IJCRT.ORG   **ISSN : 2320-2882**

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

A Study Of Blockchain For Digital Credentialing In Higher Education In India

Ms. Shweta Dogra
Ph.D. Scholar
University School of Education
Guru Gobind Singh Indraprastha University,
New Delhi
Orcid ID: https://orcid.org/0009-0003-5406-9214

Abstract

Digital credentialing forms a crucial element in today's fast-changing world, thereby helping in building trust, with the adoption of new innovative technology that tends to help an individual to keep their diplomas and certificates tamper-proof, secure, and transparent, thus providing authenticity for one's identity that can be verified anytime. However, blockchain technology comes to the rescue. With the help of blockchain, verification can be applied in a wide variety of sectors such as Education, Health and Safety, Finance, and many more. Blockchain verification bestows the power of decentralized networks to establish trust, enhance the reliability and efficiency of data verification. The purpose of this paper was to explore the awareness, perceptions, opportunities, and obstacles that educators assess. Few studies reflect how Blockchain technology for Digital Credentialing in Higher Education establishes a sense of trust by its adoption and check the awareness and perceptions amongst the educators in higher education in India, the opportunities and obstacles according to them. So, to fill this gap, the researcher conducted descriptive research. The sample consisted of 120 educators randomly selected from the university in South-West Delhi. A Likert scale was distributed to examine the awareness and perceptions of educators on the usage of blockchain for digital credentialing in higher education. The present paper attempts to explore the awareness, perceptions, opportunities, and obstacles that educators assess. Data was analyzed using percentage analysis. The findings suggest that Blockchain for Digital Credentialing in Higher Education can prove to be beneficial for establishing trust amongst educators in higher education if used with caution. Educational implications were listed at the end, followed by a conclusion.

Keywords: Blockchain, Digital Credentialing, Higher Education

Introduction:

Digital credentialing forms a crucial element in today's fast-changing world, thereby helping in building trust, with the adoption of new innovative technology that tends to help an individual to keep their diplomas and certificates tamper-proof, secure, and transparent, thus providing authenticity for one's identity that can be verified anytime. Digital credentialing is the process of issuing, managing, and verifying credentials (such as degrees, certificates, badges, licenses, etc.) electronically rather than on paper. It replaces traditional physical documents with secure, verifiable digital versions. It ensures a digital identity that is tamper-proof, secure, and transparent in nature, that can be verified, portable, accessible, and verifiable anytime. For instance, MIT's Blockcerts lets students own a digital, verifiable copy of their diploma. EduCTX and TruScholar are considered as pioneers in this space, creating a decentralised and tamper-proof systems that enhance academic integrity and streamline the verification process for institutions and employers globally. Not only this, platforms like NPTEL, Swayam provide these facilities. Also, the National Academic Depository (NAD) implemented by the Government of India (through DigiLocker and CDSL ventures) helps to store verified educational documents such as degrees, marksheets, and diplomas, and reduces document fraud, simplifying verification for students and employers. University of Nicosia (UNIC) of Cyprus offers blockchain-based credentials and was the first to offer a master's degree in digital currency. The Central Board of Secondary Education (CBSE), in collaboration with the National Informatics Centre (NIC) in the year 2021, adopted blockchain to digitally store board results for classes 10 and 12. All these come under the aegis of the Digital India initiative under the Government of India and the NEP 2020 goals under the Ministry of Education, Government of India. Many researchers have come forward with interesting proposals and solutions to adopt blockchain into the field of education. **Palanichamy, N., Haw, S. C., Anaam, E.A., & Ng, K.W. (2024)** in their paper discuss about blockchain and its advancement in the education domain with regards to storing certificates and verification, how smart contracts can be used to provide storage for certificates, and the challenges in adopting blockchain-based solutions and found that Blockchains is a distributed peer to peer ledger of data that provide trustworthiness, making it a potential technology to solve the issue of fake certificates.

Blockchain can be described as a collection of records linked with each other that is strongly resistant to alteration as protected using cryptography. Blockchain technology can be described as a technology that offer security, authenticity, immutability, longevity, data, information, decentralization, no intermediator, reliability, and data integrity. With the help of blockchain, verification can be applied in a wide variety of sectors such as Education, Health and Safety, Finance, and many more. **Dziatkovskii. A. (2022)** in a article explore one of the ways of digitalization of education and concluded that Blockchain technology opens up fundamentally new opportunities for the education system, thereby forming the conditions for the educational system to reach a qualitatively new level of development and its use of blockchain technology in the education system is associated with its ability to collect information, store it in an unchanged form, control the reliability of data, create rules and methods of management activities. **Mihus, I. (2020)** in an article, systematized the areas of possible use of blockchain technologies in the activities of universities. It can be inferred that the possibility of using blockchain technologies in the management of educational institutions will bring them to a new level of functioning, which will improve the quality of the educational process and the level of knowledge of students.

Blockchain verification bestows the power of decentralized networks to establish trust, enhance the reliability and efficiency of data verification. Blockchain verification is a fundamental process within decentralized ledger technology that confirms the authenticity and accuracy of data and

transactions by using cryptographic methods and network consensus. This mechanism ensures data integrity, making it extremely difficult to tamper with information once it's on the blockchain, which is crucial for building trust and transparency in digital systems, especially for things like financial transactions, supply chains, and digital identities.

