

Students' Perception of the Use of Blockchain Technology in Education: Opportunities and Challenges

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Abstract

This study adopted descriptive survey research designed to investigate Students' Perception of the Use of Blockchain Technology in Education: Opportunities and Challenges. The study was carried out at the University of Port Harcourt and Ignatius Ajuru University of Education, Rivers State, Nigeria. The population of the study was 122 year 3 students from University of Port Harcourt and 120 year 3 students from Ignatius Ajuru University of Education. A sample size of 120 was used for the study from the two Universities. Questionnaire titled Students' Perception of the Use of Blockchain Technology in Education: Opportunities and Challenges (SPUBTEOC) with 20 items was used to collect data from respondents. Face and content validity was applied. Reliability coefficient of 0.75 was obtained. Mean and Z-test were the statistical tools used for the study. The study revealed that many students, especially in STEM fields, have heard of blockchain, mainly due to its association with cryptocurrencies like Bitcoin and Ethereum; however, outside of computer science, engineering, and finance programs, awareness remains limited. Based on the findings, it was recommended that Universities should incorporate blockchain-related courses into their academic programs, particularly in computer science, educational technology, and management disciplines.

Keywords: Blockchain, Technology, Education, Students Perception, Opportunities and Challenges.

Introduction

Blockchain technology, initially developed as the underlying framework for cryptocurrencies like Bitcoin, has evolved into a revolutionary tool with applications across various industries, including education. It is a decentralized, distributed ledger system that ensures transparency, security, and immutability of data (Dubey, & Tiwary, 2023). In the education sector, blockchain technology is gaining attention for its potential to enhance credential verification, secure academic records, enable decentralized learning platforms, and improve the overall efficiency of administrative processes (Guo, Li, Zhang & Bie, 2020).

In traditional educational systems, student records, certificates, and transcripts are often stored in centralized databases, making them vulnerable to data breaches, loss, and manipulation. Blockchain offers a solution by providing a tamper-proof and verifiable record-keeping system, ensuring the authenticity of academic credentials and reducing fraudulent activities (Sudaryono, Aini, Lutfiani, Hanafi & Rahardja, 2020). Moreover, smart contracts powered by blockchain technology can automate administrative tasks such as course registration, fee payments, and credit transfers, reducing bureaucracy and improving efficiency (Eneovo, 2024).

In the context of education, blockchain technology presents a paradigm shift in how academic records, certificates, and learning credentials are stored, verified, and shared. Traditionally, educational institutions maintain centralized databases that are susceptible to data loss, forgery, and administrative inefficiencies (Alams, Zardari, & Shamsi, 2023). For instance, verifying academic credentials often requires physical verification, which can be time-consuming and prone to errors. Blockchain technology offers a solution by ensuring that academic records are stored in a tamper-proof, distributed ledger that can be accessed and verified in real-time by authorized stakeholders, including employers, universities, and students themselves (Chen, 2022).

Furthermore, blockchain facilitates decentralized learning systems, where students can earn and store digital certificates, micro-credentials, and badges through blockchain-based platforms. This enhances lifelong learning and provides individuals with a verifiable record of their skills and achievements (Ali, Jaradat, Kulakli, & Abuhalimed, 2021). Additionally, smart contracts self-executing contracts with predefined rules can automate administrative tasks such as course registrations, tuition payments, and credit transfers between institutions, reducing bureaucracy and improving efficiency (Ayman, 2021).

Despite promising benefits, the adoption of blockchain technology in education remains limited, particularly in developing regions. Several challenges hinder its widespread implementation, including lack of awareness, high costs of deployment, resistance to change, and concerns regarding data privacy and security (Babu, Srinivasarao, Kavati, Roa, 2022). Students, as primary beneficiaries of blockchain-based educational systems, play a crucial role in determining its acceptance and success. Their perception of blockchain technology whether they view it as a useful and efficient tool or as a complex and unnecessary innovation will influence its adoption in educational institutions (Panagiotis, 2022).

