo-C et al., 2021; Fombona et al., 2020). As teaching and learning become increasingly reliant on digital technologies, it becomes important to examine how educators and learners interact with educational digital technologies and how these tools influence learning outcomes, student engagement and performance and overall teaching effectiveness and efficiency.

The adoption and use of VAs are increasing across populations and countries; however, it is to be noted that the adoption and use of technologies determine the success of technology. The real value of a technology is shown when it successfully satisfies the needs of its users, also keeping in mind the user's ability to make use of it. Studies have shown that the extent to which technology is embraced and widely used depends on the level of user acceptance and the willingness to engage with it (Davis, 1989; Garcia et al., 2018). Users must have confidence in technology to be willing to accept and use it and that various factors contribute to the use of technology (Al-Shamsi, 2022; Labrague et al., 2023), which is why it is crucial to prioritise user-centred design during the development process. In the same vein, the efficacy of educational technology depends on user acceptance. Thus, in designing educational informatics solutions, especially in developing regions such as Nigeria, it is crucial to align technological innovation with user capabilities and contextual realities. This brought to the fore the importance of user-centred design and iterative development in educational technology systems. Scholars have advocated for more research to further understand voice-based AI interaction, to suggest best practices and guidelines and to identify the enablers of adoption and use (Huang et al., 2021; McLean et al., 2021; Roca et al., 2024; Xiao and Kumar, 2021). AI-driven VAs are key drivers of technology innovation with considerable prospects (Malodia et al., 2022; Juniper Research, 2018). These prospects can be evaluated by considering VA ownership, acceptability, use and market growth rates (Kinsella, 2020).

In Nigeria, digital transformation is gaining momentum with the support of the government and corporate entities investing in IT infrastructure, innovation, and digital literacy. However, while substantial research (e.g., Dubiel et al., 2018; Natale, 2020; and Pal et al., 2019) has been done in technologically advanced economies regarding VA adoption and educational utility, not much has been done in emerging economies such as Nigeria. It is to be noted that for digital pedagogy to succeed in such an economy, a proper understanding of the localised patterns of technology acceptance, trust and use is important. Thus, this study was designed to investigate the enablers of the adoption and educational use of VAs by students at the University of Ibadan, Nigeria. The identification of these factors would help contribute to knowledge in digital informatics and pedagogy, while also offering practical insights for the design and development of an AI-powered learning environment in higher education in Nigeria.

Literature Review

Studies have identified several factors that influence the adoption and use of technologies, yielding diverse findings. The review of the literature revealed studies on the use of VAs across various populations, including adolescents, young adults, and older adults, among others. However, studies on the use of VAs for educational purposes are scant, especially in Nigeria. Therefore, identifying the enabling factors for educational use of VAs in Nigeria will contribute to enrich the literature on educational informatics. The study of McLean and Osei-Frimpong (2019) was designed to examine the factors that influenced the use of in-home VAs. It was found that, while utilitarian benefits and social benefits remained significant factors, perceived privacy risks negatively influenced use. The findings highlight the need for VA technology developers to address privacy concerns to encourage wider adoption and use. The findings of the study also showed that privacy concerns had an impact on larger households compared to smaller ones, which emphasised the significance of considering privacy concerns and household size or composition when designing and marketing VA technology. The study concluded by suggesting that future models for technology adoption should consider the unique characteristics of this technology and how symbolic and social benefits played a significant role in driving its adoption and use, which the current study explored. An important finding from McLean & Osei Frimpong's research is the importance of considering utilitarian benefits, symbolic benefits and social benefits when studying the adoption and use of VAs for educational purposes. Utilitarian benefits, such as usefulness and convenience, and social benefits, exemplified by the capacity of VAs to generate a feeling of presence and attraction, could act as a driving force in encouraging students to use VAs.

The influence of accent differences on VA speech recognition was explored in the research conducted by Pal et al. (2019). The study used a questionnaire and real-world testing to investigate two VAs (Alexa and Siri) among two groups of VA users (English speakers and non-native English speakers) in Thailand. Data was collected from 275 individuals. The results showed that VAs could comprehend and identify English words spoken with an accent, regardless of whether the speaker was a non-native English speaker or not. Findings showed that individuals who were skilled in speaking English were more content with the VAs' comprehension capabilities compared to those who were not native speakers. It was also found that the participants desired the ability to have many accounts on the same VA device based on their unique voice characteristics. This feature was particularly useful for households with multiple family members using the same device, as it has already enabled voice-based user account profiling functionality, which created a sense of personalisation while not compromising privacy. Such a feature enabled parents to create parental locks to supervise and control their children's activities on VA devices. However, during the study period, voice-based profiling systems were not readily available. Additionally, the researchers found that one limitation of VAs is their inability to identify differences in multiple voices. The findings of Pal et al. offer an insight into the need to consider two enablers (multiple cues and the use of natural language) as some of the enablers that could determine the use of VAs for educational purposes.

