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ADVANCES IN TEACHING AND LEARNING TECHNOLOGY: A FOCUS ON THE APPLICATION OF BLOCKCHAIN TECHNOLOGY IN TERTIARY INSTITUTIONS

ENGR. UBANI AJUZIEOGU CHRISTIAN (MNSE)
Mechanical Engineering dept, Abia State Polytechnic, Aba
Email: ajuzieogu.ubani@abiastatepolytechnic.edu.ng

DR. MFREKE UMOH J.
Department of Computer Science
Akwa Ibom State Polytechnic, Ikot Osurua. Akwa Ibom State, Nigeria
Email: **mfreke_u@yahoo.com**

CHRISTIANA A. WILLIAM
Department of Library and Information Science
Akwa Ibom State Polytechnic, Ikot Osurua
Email: christiana@020gmail

DR. IME ROBSON NSEOBOT
Department of Business Administration,
Akwa Ibom State Polytechnic, Ikot Osurua, Ikot Ekpene, Nigeria
Email:nseobot857@yahoo.com

Abstract
Advances in teaching and learning technology have paved the way for innovative approaches in higher education. This abstract focuses on the application of blockchain technology in tertiary institutions and explores its potential to transform various aspects of teaching and learning. Blockchain technology, known for its association with cryptocurrencies, offers a decentralized and secures platform that can revolutionize credentialing and certification processes, enhance data management and privacy, enable personalized learning experiences, protect intellectual property rights, and streamline financial transactions. By reviewing the current literature, this abstract provides insights into the benefits, challenges, and future directions of blockchain technology in tertiary education. It emphasizes the importance of addressing technological barriers, regulatory considerations, scalability issues, adoption challenges, and ethical concerns for successful implementation. Understanding the opportunities and limitations of blockchain in tertiary institutions is crucial for educators, administrators, policymakers, and researchers seeking to harness the potential of this emerging technology in advancing teaching and learning practices

Keywords: Teaching; Learning; Technology; Blockchain; Technology; Tertiary Institutions

Introduction

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In recent years, technological advancements have significantly transformed the education sector. One emerging technology that holds great promise for revolutionizing teaching and learning processes in tertiary institutions is blockchain technology. This study aims to explore the application of blockchain technology in tertiary education, examining its potential benefits, challenges, and implications for educators, students, and institutions as a whole Agarwal, Idrees, Obaid, (2021). Nowadays the world system of education is undergoing substantial changes related to the development of new technologies and digitalization of the educational environment. Education is becoming mass and personalized simultaneously. According to the global education market intelligence firm, HolonIQ, "population growth will be a key challenge for the Education sector. By 2035, there are expected to be 2.7 billion students worldwide", with slightly more than 500 million today (Spies, Brothers, 2020).

The integration of technology in education has witnessed rapid growth, enhancing the accessibility, efficiency, and effectiveness of teaching and learning. Various digital tools and platforms have been developed to facilitate collaborative learning, personalized instruction, and data-driven decision-making. However, traditional systems face several challenges, such as centralized data management, lack of transparency, and issues related to verification and authentication Ghavifekr, & Rosdy, (2015).

Blockchain technology, initially introduced as the underlying technology for cryptocurrencies like Bitcoin, has gained attention due to its decentralized and transparent nature. It is a distributed ledger technology that securely records and verifies transactions across multiple nodes without the need for a central authority. Each transaction, or block, is time-stamped, encrypted, and linked to the previous block, forming an immutable chain of records. An advantage of digital educational technologies is that personalized education becomes possible thanks to them. The current tendency is that trainees prefer to obtain a set of high-quality professional competences individually. According to Ed Clark, Vice President for Information Technology Services and CIO at the University of St. Thomas, present-day young people have already obtained a digital personality in addition to their real one (Rudich, 2020). Influence exerted upon a student's "digital personality" makes it possible to enhance the quality of education and increase the share of students who complete their studies successfully from 20 % (in the USA in average) to 60 % (at the University of St. Thomas). The technologies of digital education make it possible to monitor how well a student has mastered new knowledge and skills, correct the learning process promptly; education becomes more personalized and flexible (Rudich, 2020).