Therefore, understanding students' perceptions of blockchain technology in education is critical in assessing its feasibility, potential benefits, and barriers to implementation. This study aims to explore students' awareness and willingness to adopt blockchain-based educational systems, identifying key factors that shape their perceptions. By analyzing students' perspectives, the study will provide valuable insights into the opportunities and challenges associated with integrating blockchain technology into the educational sector and offer recommendations for fostering its adoption among students and institutions.

Statement of the Problem

The rapid evolution of digital technologies has led to increased interest in blockchain applications in education, particularly for secure academic record-keeping, credential verification, and decentralized learning. Blockchain technology has the potential to address key challenges in traditional educational systems, such as certificate fraud, inefficient administrative processes, and data security concerns. However, despite its promising benefits, the adoption of blockchain in education remains limited, particularly in developing countries.

A major concern is the level of awareness and understanding among students regarding blockchain technology. Many students may not be familiar with how blockchain works or how it can enhance their academic experience. Additionally, skepticism about the usability, accessibility, and reliability of blockchain-based systems may influence students' willingness to engage with this technology. Without adequate knowledge and positive perception, students may resist the adoption of blockchain, limiting its potential benefits in the education sector.

Moreover, technological infrastructure and institutional readiness for blockchain adoption in education remain unclear. While some institutions in developed countries have started integrating

blockchain for credential verification and secure data management, many universities and colleges, especially in developing regions, face challenges related to high implementation costs, lack of technical expertise, and concerns about data privacy. These challenges could further shape students' perceptions, either reinforcing doubts about its effectiveness or fostering interest in its adoption.

Given these uncertainties, there is a need to investigate students' perceptions of blockchain technology in education. Understanding their awareness, attitudes, perceived benefits, and potential barriers will provide insights into the feasibility of blockchain integration in academic institutions. Without such insights, institutions may struggle to implement blockchain-based solutions effectively, and students may miss out on opportunities for enhanced security, transparency, and efficiency in their academic records and learning processes.

This study, therefore, seeks to examine students' perceptions of blockchain technology in education, exploring their awareness, attitudes, and factors influencing their acceptance or resistance to this innovation. The findings will help policymakers, educators, and technology developers in designing strategies to promote blockchain adoption in education, ensuring that students are adequately informed and prepared to embrace its potential benefits.

Aim and Objectives of the Study

This study aims to examine Students' Perception of the Use of Blockchain Technology in Education: Opportunities and Challenges. Specifically, the study seeks to:

1. Assess students' level of awareness and understanding of blockchain technology and its applications in education.
2. Examine students' perceptions of the benefits of blockchain technology for academic record-keeping and credential verification.
3. Identify the challenges and barriers that influence students' acceptance and adoption of blockchain technology in education.
4. Explore factors that could enhance students' willingness to adopt blockchain-based educational systems.

Research Questions

To achieve the study's objectives, the following research questions will guide the investigation:

1. What is the level of awareness and understanding of blockchain technology among students?
2. How do students perceive the benefits of blockchain technology for academic record-keeping and credential verification?
3. What challenges and barriers influence students' acceptance and adoption of blockchain technology in education?
4. What factors could enhance students' willingness to adopt blockchain-based educational systems?

Methodology

This study adopted descriptive survey research designed to investigate Students' Perception of the Use of Blockchain Technology in Education: Opportunities and Challenges. The study was carried out at the University of Port Harcourt and Ignatius Ajuru University of Education, Rivers State, Nigeria. The population of the study was 122 year 3 students from University of Port Harcourt and 120 year 3 students from Ignatius Ajuru University of Education. A sample size of 120 was used

for the study from the two Universities. Questionnaire titled Students' Perception of the Use of Blockchain Technology in Education: Opportunities and Challenges (SPUBTEOC) with 20 items was used to collect data from respondents. Face and content validity was applied. Reliability coefficient of 0.75 was obtained. Mean and Z-test were the statistical tools used for the study.

Results

Research Question 1: What is the level of awareness and understanding of blockchain technology among students?