The study of van Bussel et al. (2022) adapted the Unified Theory of Acceptance and Use of Technology (UTAUT) framework to examine the important factors that influenced the use of VAs. A mixed approach (qualitative and quantitative methods) was used. The traditional UTUAT model was expanded by incorporating three additional variables (self-efficacy, trust, and resistance to change) into the original UTAUT constructs of performance expectancy (PE), effort expectancy (EE), social influence (SI) and facilitating conditions (FC). The results from the quantitative study found that PE (ß = 0.399), EE (ß = 0.258), SI (ß = 0.114), and trust (ß = 0.210) significantly influenced behavioural intention to use a VA, explaining 80% of its variance. Self-efficacy (ß = 0.792) was a precursor of EE, while FC and resistance to change had no significant relationship with user intention. The results from the qualitative study supported all four factors of the UTAUT. The study concluded that PE and EE were major determinants of the use of VAs, with EE dependent on the self-efficacy of the participants.

Habes et al. (2024) study focused on multimedia file management in VA, specifically, in Cortana-facilitated laptops and personal computers used by university students in Pakistan. The study used a Structural Equation Modelling to test the proposed conceptual model adopted from the Theory of Reasoned Action. Data was gathered from 290 students at two public sector universities in Islamabad, Pakistan. The results showed that Beliefs about the useful outcomes attributed to AI adoption significantly influenced behavioural intention to use, leading to Cortana acceptance. But this influence was mediated by Attitude and Subjective Norms. This showed that the students accepted VAs due to their usefulness.

Filiz et al. (2025) investigated the psychological and pedagogical factors influencing K-12 teachers' readiness to integrate Artificial Intelligence (AI) into educational settings using an exploratory qualitative design. Sixty six teachers working at a private school in Türkiye were the subjects. Data were collected through online discussion forums and AI-supported learning activity design tasks. Inductive thematic analysis was conducted. The findings show that the teachers used AI for its efficiency, interactivity, and adaptability, particularly in AI technologies such as ChatGPT and

MagicSchool, which have the capacity for personalised learning. Some challenges, such as technical issues, curriculum misalignment, ethical concerns, and difficulties adapting AI-generated content to local contexts, were identified. The study concluded that while AI offers significant potential to enhance education, successful integration requires addressing the identified barriers through targeted support, resources, and ethical guidelines. The authors suggested some implications for further research, which included exploring diverse educational settings to generalise findings, conducting longitudinal studies to assess long-term impacts, and investigating strategies to align AI tools with existing curricula and ethical standards. Some of these suggestions were addressed by this current study.

This review will conclude with the study of Todericiu (2025). The study, adopting a literature analysis, assessed diverse applications of VAs across domains and examined the challenges and limitations of VAs, and provided a unified framework for understanding VAs and their future role in fostering intelligent, inclusive ecosystems. The study demonstrated that VAs have emerged as a breakthrough advancement in AI, easily integrating into daily life and transforming human–machine interactions across various disciplines and industries. Their use of NLP, cloud, and IoT facilitates assistance with activities from everyday conveniences to intricate decision-making in healthcare, education, and other domains, which makes this current study relevant to research.

Theoritical Background, Research Model, and Hypotheses Development

Scholars investigating the determinants of the acceptance and use of technology have taken into account several theoretical foundations. However, sparse studies have considered the Uses and Gratifications Theory, the Media Richness Theory and the Extended Unified Theory of Acceptance and Use of Technology (UTAUT2). Thus, this study was anchored on these three theories.

According to Blumler and Katz (1974), the Uses and Gratifications Theory (U & G) provides an understanding of what makes people use certain types of media, the needs the media are used to meet, and the gratifications derived from using the media. The theory is therefore relevant to our understanding of the use of media. The theory helps understand the reasons behind individuals' choices for particular media sources and content, and the implications of these decisions for society. One of the variables adopted from the U & G is utilitarian benefits, which allows us to consider the real-world advantages and usefulness that VAs have for a user (McLean & Osei-Frimpong, 2019). Utilitarian benefits relate to the tangible benefits an individual gets from its use of technology and instrumental value. The current research focused on the way these benefits and gratifications can determine the level at which they may adopt and use VAs.