Statement of the problem

Blockchain technology has gained significant attention in various sectors for its potential to revolutionize traditional systems and processes. In the context of tertiary education, the application of blockchain technology holds promise for enhancing teaching and learning experiences. However, despite the growing interest and potential benefits, there is a lack of comprehensive understanding and exploration of the specific challenges and opportunities associated with implementing blockchain technology in tertiary institutions. The primary problem to address in this study is the need to examine the advancements in teaching and learning technology, with a particular focus on the application of blockchain technology in tertiary institutions.

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Objectives of the Study

The primary objectives of this study are as follows:

To examine relationship between application of blockchain technology and students efficient learning and teaching outcomes in tertiary education

To examine the relationship between application of block chain on prompt access to resource and instruction

Significance of the Study

This study will contribute to the growing body of knowledge on the application of blockchain technology in tertiary education. The findings will help educators, administrators, policymakers, and other stakeholders make informed decisions regarding the integration of blockchain technology in their institutions. Furthermore, it will shed light on the potential benefits and challenges of adopting this technology and provide insights into strategies for successful implementation.

Literature Review

Analysis of Existing Blockchain Implementations in Tertiary Institutions

Blockchain technology has gained attention in the education sector, and several tertiary institutions have explored its implementation to enhance various aspects of teaching and learning Tapscott and A. Kaplan, (2019). The following analysis examines some of the existing blockchain implementations in tertiary institutions and highlights their key features, benefits, and challenges Devine, (2015).

Credentialing and Certification

Many tertiary institutions have implemented blockchain-based systems for issuing and verifying academic credentials and certifications. These implementations aim to provide a tamper-proof and decentralized platform for storing and sharing student records. By leveraging blockchain, institutions can enhance the transparency, security, and portability of credentials, streamlining the verification process for employers and other educational institutions. Notable examples include the MIT Media Lab's Blockcerts initiative and the University of Melbourne's digital credentialing project Alammary et al., (2019).

Secure Data Management

Blockchain has been utilized by tertiary institutions for secure data management, particularly in storing and sharing student records and personal information. These implementations provide students with ownership and control over their data, allowing them to share selected information securely with relevant parties. Additionally, blockchain-based systems offer enhanced security measures, reducing the risk of data breaches and unauthorized access. Holberton School's use of blockchain for storing student academic records is a notable example in this domain Bartolomé et al., (2017).

Learning Analytics and Personalization

Some tertiary institutions have explored blockchain's potential in capturing and analyzing learner data for personalized learning experiences. By recording student interactions and achievements on the blockchain, institutions can generate valuable insights into student performance,

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preferences, and learning patterns Bartolomé et al., (2017). These insights can inform instructional design and interventions, facilitating adaptive and personalized learning environments. The Dutch research project "Blockchain-based Badge Passport" exemplifies the use of blockchain for tracking and verifying digital badges and competencies.

Intellectual Property Rights

Blockchain technology has been employed by tertiary institutions to address intellectual property rights challenges. Blockchain-based systems can provide a timestamped and immutable record of intellectual property creations, such as research outputs and publications, protecting ownership and facilitating attribution Yuan and Wang, (2018). These implementations also offer opportunities for automating royalty payments and licensing agreements through smart contracts. The partnership between Sony and IBM for a blockchain-based educational rights management system is an example of this application.

Financial Transactions

Blockchain-based systems have been implemented in tertiary institutions to facilitate financial transactions, including tuition payments, scholarship distributions, and grant management. These implementations leverage smart contracts to automate and streamline financial processes, reducing administrative overhead and ensuring transparency and accountability. The University of Nicosia's acceptance of cryptocurrency payments for tuition fees is a notable example of blockchain-based financial transactions in tertiary education Casino, Dasaklis, Patsakis, 2019).

While existing blockchain implementations in tertiary institutions demonstrate the potential benefits of this technology, they also face challenges that need to be addressed for wider adoption. These challenges include technological barriers, regulatory compliance, scalability, interoperability, adoption and implementation challenges, and ethical considerations regarding data privacy and ownership. Future research and collaboration are needed to address these challenges and develop robust and sustainable blockchain solutions tailored to the specific needs of tertiary education institutions Hillman, V.; Ganesh, V. Kratos, (2019).