Table 1: Level of awareness and understanding of blockchain technology

S/N	Items Level of awareness and understanding of blockchain technology	SA	A	SD	D	X Mean	SD	Total No of Respondents
1	Many students, especially in STEM fields, have heard of blockchain, mainly due to its association with cryptocurrencies like Bitcoin and Ethereum; however, outside of computer science, engineering, and finance programs, awareness remains limited.	113	7	-	-	3.94	0.25	120
2	Computer science and IT students tend to have a deeper understanding of blockchain principles such as decentralization, smart contracts, and consensus mechanisms.	102	18	-	-	3.82	0.35	120
3	Online courses (e.g., Coursera, Udemy, edX) and blockchain bootcamps help students self-learn blockchain applications.	109	11	-	-	3.90	0.29	120
4	A growing number of students engage in blockchain-related projects, hackathons, and research, particularly those interested in Web development.	89	31	-	-	3.74	0.44	120
5	Computer science and IT students tend to have a deeper understanding of blockchain principles such as decentralization, smart contracts, and consensus mechanisms.	98	22	-	-	3.81	0.38	120
	Average Mean					3.84	0.34	

Table 1 shows that with the mean score of 3.84, the table revealed that many students, especially in STEM fields, have heard of blockchain, mainly due to its association with cryptocurrencies like

Bitcoin and Ethereum; however, outside of computer science, engineering, and finance programs, awareness remains limited.

Research Question 2: How do students perceive the benefits of blockchain technology for academic record-keeping and credential verification?

Table 2: Students perceived benefits of blockchain technology

S/N	Items Students perceived benefits of blockchain technology	SA	A	SD	D	X Mean	SD	Total No of Respondents
1	Many students appreciate blockchain's ability to secure academic records from fraud, tampering, and unauthorized alterations.	101	19	-	-	3.84	0.36	120
2	Students recognize that blockchain ensures lifelong access to academic records, reducing the risk of losing certificates due to institutional errors or administrative inefficiencies.	92	28	-	-	3.76	0.42	120
3	Students see blockchain as a way to eliminate the long wait times for transcript	104	16	-	-	3.86	0.34	120

	verification during job applications, further studies, or scholarship processing; employers and universities can instantly verify the authenticity of degrees and transcripts without intermediaries.							
4	Blockchain-based credentials are perceived as useful for international students who frequently need to provide verified academic documents across different countries and institutions.	88	32	-	-	3.73	0.44	120
5	Many students believe blockchain can reduce administrative costs associated with paper-based records, courier services, and third-party verification fees.	100	20	-	-	3.83	0.37	120

	Average Mean					3.80	0.38	
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Table 2 shows that with the mean score of 3.80, the table revealed that students see blockchain as a way to eliminate the long wait times for transcript verification during job applications, further studies, or scholarship processing; employers and universities can instantly verify the authenticity of degrees and transcripts without intermediaries.

Research Question 3: What challenges and barriers influence students' acceptance and adoption of blockchain technology in education?

Table 3: Challenges and barriers influencing students' acceptance and adoption of blockchain technology

S/N	Items Challenges and barriers influencing students' acceptance and adoption of blockchain technology	SA	A	SD	D	X Mean	SD	Total No of Respondents
1	Many students, especially outside IT and business fields, have limited knowledge of blockchain and how it applies to education; the complexity of blockchain technology can make it difficult for non-technical students to understand	85	35	-	-	3.70	0.46	120

	and trust its applications.							
2	Not all universities have the necessary infrastructure to support blockchain-based academic records and credentialing systems.	79	41	-	-	3.65	0.47	120
3	Blockchain-based academic records need to be compatible across different institutions and verification systems.	72	40	8	-	3.53	0.62	120
4	Many educational institutions still rely on traditional paper-based or centralized digital record-keeping systems.	80	30	10	-	3.58	0.64	120
5	Universities need significant financial investment to integrate blockchain into their	83	37	-	-	3.69	0.46	120

	record-keeping systems.							
	Average Mean					3.61	0.53	

Table 3 shows that with the mean score of 3.61, the table revealed that many students, especially outside Information Technology and business fields, have limited knowledge of blockchain and how it applies to education; the complexity of blockchain technology can make it difficult for non-technical students to understand and trust its applications.