The second theory, which was also used effectively in our research, is the Media Richness Theory (MRT), conceived by Daft and Lengel (1986), which is the relative capacity of communication media to reproduce meanings. MRT explains that communication media have characteristics that will influence the depth and richness of the information being conveyed (Daft et al., 1987). Jiang et al. (2013) clarify that richer media generate benefits to individuals through online social engagements that bring social rewards, as individuals experience enjoyment, pleasure, satisfaction and fulfilment whilst they engage in interpersonal communication via media that can help manage social richness. Media richness creates the gratification derived from using a medium (Vazquez et. al., 2017), and as VAs depend solely on the richness of communication with them, it is essential to explore how the richness of the medium (VA) can affect how VAs are used. Examining the contribution of the MRT constructs, such as the level of interactivity, personalisation, use of language and multiple feedback, can provide insights into how effective VAs are as a communication medium and how they may mediate user behaviour in relation to behaviour.

The MRT has been thoroughly embraced and utilised as a framework to examine information systems and their particular applications and is a core guide for research in this space (Kahai and Cooper, 2003). Media richness also has very strong impacts across areas such as the use of technology in education (Hew & Kadir, 2016) and the learners' involvement in immersive learning environments (Chang et al., 2017). The arguments made thus far effectively support our usage of MRT in this research. Immediate feedback, Multiple cues, Personal focus, and Use of natural language are the variables adapted.

The UTAUT2 model, while built on the original UTAUT and its applications, provides a greater specificity in examining and explaining user behaviour (Venkatesh et al., 2012). UTAUT was developed specifically for the study of technology adoption in organizational settings, but UTAUT2 was designed to model technology acceptance in a consumer framework (i.e., a customer setting), with a focus on the user and the factors of attitudes and behaviours of users engaging with technology in their day lives. UTAUT2 added the three factors (hedonic motivation, price value and habits) to the existing four constructs in the original UTAUT (PE, EE, SI, FC) that had direct and significant contributions to intention and actual behaviour when using technology, respectively. The three factors are used in examining the individual interest in using technology. The hedonic motivation was the variable adopted from the UTAUT2 with an understanding of the pleasurable and enjoyable aspects of VAs for educational purposes.

Utilitarian Benefits

Utilitarian benefits refer to the practical advantages, usefulness, or value that individuals gain from using a product or service, such as increased efficiency, convenience, or productivity (Rokito et al., 2019). These benefits are often associated with the functionality of a product, such as how useful, effective, reliable, convenient, and affordable it is. Utilitarian benefits arise from the idea that people mainly use a product or service to solve a problem, meet a need and accomplish a goal. VAs have been designed to help their users gain utilitarian benefits, including saving time, reducing effort, increasing productivity, enhancing performance, and achieving cost savings. Studies such as Liu et al. (2020), McLean and Osei-Frimpong (2019), and Shin (2011) have shown that UB is a significant motivator for users to use VAs. Hence, the first hypothesis was proposed:

H_1: There is a significant relationship between utilitarian benefits and the use of VAs.

Immediate Feedback

Immediate feedback describes the capacity of technology to enable swift, reciprocal communication and rapid response times between the media and its users, fostering a real-time, interactive, and dynamic exchange of information (Daft et al., 1987). Immediate feedback refers to how a medium can provide timely responses to the user. VAs are designed to give immediate feedback to users, which allows for a seamless interaction between the user and the VAs. Similarly, when VAs provide suggestions to the user, prompt feedback ensures that the information presented is understood by the user so they can act. Prompt feedback ensures that the information presented by VA is understood by the user so they can act on it. The immediate feedback feature of VAs plays a role in developing a VA that meets users' needs and expectations. Immediate feedback has been explored in a number of studies (e.g., Barber, 2018; Dennis & Kinney, 1998; Iyinolakan, 2022; Mammadov, 2019; Oyeleye & Ademosu, 2021; Tseng et al., 2019), and a significant relationship was found between immediate feedback and the use of VAs. Receiving immediate feedback is important for the design of VAs to be effective and efficient at serving user needs and expectations; therefore, the second hypothesis was proposed:

H_2: There is a significant relationship between immediate feedback and the use of VAs.

Multiple Cues

Multiple cues refer to the different kinds of information that can be used to improve a user experience and enhance communication between users and a medium. In terms of communication, multiple cues communicate an indication of providing multiple or richer information channels (Daft et al., 1987; Dennis & Kinney, 1998; Tseng et al., 2017). The reality that media provides multiple cues allows users to access various forms of information that can be used to improve experiences for users and enhance communication between audiences and the media. In the case of VAs, cues can include audio and tactile feedback but extend into features such as Natural Language Processing (NLP) and gesture recognition. The multi-modal nature of VAs opens the potential to enhance communication with cues as opposed to just using words or symbols. VAs enable the user to leverage different forms of communication, including facial expression, gestures, and other non-verbal cues that might enrich, clarify or augment their interactions with VAs. Auditory cues such as sound synthesis or sound effects can provide added feedback and generally make the interactions between VAs and users appear more natural and intuitive. Thus, it is assumed that the use of VAs could be influenced by the opportunity to interact with VAs in multiple cues; hence, the third hypothesis was proposed:

H_3: There is a significant relationship between multiple cues and the use of VAs.