Applications of Blockchain Technology in Tertiary Institutions

Blockchain technology has the potential to revolutionize various aspects of tertiary education. The following section explores the key applications of blockchain in higher education and how they can benefit institutions and learners Ubaka-Okoye, Azeta, Oni, Okagbue, Nicholas-Omoregbe, (2020).

Credentialing and Certification

One of the prominent applications of blockchain technology in tertiary institutions is in credentialing and certification. Blockchain can provide a secure and decentralized system for storing and verifying academic credentials, such as degrees, diplomas, and certifications. By issuing these credentials on the blockchain, educational institutions can ensure immutability, transparency, and tamper-proof verification. This eliminates the need for manual verification processes, reduces fraud, and enhances the credibility and portability of qualifications for students Ayub, Laghari, Shaikh, Bourouis, Mamlouk, and Alshazly (2012).

Secure Data Management

Blockchain technology offers a secure and tamper-resistant platform for managing student data. Student records, including personal information, grades, transcripts, and assessments, can be stored on the blockchain, ensuring their integrity and privacy. This decentralized approach reduces the risk of data breaches and unauthorized access. Furthermore, blockchain-based

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systems enable students to have ownership and control over their data, allowing them to share selected information securely with employers or other educational institutions.

Learning Analytics and Personalization

Blockchain can facilitate the collection and analysis of learner data, leading to more effective learning analytics and personalized educational experiences. By tracking and recording student interactions with learning materials, assessments, and collaboration platforms, blockchain-based systems can generate valuable insights into student performance, preferences, and learning patterns. These insights can help educators tailor instruction and interventions to meet individual student needs, fostering personalized and adaptive learning environments Upadhyay, (2020).

Intellectual Property Rights

Blockchain technology can address intellectual property rights challenges in tertiary institutions. With blockchain, educators, researchers, and students can securely record and timestamp their creations, such as research outputs, publications, and innovative projects. This establishes a verifiable proof of ownership and supports the attribution of intellectual property. Blockchain-based smart contracts can automate royalty payments and licensing agreements, ensuring fair compensation and incentivizing innovation and creativity within the academic community Zheng, Xie, Dai, Chen, and Wang, (2017).

Smart Contracts and Financial Transactions

Blockchain-based smart contracts enable automated and transparent financial transactions within tertiary institutions. These self-executing contracts can facilitate tuition payments, scholarship distribution, grant management, and other financial processes. By leveraging blockchain's transparency and auditability, institutions can enhance financial accountability, reduce administrative burdens, and streamline transactional processes. Additionally, smart contracts can facilitate peer-to-peer transactions, such as content sharing or micro-credentialing, creating new opportunities for collaborative and decentralized learning Alammary et al., (2019).

Overall, the applications of blockchain technology in tertiary institutions have the potential to enhance the credibility and efficiency of credentialing, improve data management and security, enable personalized learning experiences, protect intellectual property rights, and streamline financial transactions. However, it is important to address the challenges and considerations associated with implementing blockchain in higher education, such as technological barriers, regulatory compliance, scalability, and ethical concerns, to fully harness its benefits Zheng et al., (2017)

Benefits and Opportunities of Blockchain in Tertiary Education

The adoption of blockchain technology in tertiary education brings forth numerous benefits and opportunities that can significantly impact teaching, learning, and administrative processes. The following section highlights some of the key advantages associated with the utilization of blockchain in higher education.

Enhanced Security and Privacy

Blockchain's decentralized and cryptographic nature ensures robust security and privacy in tertiary institutions. By storing student records, credentials, and sensitive data on the blockchain, the risk of data breaches and unauthorized access is reduced. The immutable nature of blockchain ensures that once data is recorded, it cannot be altered or tampered with, providing a

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high level of data integrity and trust. This enhances the protection of student information and promotes a secure environment for academic activities Saberi, Kouhizadeh, Sarkis, Shen, (2019).

Increased Transparency and Trust

Blockchain technology promotes transparency and trust in tertiary education by providing a decentralized and auditable system. The distributed ledger allows multiple stakeholders, including students, educators, employers, and regulators, to access and verify information without relying on a central authority. This transparency improves the credibility of academic credentials, certifications, and other educational records, as they can be independently verified by anyone with access to the blockchain. It also reduces the need for intermediaries and enhances trust among stakeholders Raimundo, and Rosário (2021).