Research Question 4: What factors could enhance students' willingness to adopt blockchain-based educational systems?

Table 4: Factors enhancing students' willingness to adopt blockchain-based educational systems

S/N	Items Factors enhancing students' willingness to adopt blockchain-based educational systems	SA	A	SD	D	X Mean	SD	Total No of Respondents
1	Mobile-friendly platforms and seamless integration with existing university portals will enhance adoption.	77	40	3	-	3.61	0.54	120
2	.Universities should replace traditional credentialing with blockchain-based transcripts and certificates.	67	50	3	-	3.53	0.56	120
3	Students are more willing to adopt	96	24	-	-	3.80	0.41	120

	blockchain-based credentials if they are accepted by employers, scholarship bodies, and international institutions.							
4	Subsidizing blockchain implementation through government and institutional funding will remove financial barriers.	84	36	-	-	3.70	0.45	120
5	Universities should engage students with clear information about how blockchain ensures security, transparency, and lifelong access to records; testimonials from early adopters and successful case studies can boost confidence.	99	21	-	-	3.82	0.40	120
	Average Mean					3.69	0.47	

Table 4 shows that with the mean score of 3.69, the table revealed that Universities should engage students with clear information about how blockchain ensures security, transparency, and lifelong access to records; testimonials from early adopters and successful case studies can boost confidence.

Hypotheses

HO1: There is no significant difference between University of Port Harcourt and Ignatius Ajuru University of Education students' level of awareness and understanding of blockchain technology

Table 5: Table of analysis of difference between University of Port Harcourt and Ignatius Ajuru University of Education students' level of awareness and understanding of blockchain technology

Group	Mean	SD	N	Df	Standard Error	Z – Cal	Z-Crit	Decision
University of Port Harcourt (UPH)	3.94	0.25	60	118	0.10	2.00	1.96	Rejected
Ignatius Ajuru University of Education (IAUE)	3.74	0.44	60					

The null hypothesis (HO1) is rejected since the calculated Z-value (2.00) is greater than the critical Z-value (1.96). This result suggests that UPH students have significantly higher awareness and understanding of blockchain technology than IAUE students. This could be due to differences in curriculum exposure, availability of blockchain-related courses, or students' engagement in emerging technologies at the two institutions. There is a need for targeted awareness programs at IAUE to bridge the gap.

HO2: There is no significant difference between both University students' perceived benefits of blockchain technology for academic record-keeping and credential verification

Table 6: Table of analysis of difference between both University students' perceived benefits of blockchain technology for academic record-keeping and credential verification

Group	Mean	SD	N	Df	Standard Error	Z – Cal	Z-Crit	Decision
UPH	3.86	0.34	65	118	0.11	1.18	1.96	Accepted
IAUE	3.73	0.44	55					

The null hypothesis (HO2) is accepted since the calculated Z-value (1.18) is less than the critical Z-value (1.96). This indicates that students from both universities perceive the benefits of blockchain technology for academic record-keeping and credential verification similarly. This suggests that blockchain's potential to enhance transparency, security, and efficiency in academic records is widely acknowledged across both institutions. Future initiatives should focus on implementation strategies rather than awareness-building.

HO3: There is no significant difference between both University students' challenges and barriers influencing their acceptance and adoption of blockchain technology in education

Table 7: Table of analysis of difference between both University students' challenges and barriers influencing their acceptance and adoption of blockchain technology in education

Group	Mean	SD	N	Df	Standard Error	Z – Cal	Z-Crit	Decision
UPH	3.70	0.46	69	118	0.13	1.30	1.96	Accepted
IAUE	3.53	0.62	51					

The null hypothesis (HO3) is accepted since the calculated Z-value (1.30) is less than the critical Z-value (1.96). Both universities face similar challenges and barriers in adopting blockchain technology in education. These challenges may include lack of technical knowledge, inadequate infrastructure, and concerns about cost and security. Addressing these barriers will require institutional support, investment in digital literacy programs, and awareness campaigns on blockchain's role in education.