Personal Focus

Personal focus describes the degree to which a medium of communication supports a personalized and individualized response to users (Shim et al. 2007; Tseng et al. 2017; Tseng et al. 2018). The use of personal focus in modern ICTs provides the facility that users need to express and convey personal feelings and allows users to deliver these messages in a way that fits their purpose and determination. Personal focus adds richness to the communication experience by increasing the relevance, engagement, and satisfaction with communication for the user (Barber, 2018; Xiao & Benbasat, 2018). A VA can tailor its responses to the individual user through various personalization techniques in which a VA will draw on information from previous interactions, users' preferences, and behaviours. The findings from the study by Tseng et al. (2019) provided evidence of a significant relationship between personal focus and use of technologies. Thus, the value of personal focus presented by VAs might be an important factor in how people use them, which provides the justification for the inclusion of the variable in this study. Therefore, the fourth hypothesis was proposed:

H_4: There is a significant relationship between personal focus and the use of VAs.

Use of Natural Language

Language variety in the MRT refers to whether a medium can accurately express the information being presented across a multitude of languages. Language processing, which is a form of natural language processing, recognises and accepts pieces of the human language, including slang and jargon (Huang et al., 2019; Nobles et al., 2020). The role of language variety in VAs gives users access to interact with VAs on terms of their choosing, without a specific arrangement of steered language, which enhances the experience of the user. Using language variety, users are able to express an extensive range of interpretations, using the available characters, in many languages (Tseng et al., 2019). Language can be thought of in several ways, either as natural language, which could be images, text, etc., or number language, which typically consists of numerical data (Daft et al., 1987). Some studies, for example, Dubiel et al. (2018), Iyinolakan (2022), Oyeleye and Ademosu (2021), Pal et al. (2019) and Tseng et al., (2017), found a correlational and a significant relationship between the use of natural language and the use of VAs, that the acceptance that VAs have with the recognition of users' accent patterns and the influences it has on how an individual uses a VA was prevalent. Furthermore, acceptance for the opportunity to interact and converse with a VA in a natural language could have an effect in encouraging users' interactions with VAs. Hence, the following hypothesis:

H_5: There is a significant relationship between the use of natural language and the use of VAs.

Hedonic Motivation

Hedonic Motivation is the pleasure or enjoyment derived from using a technology, without any additional benefit (Venkatesh et al., 2012). The enjoyment or pleasure derived from using a technology influences technology acceptance and use (Brown & Venkatesh, 2005). Some scholars (e.g., Al Shamsi et al., 2021; Cyr et al., 2007; and Vimalkumar et al., 2021) have shown that hedonic motivation plays a pivotal role in users' usage of VAs. The level of enjoyment derived from utilising VAs can have an impact on users' intentions to adopt and use VAs; hence, the last hypothesis:

H_6: There is a significant relationship between hedonic motivation and the use of VAs.

The research conceptual framework, showing the relationship between the independent variables (utilitarian benefits, immediate feedback, multiple cues, personal focus, use of natural language, and hedonic motivation) and the dependent variable (the use of VAs) is presented in Figure 1.