Streamlined Credential Verification

Traditional methods of verifying academic credentials often involve time-consuming manual processes, such as contacting institutions directly for verification. Blockchain streamlines this process by enabling instant and tamper-proof verification of credentials. Educational institutions can issue digital credentials on the blockchain, allowing employers and other institutions to verify their authenticity quickly and easily Raimundo, and Rosário (2021). This simplifies the hiring process for employers and facilitates the seamless transfer of credits and qualifications between educational institutions.

Improved Data Accessibility and Ownership

Blockchain technology empowers learners by giving them control over their own data. Through blockchain-based systems, students can maintain ownership of their educational records and decide who can access specific information. This grants students greater agency in managing their educational journey and provides them with a portable and secure digital identity. Additionally, blockchain's decentralized nature ensures that even if an institution ceases to exist or changes its systems, students can retain access to their records Zheng et al., (2017).

Cost Reduction and Efficiency

Implementing blockchain technology in tertiary education has the potential to reduce costs and improve efficiency. By automating administrative processes through smart contracts, institutions can streamline tasks such as enrollment, financial transactions, and contract management. This reduces the need for manual interventions, minimizes errors, and eliminates the associated administrative overhead. Moreover, blockchain can facilitate seamless collaboration and sharing of resources among institutions, resulting in cost savings and increased efficiency in areas such as research, course development, and knowledge sharing.

The adoption of blockchain technology in tertiary education offers a range of benefits, including enhanced security and privacy, increased transparency and trust, streamlined credential verification, improved data accessibility and ownership for learners, and cost reduction and efficiency gains for institutions. However, it is essential for educational institutions to consider the challenges and limitations of implementing blockchain, such as technological readiness, regulatory compliance, scalability, and ethical considerations, to maximize the potential benefits and ensure successful integration into existing educational systems.

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Challenges and Limitations of Blockchain in Tertiary Education

While blockchain technology presents several benefits and opportunities for tertiary education, its implementation also faces certain challenges and limitations. It is crucial to be aware of these factors to effectively address them and ensure the successful integration of blockchain in higher education environments. The following section outlines some of the key challenges and limitations associated with blockchain adoption in tertiary education.

Technological Barriers

Blockchain technology is still evolving, and its implementation requires technical expertise and infrastructure. Tertiary institutions may face challenges in terms of the scalability, interoperability, and integration of blockchain with existing systems and platforms. Additionally, blockchain networks often require significant computational power and energy resources, which can pose infrastructure challenges for some institutions, particularly smaller ones with limited resources Watters, (2016).

Regulatory and Legal Considerations

Blockchain adoption in tertiary education may be subject to regulatory and legal frameworks. Compliance with data protection and privacy laws, such as the General Data Protection Regulation (GDPR), may present challenges, especially when sharing student data on a decentralized blockchain network. Institutions need to ensure that their blockchain implementations adhere to relevant regulations and policies governing data privacy, security, and ownership.

Scalability and Interoperability

Blockchain technology faces scalability challenges when it comes to handling a large volume of transactions and data. As more educational institutions adopt blockchain, the network may experience congestion and slower transaction processing times. Interoperability is another concern, as different blockchains may have their own protocols and standards, making it difficult to seamlessly exchange data and credentials between institutions using different blockchain networks Snowden, (2019).

Adoption and Implementation Challenges

The adoption of blockchain technology requires significant institutional commitment and collaboration. Institutions need to invest in research, development, and training to understand the intricacies of blockchain and its potential applications. Resistance to change and lack of awareness among stakeholders can impede adoption efforts. Moreover, the integration of blockchain into existing educational systems and processes may require a phased approach and careful planning to ensure a smooth transition and user acceptance Kamišali, Turkanovi, Mrdovi, and Heri´cko, (2019).

Ethical and Privacy Concerns

While blockchain enhances data security, it also raises ethical and privacy concerns. The immutability of data recorded on the blockchain can create challenges in correcting errors or removing outdated or sensitive information. Student consent and control over their data become critical considerations, requiring mechanisms to manage data sharing and ensure that personal information is not exposed beyond what is necessary Schuetz and Venkatesh (2019).