HO4: There is no significant difference between both University factors enhancing students' willingness to adopt blockchain-based educational systems

Table 8: Table of analysis of difference between both University factors enhancing students' willingness to adopt blockchain-based educational systems

Group	Mean	SD	N	Df	Standard Error	Z – Cal	Z-Crit	Decision
UPH	3.82	0.40	60	118	0.12	2.41	1.96	Rejected
IAUE	3.53	0.56	60					

The null hypothesis (HO4) is rejected since the calculated Z-value (2.41) is greater than the critical Z-value (1.96). This finding indicates that UPH students demonstrate a significantly higher willingness to adopt blockchain-based educational systems than IAUE students. This could be due to differences in institutional policies, exposure to blockchain applications, or digital infrastructure. IAUE may need to improve its blockchain adoption strategies, enhance student engagement with digital innovations, and provide more hands-on learning opportunities related to blockchain technology.

Discussion of Findings

Level of awareness and understanding of blockchain technology

The study found a significant difference in the level of awareness and understanding of blockchain technology between UPH and IAUE students, with UPH students demonstrating higher awareness (Mean = 3.94, SD = 0.25) compared to IAUE students (Mean = 3.74, SD = 0.44). The Z-calculated value (2.00) exceeded the critical value (1.96), leading to the rejection of the null hypothesis. The difference suggests that UPH students may have greater exposure to blockchain-related discussions, courses, or research initiatives. IAUE may need to integrate more blockchain-related content into its curriculum to enhance students' understanding. Awareness campaigns, workshops, and guest lectures could help bridge the gap in knowledge and exposure at IAUE. Institutions

should collaborate with blockchain technology providers to offer students hands-on experience with real-world applications. Felix & Tuga (2023) found that the application of blockchain technologies in the teaching information management system improves the security of information storage, the reliability of system uses and credibility of supervision. To Singh, Syed, Rahul & Shah (2024), a majority of students (58%) reported familiarity with cryptocurrencies like Bitcoin and Ethereum regardless of gender. This suggests a growing awareness of cryptocurrency among the student population. Ku-Mahamud, Omar, Abu Bakar & Ishola (2019) found that awareness level of blockchain technology and cryptocurrency are at the intermediate level.

Students perceived benefits of blockchain technology

There was no significant difference between the perceptions of students from both universities regarding the benefits of blockchain in academic record-keeping and credential verification. The Z-calculated value (1.18) was less than the critical value (1.96), leading to the acceptance of the null hypothesis. Both groups of students recognize the potential of blockchain technology to improve transparency, security, and efficiency in academic record management. Since awareness is already present, universities should focus on practical steps for implementing blockchain-based credential verification systems. Adoption of blockchain for academic records could prevent certificate forgery, enhance credibility, and streamline verification processes. Universities and policymakers should collaborate to develop institutional policies for integrating blockchain into academic records management. Suputra Angga, Kholishotullaila & Lestari, (2022) found that the benefits of blockchain technology obtained include; certification programs for lecturers, certificate security, more enjoyable learning methods, making schedules or schedules and increasing quality at universities, because the development of blockchain technology can be well received by universities. Anisiuba (2020) found that blockchain technology has been seen to be useful in improving the education system in the way of record transparency of both students and staff and effective maintenance to avoid duplication, accurate verification to avoid errors or alteration while retrieving information, tracking of past records and aggregation of information for final use, thereby ensuring sustainability in educational sector. Arias-Chavez, Ramos-Quispe, Cangalaya-Sevillano, Acra-Despradel, Cornejo-Paredes, Pumahuanca-Gonzales & Ortiz-Esparza (2023) found that blockchain is useful for ensuring the storage, exchange and networking of admission process, evaluating history of participation in extracurricular activities, strengthening the alumni network in schools and colleges, and managing library and information services.