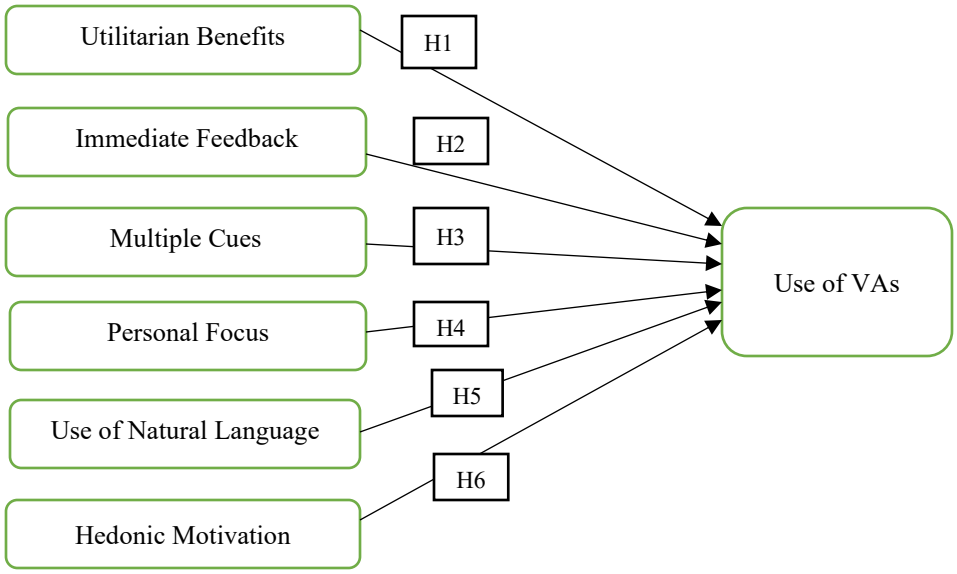

Figure 1. Research Framework

Methodology

This study employed a descriptive survey design. The research was conducted in Ibadan, Nigeria, with a focus on students at the University of Ibadan. The sample size was calculated using Slovin's (1960) formulae as shown below: **$n = N / (1 + Ne^2)$, w**here n = Number of samples, N = Total population and e = Error tolerance (level) (0.05). Thus, the sample size for postgraduate students is: $12269/ (1 +12{,}269 * (0.05)^2) = 387$. From this calculation, the sample size ideal for this population is 387. The multi-stage sampling approach was used to select the sample. The first stage

involved a simple random sampling technique to select three faculties from the list of faculties at the university. The simple random sampling ensures that every potential combination of elements has an equal chance of being selected. The second stage also involved the use of simple random sampling to select two departments from each of the three faculties. To select the faculties, the ballot method was used by assigning numbers to each faculty based on their population. The names of the faculties were written on separate pieces of paper. These papers were folded and placed in a container and mixed and one of the researchers blindly drew three faculties from the container. This process ensured that every faculty had an equal chance of being selected. The Faculty of Science, Public Health and the Faculty of Economics and Management Studies were selected. The same ballot method was used to select the departments from the list of departments at the selected faculties. The departments selected were Statistics and Computer Science (Faculty of Science), Human Nutrition & Dietetics and Environmental Health Science (Faculty of Public Health) and Accounting and Economics (Faculty of Economics and Management Studies). The third stage involved the use of proportionate-to-size sampling to select the subjects. This was to ensure the sample size of each stratum was proportional to its share of the population. Specifically, 45% of the population of students in the selected departments were chosen, resulting in a total sample size of 391 individuals. The population and the samples selected from the selected departments are presented in Table 1.

Table 1. Population and sample size of postgraduate students selected

Faculty	Department	Population Size (n=867)	Sample Size (45%)
Science	Statistics	143	64
	Computer Science	195	88
Public Health	Human Nutrition and Dietetics	137	62
	Environmental Health Science	115	52
Economics and Management Studies	Accountancy	108	49
	Economics	169	76

A structured questionnaire, which had some items adapted from the studies of McLean & Osei-Frimpong (2019), Dubiel et al. (2018), Tseng et al. (2019) and Oyeleye and Ademosu (2021), was used. The questionnaire items were measured using a five-point Likert scale structure (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) as shown in Appendix 1. Purposive and convenience sampling techniques were used to administer the instrument to 391 students who had used or were using VAs. The questionnaire was subjected to face, content and construct validity. The reliability was determined by conducting a pre-test among 20 students at another university (University of Lagos, Nigeria). The result of the Cronbach alpha reliability test showed that all the constructs are reliable as they have an alpha above 0.70 (Utilitarian benefits = 0.792; Immediate feedback = 0.808, Multiple cues = 0.752, Personal focus = 0.907 and Use of natural language = 0.766 and Hedonic motivation = 0.767). After the data collection process, 368 copies of the questionnaire were retrieved and were useful for analysis (94.0% response rate). The study adhered to acceptable ethical standards, which entail obtaining informed consent from participants, preventing plagiarism, and maintaining the confidentiality and anonymity of the respondents. The data was analysed using IBM SPSS Statistics version 20, following coding. The hypotheses were tested at a 5% significance level ($\alpha = 0.05$) using Spearman's rank-order correlation coefficient (rho). Additionally, linear regression analysis was performed to examine the individual effects of the independent variables on the dependent variable, and multiple regression analysis was used to investigate the collective impact of all independent variables on the dependent variable, revealing the extent to which they collectively influence the outcome.

Result

This section presents the results of the descriptive and inferential analysis.

Demographic Profile of the Respondents

The results of the analysis of the demographic characteristics of the respondents are presented in Table 2. About one-third (66.6%) were males, while 33.4% were females. A significant proportion (87.2%) were within the range of 21-30. Most were master's students (84.8%), with the Faculty of Public Health having the highest number of representatives (37.5%).