Addressing these challenges and limitations requires collaborative efforts among educational institutions, policymakers, and technology providers. Clear guidelines and standards must be established to address regulatory concerns and ensure ethical use of blockchain in education.

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Ongoing research and development are essential to improving the scalability, interoperability, and user experience of blockchain-based solutions in tertiary education.

While challenges exist, the potential benefits of blockchain in tertiary education make it a field worth exploring and developing. With careful consideration of these challenges and strategic planning, blockchain technology can contribute to the transformation of teaching, learning, and administrative processes in higher education institutions Bhaskar, Tiwari and Joshi (2020)

Theoretical Framework

Unified Theory of Acceptance and Use of Technology (UTAUT)

The theoretical model of UTAUT suggests that the actual use of technology is determined by behavioural intention. The perceived likelihood of adopting the technology is dependent on the direct effect of four key constructs, namely performance expectancy, effort expectancy, social influence, and facilitating conditions. The effect of predictors is moderated by age, gender, experience and voluntariness of use (Venkatesh et al., 2003).

Performance expectancy is defined as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al., 2003). Performance expectancy is based on the constructs from Technology Acceptance Model (TAM), TAM2, Combined TAM and the Theory of Planned Behaviour (CTAMTPB), Motivational Model (MM), the model of PC utilisation (MPCU), Innovation Diffusion Theory (IDT) and Social Cognitive Theory (SCT) (i.e. perceived usefulness, extrinsic motivation, job-fit, relative advantage and outcome expectations). It is the strongest predictor of use intention and is significant in both voluntary and mandatory settings (Zhou, Lu & Wang, 2010; Venkatesh, Thong & Xu, 2016).

Effort expectancy is defined as "the degree of ease associated with the use of the system" (Venkatesh et al., 2003). Effort Expectancy is constructed from perceived ease of use and complexity driven from TAM, MPCU, IDT, which share a similarity in definitions and scales. The effect of the construct becomes nonsignificant after extended usage of technology (Gupta, Dasgupta & Gupta, 2008; Chauhan & Jaiswal, 2016).

Social Influence is defined as "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003). Social influence is similar to the subjective norms, social factors and image constructs used in TRA, TAM2, TPB, CTAMTPB, MPCU, IDT in the way that they denote that the behaviour of people is adjusted to the perception of others about them. The effect of social influence is significant when the use of technology is mandated (Venkatesh et al., 2003). In the mandatory context, individuals might use technology due to compliance requirement, but not personal preferences (Venkatesh & Davis, 2000). This might explain the inconsistent effect that the construct demonstrated across further studies validating the model (Zhou, Lu & Wang, 2010; Chauhan & Jaiswal, 2016).

Facilitating conditions is defined as "the degree to which an individual believes that an organisation's and technical infrastructure exists to support the use of the system" (Venkatesh et al., 2003). The facilitating conditions construct is formed from compatibility, perceived behavioural control and facilitating conditions constructs drawn from TPB, CTAMTPB, MPCU and IDT. Facilitating conditions have a direct positive effect on intention to use, but after initial use, the effect becomes nonsignificant. Therefore, the model proposes that facilitating conditions have a direct significant effect on use behaviour (Venkatesh et al., 2003).