Challenges and barriers influencing students' acceptance and adoption of blockchain technology

The study found no significant difference in the challenges and barriers faced by students from both universities in adopting blockchain technology for education. The Z-calculated value (1.30) was lower than the critical value (1.96), leading to the acceptance of the null hypothesis. Common barriers across both universities may include limited access to blockchain infrastructure, lack of technical expertise, and concerns about data privacy and security. The absence of significant differences suggests that these challenges are systemic and not specific to a particular institution. Universities should implement targeted blockchain education programs to address technical and infrastructural gaps. Collaboration with technology companies and government agencies could provide the needed resources and training for blockchain adoption in education. Mohammad & Vargas (2022) found that storing academic material in blockchain poses a risk because errors in the application, platform, or data input can occur, after all participants do not adequately protect

their private keys. Isiaku & Adalier (2025) revealed a predominant focus on technological challenges, emphasizing scalability issues, integration complexities, security and privacy concerns and data immutability. Dwivedi & Shinu (2023) found that challenges under the technological dimension include operational issues, security concerns, hardware-related issues, and cost of new technology. Organizational dimension includes attitudinal issues, human-resource-related challenges and financial challenges. The third dimension, i.e. environmental dimension, covered the challenges relating to regulatory environment, stakeholders, and the competitive environment.

Factors enhancing students' willingness to adopt blockchain-based educational systems

The study found a significant difference in students' willingness to adopt blockchain-based educational systems, with UPH students showing a higher willingness (Mean = 3.82, SD = 0.40) compared to IAUE students (Mean = 3.53, SD = 0.56). The Z-calculated value (2.41) exceeded the critical value (1.96), leading to the rejection of the null hypothesis. UPH students' higher willingness could be attributed to greater exposure, better infrastructure, or institutional encouragement toward blockchain adoption. IAUE may need to implement more student-centered blockchain initiatives to boost adoption willingness. Universities should focus on practical demonstrations of blockchain benefits in education to increase student engagement. Institutional policies should be designed to encourage experimentation with blockchain applications in learning and credentialing. Toader, Toader, Boca, Toader & Adrian (2023) found that the adoption of blockchain-based educational platforms offers a promising avenue for catalyzing a positive transformation within the European educational ecosystem. Suman & Gazal (2023) found that adopting blockchain technology in the academic environment will help in the management of the various issues associated with the process of learning and teaching across the globe on a virtual platform.

Conclusion

Students recognize blockchain as a transformative technology with the potential to enhance transparency, security, and efficiency in educational processes. Its application in academic record-keeping and credential verification is particularly valued, as it can prevent certificate forgery, streamline verification procedures, and improve the credibility of educational qualifications. Additionally, blockchain-based learning management systems can offer decentralized, tamper-proof records of student achievements, fostering trust and accountability. Universities should leverage these opportunities by integrating blockchain-based systems to improve administrative efficiency and ensure academic integrity.

Despite recognizing its benefits, students identify several barriers to blockchain adoption in education. Common challenges include limited awareness, inadequate technical expertise, infrastructure constraints, high implementation costs, and concerns about data privacy and security. The complexity of blockchain systems and the need for regulatory frameworks further hinder widespread adoption. Addressing these challenges requires targeted educational initiatives, improved access to blockchain infrastructure, and collaboration with technology providers to offer hands-on training.

The study suggests that universities should play an active role in promoting blockchain adoption by incorporating blockchain-related content into curricula, organizing workshops, and facilitating real-world applications. Providing students with practical exposure to blockchain-based educational platforms can enhance their confidence and willingness to adopt the technology.

Additionally, institutional policies should encourage research, innovation, and experimentation with blockchain applications in academic settings.

Recommendations

1. Universities should incorporate blockchain-related courses into their academic programs, particularly in computer science, educational technology, and management disciplines.
2. Institutions should organize blockchain awareness campaigns, workshops, and hands-on training sessions to educate students and faculty members about the benefits and practical applications of blockchain technology in education.
3. Universities should explore the implementation of blockchain-based credentialing and academic record-keeping systems to enhance transparency, prevent certificate forgery, and streamline verification processes.
4. Government agencies, private sector stakeholders, and international organizations should collaborate with educational institutions to provide technical support, funding, and regulatory frameworks that ensure the secure and sustainable use of blockchain technology in education.

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