Table 2. Frequency distribution of the demographic characteristics of the respondents

Demographic Variables	Frequencies (N=368)	Percentage
Gender		
Male	245	66.6
Female	123	33.4
Age Group		
15 -20	0	0
21-30	321	87.2
31-40	41	11.1
41-50	6	1.6
Above 50	0	0
Department		
Statistics	39	10.6
Computer Science	70	19.0
Accountancy	41	11.1
Economics	80	21.7
Human Nutrition and Dietetics	68	18.5
Environmental Health Science	70	19.0

Test of Hypotheses

The hypotheses were tested in the null form (H_0) with the assumption that there is no significant relationship between the independent variables and the dependent variable. The results of the test of hypotheses are presented in Table 3.

Table 3. Correlation analysis and p-values of the relationships

	Independent Variables	Correlation Coefficients	N	p value (Sig. (2-tailed)
H01	Utilitarian benefits	0.754**	368	0.000
H02	Immediate feedback	0.681**	368	0.000
H03	Multiple cues	0.614**	368	0.000
H04	Personal focus	0.667**	368	0.000
H05	Use of natural language	0.581**	368	0.000
H06	Hedonic motivation	0.686**	368	0.000
Dependent variable: Use of VAs				

A strong positive correlation and significant relationship ($p=0.00< 0.05$) was found between Utilitarian benefits, Immediate feedback, Multiple cues, Personal focus, Use of natural language and Hedonic motivation, and the Use of Virtual Assistants ($r = 0.754, 0.681, 0.614, 0.667, 0.581$ and 0.686, respectively). An increase in the perception of the utilitarian benefits of VAs, the opportunity for immediate feedback, multiple cues, personal focus and the use of natural language would increase use. Also, the more the students perceived that the use of VAs was enjoyable (hedonic motivation), the more the technology would be used. Therefore, the six null hypotheses were rejected, and the alternative hypotheses were accepted.

A further test of the joint influence of the independent variables (Utilitarian benefits, Immediate feedback, Multiple cues, Personal focus, Use of natural language and Hedonic motivation) and use of virtual assistants was carried out. Also, the individual contributions of the independent variables on the dependent variable (use of virtual assistants) were determined. The results are presented in Tables 4, 5 and 6.

Table 4. Predictive power of the independent variables on the dependent variable

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.882a	.777	.773	.56942

a. Predictors: (Constant), Utilitarian benefits, Immediate feedback, Multiple cues, Personal focus, Use of natural language, Hedonic motivation

Table 5. ANOVA table showing the goodness of fit

ANOVAa						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	408.271	6	68.045	209.861	.000b
	Residual	117.051	361	.324		
	Total	525.321	367			

a. Dependent Variable: Use of VAs
b. Predictors: (Constant), utilitarian benefits, immediate feedback, multiple cues, personal focus, use of natural language, and hedonic motivation

Table 6. Individual contributions of the independent variables to the dependent variable

Coefficientsa						
Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.180	.092		1.962	.051
	Utilitarian benefits	.429	.060	.460	7.162	.000
	Immediate feedback	.180	.058	.189	3.076	.002
	Multiple cues	.011	.054	.011	.199	.843
	Personal focus	.061	.057	.062	1.080	.281
	Use of natural language	.060	.052	.059	1.144	.253
	Hedonic motivation	.155	.061	.150	2.557	.011

a. Dependent Variable: Use of VAs

The joint influence of the independent variables (Utilitarian benefits, Immediate feedback, Multiple cues, Personal focus, Use of natural language, and Hedonic motivation) on the dependent variable (use of VAs) was significant ($F = 209.861$, $p = 0.000 < 0.005$). The independent variables also have a coefficient of multiple regression ($df = 367$, $R = 0.777$) and an adjusted R-squared of 0.773. This means that the independent variables collectively explained 77.3% of the variation in the dependent variable, indicating a strong predictive relationship between the variables. Some other variables not considered in this study accounted for 22.7%. The individual contribution of each of the independent variables was expressed as a beta weight at the 0.05 level of significance. The results showed that only Utilitarian benefits ($\beta = 0.460$, $p = 0.000 < 0.005$), Immediate feedback ($\beta = 0.460$, $p = 0.002 < 0.005$) and Hedonic motivation ($\beta = 0.150$, $p = 0.011 < 0.005$) had significant relationships with the use of VAs individually.