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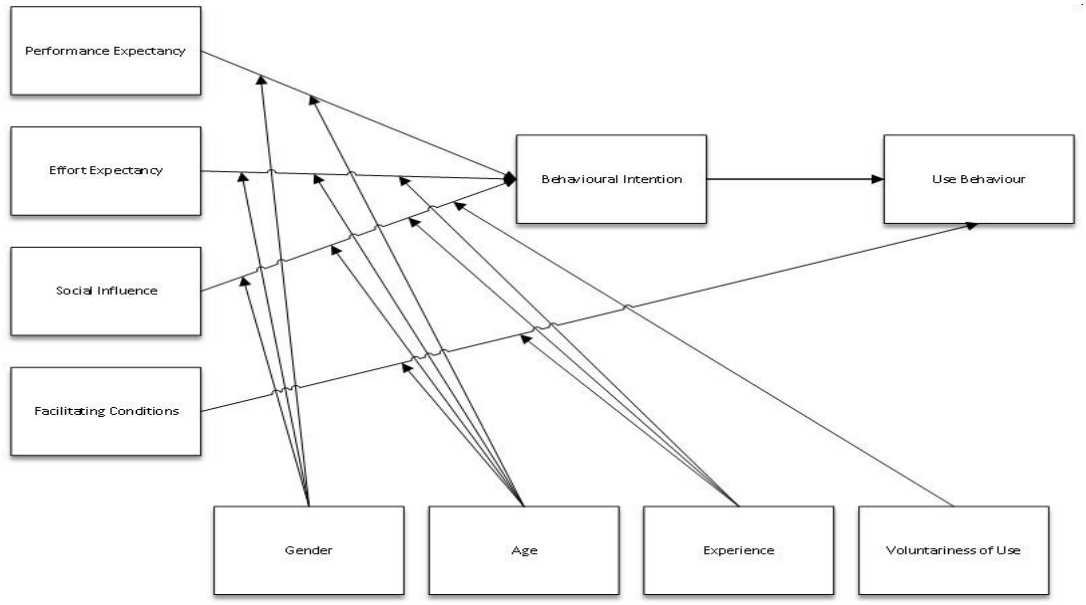
The moderation effects of age, gender, experience and voluntariness of use define the strength of predictors on intention. Age moderates the effect of all four predictors. Gender effects the relationships between effort expectancy, performance expectancy and social influence. Experience moderates the strength of the relationships between effort expectancy, social influence and facilitating conditions. Voluntariness of use has a moderating effect only on the relationship between social influence and behavioural intention (Venkatesh et al., 2003).

UTAUT has made several contributions to the literature. The model provides empirical insight into technology acceptance by comparing prominent technology acceptance theories, which often offer competing or partial perspectives on the subject. UTAUT demonstrates that proposed factors account for 70 percent of the variance in use intention (Venkatesh et al., 2003), offering stronger predictive power compared to the rest of the models that examine technology acceptance (e.g. (Davis, 1993; Sheppard, Hartwick & Warshaw, 1988). The interactive effect of some constructs with personal and demographic factors demonstrates the complexity of the technology acceptance process, which is dependent on individuals' age, gender and experience (Venkatesh et al., 2003).



The adaptations of the model were underpinned by four main approaches, reflecting a) the modification of the model to different contexts, b) the alterations of the endogenous variables, c) the addition of attitudinal antecedents, and d) the examination of various moderating variables. The first stream of research extended the model to apply it to new technologies (e.g. enterprise systems, e-health systems), focus on new user segments (e.g. healthcare professionals), and examine it in new geographical and cultural settings (e.g. India, China) (Chang et al., 2007; Yi et al., 2006; Gupta, Dasgupta & Gupta, 2008). For instance, the model was extended by a set of web-specific constructs, including trust and personal web innovativeness to explore how well it predicts the use of web tools (Casey & Wilson-Evered, 2012). Another stream of research extended UTAUT by incorporating additional endogenous variables (e.g. (Sun, Bhattacherjee &

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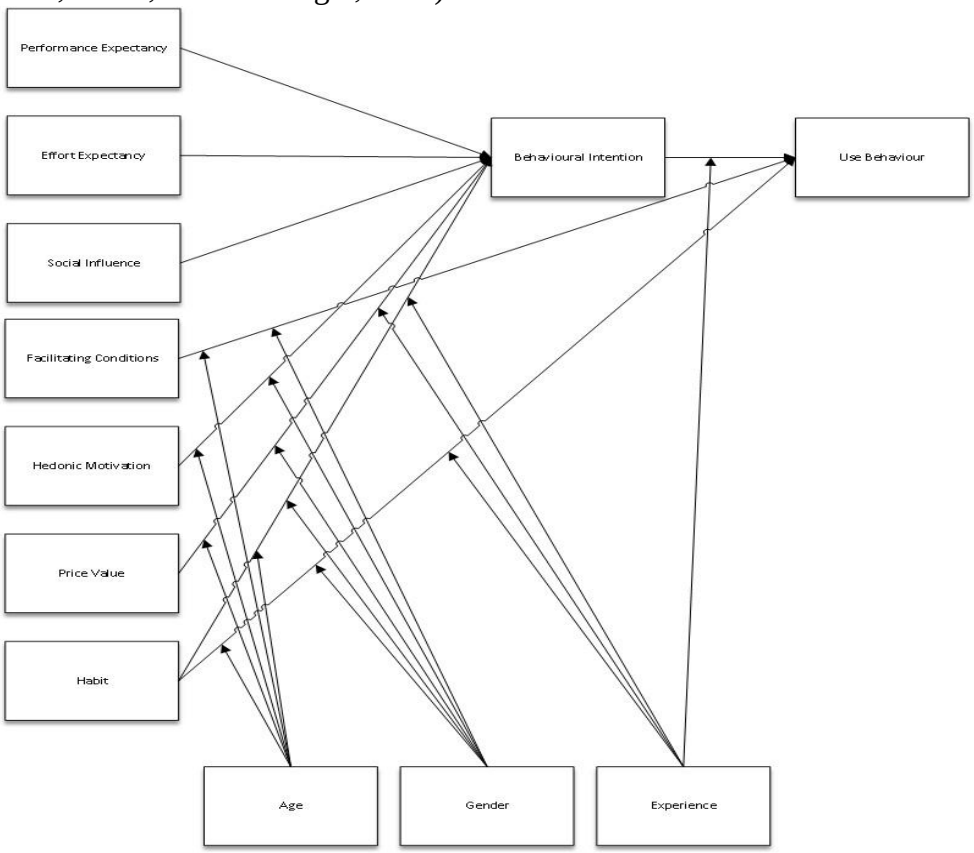
Ma, 2009)), such as satisfaction and continuous intention to use (Maillet, Mathieu & Sicotte, 2015). The third stream of research scrutinised additional determinants of use and behavioural intention, such as task-technology fit and personality traits (Zhou, Lu & Wang, 2010; Wang, 2005). Finally, some studies extended UTAUT by introducing new contextual and moderating variables, such as culture, ethnicity, religion, employment, language, income, education and geographical location, among others (Im, Hong & Kang, 2011; Al-Gahtani, Hubona & Wang, 2007; Riffai, Grant & Edgar, 2012).



By applying the UTAUT framework, researchers and educators can assess the readiness and acceptance of blockchain technology in tertiary institutions. They can conduct surveys, interviews, or focus groups to collect data on the perceptions and attitudes of different stakeholders. The findings can then inform the design and implementation of blockchain-based applications that align with the identified factors of acceptance and use.

Additionally, UTAUT can guide the development of interventions, training programs, and communication strategies to promote the adoption and effective utilization of blockchain technology in teaching and learning. Understanding the underlying factors influencing acceptance can help identify potential barriers and inform targeted interventions to address them.

In summary, the application of the Unified Theory of Acceptance and Use of Technology (UTAUT) can provide a framework for understanding and predicting the acceptance and use of blockchain technology in tertiary institutions. By considering factors such as performance

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expectancy, effort expectancy, social influence, and facilitating conditions, stakeholders can better assess readiness, address barriers, and promote successful integration of blockchain technology in teaching and learning environments.

Methodology

This research adopts a mixed-methods approach, combining qualitative and quantitative data collection methods Tegan, (2021). The study will include literature reviews, interviews with educators and administrators, surveys of students and other stakeholders, and analysis of existing blockchain implementations in tertiary institutions. The questionnaire was administered to 313 sampled students from 9821 students of Uyo local government area of Akwa Ibom State after obtaining permission from the school principals on presentation. All the questions on the questionnaire were read to the students to avoid any misunderstanding. The teachers of the selected classes assisted the researcher in the distribution and collection of completed copies of the questionnaire on the spot method. This method adopted by the researcher to ensure that time was judiciously utilized and to avoid missing copies of the questionnaire. At the end, all the copies distributed were collected for subsequent analysis. The collected data were analyzed using appropriate statistical technique such as descriptive statistics for research questions while Pearson Product Moment Correlational analysis was used to test the null hypothesis.