Discussion

The findings of this study confirmed some of the enablers driving the use of VAs by the students at the University of Ibadan, Nigeria. The extent of the influence of utilitarian benefits, immediate feedback, multiple cues, personal focus, use of natural language, and hedonic motivation on the use of VAs was revealed. All the variables demonstrated a strong influence on the use of VAs. Our findings show that the utilitarian benefits of VAs were the strongest factor considered by the students ($r=0.754$). Studies such as Babić (2025), Mclean-Osei and Frimpong (2019), Kefi et al. (2021), and Lan et al. (2024) have supported this finding that the utilitarian benefits can influence the use as well as the continuous use of VAs. The use of VAs by students may largely be influenced by the utilitarian benefits they offer, such as convenience, efficiency, and immediate access and feedback, which make them valuable tools for academic tasks. Many students are increasingly drawn to use VAs because these tools can support coursework and project writing, thereby enhancing students' productivity. Hence, these capabilities of VAs, such as convenience, efficiency, multitasking, organisation, and task-technology fit, could have contributed to the adoption and use by the students.

In addition, one of the features of VAs is the opportunity for immediate feedback, which allows users to have instant and prompt responses to queries. Our findings support the findings of previous studies, such as Oyeleye & Ademosu (2021) and Tseng et al. (2019), which found that immediate feedback is one of the factors that could influence the use of VAs. Tseng et al. (2019) found that immediate feedback had a positive correlation and significant relationship with social presence, relatedness need satisfaction and user loyalty to mobile messaging. VAs respond to users' inquiries, commands, queries, or other messages that require immediate feedback, thereby removing the waiting time that may be associated with consulting humans or searching for the information elsewhere. This ability of VAs to provide an immediate response is a key factor driving their use among students (Essel et al., 2022), who can quickly use the technology to support their academic tasks. This timely interaction enhances learning efficiency, keeps students engaged, and supports continuous progress in their coursework and projects without the delays associated with the traditional help-seeking methods.

The findings from this study also show that the availability of multiple cues in VAs was one of the enablers of the use of VAs. This finding conforms with the findings of other studies (e.g., Oyeleye & Ademosu, 2021; Tseng et al., 2019). This shows that the use of VAs by the students is driven by their ability to communicate using multiple cues such as voice, text, visual prompts, different tones, gestures and contextual suggestions, which enhances understanding and supports diverse learning styles. This multimodal interaction makes it easier for students to understand complex information, stay engaged and receive support in a format that aligns with their individual preferences and academic needs. The multi-cue capability of VAs significantly influences communication and message comprehension beyond the literal message. Studies have shown that as the number of cues increases, decision-making time decreases (Barber, 2018; Dennis & Kinney, 1998; Siegel et al., 1983) and decision quality improves (Kahai & Cooper, 2003), highlighting the benefits of multi-modal communication in group settings. It has also been shown that, beyond the speed of comprehension, media with multiple cues have a significant influence on the social perceptions of messages (Tseng et al., 2019). Thus, the ability to interact with VAs in multiple cues is an important factor considered by the students.

The findings of this study also show a significant relationship between personal focus and the use of VAs by the students. The students may be drawn to VAs because of their ability to deliver personalised support tailored to previous interactions, individual learning needs, preferences, and academic goals. This personal focus enables VAs to tailor their responses to the user's browsing history, subject focus, or learning pace, thereby creating a more relevant and effective learning experience that encourages continued use. Previous studies (e.g., Barber, 2018; Tseng et al., 2019; Xiao & Benbasat, 2018) have shown that students use VAs for academic works that require expressing personal feelings and an expectation of results tailored to their expressions. Tseng et al. (2019), for instance, explain that the ability to provide tailored recommendations to users is a useful benefit considered by most users of VAs because of the personalisation of VAs or the personal focus provided by the them, which makes it easier to customise the message to the need and wants of the users. VAs not only provide personal focus but also offer distinct social benefits, including social presence and attractiveness. While previous technologies have demonstrated social presence, with users applying social norms to computer interactions (e.g., waiting for responses, showing politeness and empathy), VAs uniquely convey a strong sense of anthropomorphism through voice communication, fostering a more human-like interaction experience.