Data Analysis and Presentation

Hypothesis One

The null hypothesis states that there is no significant Relationship between application of blockchain technology and students efficient learning and teaching outcomes in tertiary education. In order to test the hypothesis, Pearson Product Moment Correlation analysis was then used to analyze the data in order to determine the relationship between the two variables (see table 1).

TABLE 1

Pearson Product Moment Correlation Analysis of relationship application of blockchain technology and students efficient learning and teaching outcomes in tertiary education

Variable	$\sum x$ $\sum y$	$\sum x^2$ $\sum y^2$	$\sum xy$	r
Efficient learning and teaching outcomes (x)	9011	270655	134663	0.94*
Applications of Blockchain(y)	9113	58989		

***Significant at 0.025 level; df =311; N =313; critical r–value = 0.086**

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Table 1 presents the obtained r-value as (0.94). This value was tested for significance by comparing it with the critical r-value (0.086) at 0.025 levels with 311 degrees of freedom. The obtained r-value (0.94) was greater than the critical r-value (0.086). Hence, the result was significant. The result therefore means that there is significant relationship between application of blockchain technology and students efficient learning and teaching outcomes in tertiary education

Hypothesis Two

The null hypothesis states that there is no significant relationship between application of block chain on prompt access to resource and instruction. In order to test the hypothesis, Pearson Product Moment Correlation analysis was then used to analyze the data in order to determine the relationship between the two variables (see table 2).

TABLE 2

Pearson Product Moment Correlation Analysis of the relationship between application of block chain on prompt access to resource and instruction

Variable	$\sum x$ $\sum y$	$\sum x^2$ $\sum y^2$	$\sum xy$	r
application of block chain(x)	9011	270655	140162	0.83*
Prompt access to Resource and instruction (y)	9113	58989		

***Significant at 0.025 level; df =311; N =313; critical r–value = 0.086**

Table 2 presents the obtained r-value as (0.83). This value was tested for significance by comparing it with the critical r-value (0.086) at 0.025 levels with 311 degrees of freedom. The obtained r-value (0.83) was greater than the critical r-value (0.086). Hence, the result was significant. The result therefore means that there is significant relationship between application of block chain on prompt access to resource and instruction.

Conclusion

By exploring the potential of blockchain technology in tertiary institutions, this study aims to contribute to the advancement of teaching and learning practices. The application of blockchain has the potential to revolutionize academic processes, offering increased security, transparency, and efficiency. As the technology continues to evolve, it is essential to understand its implications and challenges to maximize its benefits and ensure its successful integration into tertiary education.

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Recommendations

Based on the research conducted, here are some recommendations for the successful integration of blockchain technology in tertiary institutions:

Begin by implementing small-scale pilot programs to test the feasibility and effectiveness of blockchain technology in specific areas of the institution. This will help identify potential challenges and allow for necessary adjustments before full-scale implementation.

Engage with experts in the blockchain industry to gain insights into best practices, emerging trends, and potential applications of the technology in the education sector. Collaborations can provide valuable guidance and expertise during the implementation process.

Conduct comprehensive training and awareness programs to educate educators, administrators, students, and other stakeholders about blockchain technology. Provide resources, workshops, and seminars to ensure that stakeholders understand the benefits, functionalities, and implications of blockchain in education. This will foster acceptance and engagement with the technology.

As blockchain technology involves the storage and sharing of sensitive data, it is crucial to address privacy concerns and ensure robust data protection measures. Implement mechanisms such as encryption and permissioned access to safeguard student information and prevent unauthorized access.

Continuously monitor and evaluate the implementation of blockchain technology in tertiary institutions. Collect feedback from stakeholders, assess the impact on teaching and learning processes, and make necessary adjustments to optimize the benefits and address any emerging challenges.

Encourage research and development initiatives to explore further applications of blockchain technology in tertiary education. Support collaborations between academia and industry to drive innovation and discover new ways to leverage blockchain for enhancing teaching, learning, and administrative processes.

By following these recommendations, tertiary institutions can navigate the integration of blockchain technology successfully and harness its potential to transform teaching and learning in the digital age

Limitations

The study acknowledges some limitations, including the relatively nascent stage of blockchain implementation in education. The generalizability of the findings may be limited to specific contexts and may require further research to validate and refine the results.

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