The ability of VAs to understand and naturally communicate with their users by understanding accent patterns and different languages (use of natural languages) was also an important enabler considered by the respondents. People converse with VAs the same way they do with other humans, thereby developing a rapport with the assistant. This ability to communicate with VAs in the English language, which is an official language in Nigeria, could have influenced their usage by the students. This finding corresponds with that of Iyinolakan's (2023) study in Ebonyi state, Nigeria and Oyeleye & Ademosu (2021) in Lagos state, Nigeria, and some others outside the country (e.g., Cerekovic et al., 2017, Dubiel et al., 2018, Lan et al., 2024, and Mclean-Osei & Frimpong, 2019). Research studies (e.g., Malodia et al., 2022; Schuetzler et al., 2020) have demonstrated that AI with advanced communication capabilities, such as personalised responses and diverse feedback, similar to those integrated into VAs, significantly enhances perceived social presence, user engagement, and interactive experiences. In informatics education, where technical language and problem-solving are central, the ability of VAs to understand and naturally communicate with students, especially by recognising diverse accent patterns and supporting multiple languages, is a crucial enabler. The linguistic adaptability of VAs enhances accessibility for a broader range of students, including those for whom English is a second language or who speak with regional accents (Aju & Osubor, 2022). By minimising communication barriers, VAs can provide clearer explanations of complex informatics concepts, respond accurately to voice commands, and assist students more effectively with tasks such as code interpretation, algorithm design, or system modeling (Hoy, 2018). This inclusiveness not only supports equity in digital learning environments but also fosters greater engagement and participation among linguistically diverse learners in informatics-related coursework and projects.

Lastly, hedonic motivation is one of the enablers of the use of VAs by the students. Previous studies (e.g., Babić, 2025; Fang, 2019; Rauschnabel et al., 2018; Tafesse, 2021) have identified the role of enjoyment (hedonic motivation) in influencing individuals to adopt and use technologies, including VAs. Hedonic motivation drives individuals to engage in behaviours that maximise pleasure and enjoyment while minimising discomfort or pain. As a result, hedonic benefits or attributes are associated with the emotional experience of pleasure, enjoyment and satisfaction that come from using new technology such as VAs, and which enhance overall well-being and happiness (Schuitema et al., 2013). Beyond practical benefits, students are motivated to use VAs due to the enjoyment and satisfaction derived from interacting with their smartphones or other technologies. The engaging, conversational nature of VAs, combined with their anthropomorphic features, novelty, and entertainment values, makes them appealing tools that can support academic work and also offer a pleasurable user experience, encouraging frequent and continual use among students (Rohit et al., 2025). However, Mclean-Osei & Frimpong (2019) found that hedonic motivation did not influence the use of in-home VAs.

All the variables (utilitarian benefits, immediate feedback, multiple cues, personal focus, hedonic motivation, use of natural language and hedonic motivation) predicted the use of VAs and accounted for 77.3% of the variance in the use of VAs by the students. This shows the importance of these constructs in the adoption and use of Vas among this population. These factors could be leveraged by VA developers to improve the design of VAs for optimal adoption and use by users.

Conclusion and Recommendations

The study identified the enablers of students' use of VAs at the University of Ibadan, Nigeria, specifically, utilitarian benefits, immediate feedback, multiple cues, personal focus, hedonic motivation, use of natural language and hedonic motivation. The use of VAs in informatics education holds significant pedagogical potential for enhancing students' learning and engagement. By providing real-time, on-demand support, VAs can help students navigate complex topics such as programming, data structures, and algorithm design with greater ease. Their ability to offer immediate feedback allows learners to quickly identify and correct errors, facilitating more efficient problem-solving and iterative learning. Moreover, VAs have a personal focus and can tailor responses to individual learning needs, thereby supporting differentiated instruction and fostering independent learning. The use of multiple cues, such as voice, text, and visual aids, also accommodates diverse learning styles, making informatics content more accessible. Additionally, the interactive and often enjoyable nature of VAs can increase student motivation through hedonic engagement, while their practical benefits enhance task completion and academic productivity. Altogether, these features make VAs valuable pedagogical tools for learning. disciplines.

These findings offer valuable insights for enhancing informatics learning by highlighting the conditions under which students are more likely to engage with intelligent digital tools. To support informatics education, the study recommends emphasising these enabling factors when promoting VA use among students. Informatics curricula can integrate VAs more effectively by ensuring they deliver timely assistance, offer real-time feedback, recognise diverse accents, understand local Nigerian languages, and continually improve their technical capabilities. These improvements can enhance user experience and encourage long-term engagement with the technology, an important goal in informatics learning environments such as technology-enhanced classrooms, where sustained use and user familiarity are critical.

Limitations and Suggestions

The respondents were limited to the students who were chosen by a non-probabilistic technique from six departments; hence, the results cannot be generalised to the entire university. Therefore, further studies could be expanded to cover some other departments left out. Future studies could be done to cover students in other universities or other academic institutions. Also, the variables considered were limited to just six. Some other variables not considered also account for the use of VAs among the students. Hence, future studies could include some other variables. The data collection instrument used was a questionnaire. Further studies could triangulate with interview sessions or group discussions to provide more robust data.

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