As per the National Education Policy 2020 (NEP 2020), the role of technology in all aspects of education, including teaching, learning, and assessment, is given priority. It mentions that different technological advancements, including artificial intelligence and blockchain, will help shape the future of learning. The NEP 2020 mandates the creation of the National Education Technology Forum (NETF), a body that promotes the use of technology to enhance learning, assessment, and planning. It serves as a platform to exchange ideas on how technologies like blockchain can be used to improve the education system. A key initiative under the NEP 2020, the National Credit Framework (NCrF), is a framework for accumulating and transferring academic credits. Blockchain technology provides the secure, tamper-proof ledger needed for this system to ensure that student records and credits are authentic and easily transferable between institutions. The Academic Bank of Credits (ABC), a digital repository under the NCrF, stores academic credits earned by students. Blockchain ensures these credits are tamper-proof and securely stored, allowing for seamless credit transfers and recognition of prior learning. The Central Board of Secondary Education (CBSE) has collaborated with the National Informatics Centre (NIC) to launch the Academic Blockchain Documents initiative. This system uses blockchain to record academic documents securely, preventing fraud and speeding up the verification process for students, higher education institutes, and employers. The tamper-proof and transparent nature of blockchain technology helps to build trust in Indian educational credentials, which is crucial for international recognition.

In many nations, some jurisdictions have laws like GDPR (General Data Protection Regulations), which can affect the decision when creating blockchain-based platforms for such regions. Institutes storing certificates on blockchain also need to have credibility and trust in them. However, blockchain technology comes to the rescue.

The researcher aims to explore the awareness, perceptions, opportunities, and obstacles that the educators assess.

Review of the Related Literature:

S.No	Author name	Year	Research Design	Data collection	Findings
1.	Caramihai, M., & Severin, I. A.	2023	Mixed methods research approach	Questionnaires. Interviews	• The participants can have an in-depth understanding of the implications of blockchain in education. • Various relationships exist between the application of blockchain technology within the education sector and other fields.
2.	Chae, Y.	2023	Systematic literature review	Inclusion and exclusion criteria	• Adoption of blockchain in the field of education is inhibited by concerns with respect to privacy, standardization, scalability, juristic considerations, control of data, cost of implementation, technical gap, security of data, and acceptance in the socio-cultural context.
3.	Chivu et al.,	2022	Quantitative research	Semi structure interviews. Questionnaires	• Both students and educators from the university environment could be interested in the application of blockchain technologies within the teaching-learning process.
4.	Delgado-von-Eitzen, C., Anido-Rifón, L., & Fernández-Iglesias, M. J.	2021	Systematic literature reviews	PRISMA	• Blockchain may become a significant technology in the educational field.
5.	Dewangan et al.,	2023	Experimental research	Pre-test, post-test design	• A comparison of the proposed system with the previously developed systems in terms of privacy, transaction cost, large file storage, blockchain implementation, and registration cost

					was observed, and found to be more effective than the previous version.
6.	Dubey, S., & Tiwary, A. K.	2023	Systematic literature review		● Blockchain-based smart education has the potential to revolutionize the education sector by providing secure, decentralized, and open systems for maintaining academic records, verifying credentials, and tracking learning progress.
7.	Gutowski, P., Markiewicz, J., Niedzielski, P., & Klein, M.	2022	Qualitative research	Delphi method	● Blockchain technology itself is important in learning about business transformations. ● The ever-evolving technology has not yet fully explored the limits of its applications. ● Blockchain is a new paradigm for digital data management and learning.
8.	Iyer, S. S.	2022	Quantitative research	PLS-SEM	● The Education Blockchain 4.0 smart system is certain to integrate further technologies, making it the most desirable choice for such applications.
9.	Kaur, K.	2024	Conceptual paper		● The adoption of blockchain technology in the education sector is still at an early stage. ● Blockchain technology is mostly used to issue and verify academic certificates, share students' competencies and learning achievements, and evaluate their professional ability. ● Blockchain brings important benefits to education, like providing a secure platform to share students' data, lowering costs, and enhancing trust and transparency.

					● The use of blockchain technology has certain challenges such as security, privacy, cost, scalability, and availability before adopting the technology.
10.	Leung, A. C. Y., Liu, D. Y.W., Luo, X., & Au, M. H.	2024	Mixed methods research	Questionnaires	● This study can serve as an example for educators in blockchain to implement a systemic approach that scaffolds the teaching-learning process and further improves the field of blockchain and education.
11.	Meyliana, et al.,	2020	Mixed methods research approach	pre- and post-questionnaires	● Blockchain technology can be used to solve the problems in universities.

Research Objectives:

RO1: To check the awareness among educators regarding the blockchain technology used in digital credentialing in higher education.

RO2: To examine the perceptions of educators regarding the blockchain technology used in digital credentialing in higher education.

Research Design:

The researcher, by undertaking the present study, aims to explore the awareness, perceptions, opportunities, and obstacles that educators assess. For this, the researcher undertook descriptive research. The sample consisted of 120 educators randomly selected from the university in South-West Delhi. A survey method was used to check the awareness, and a Likert scale was distributed to list the opportunities and the obstacles assessed by educators in using blockchain technology in digital credentialing in higher education. Data was analyzed using percentage analysis.

Findings and Interpretation of Results:

RO1: To check the awareness among educators regarding the blockchain technology used in digital credentialing in higher education.

1. Have you heard of blockchain technology before?
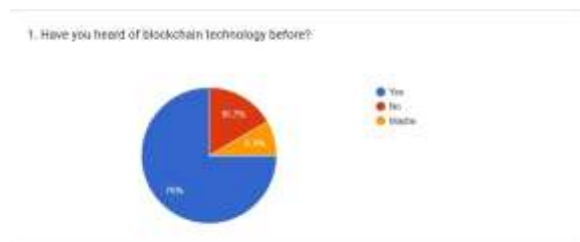
The pie chart illustrates respondents' prior awareness of blockchain technology. The data indicate that a substantial majority of respondents (75%) reported that they had heard of blockchain

technology. In contrast, 16.7% of the respondents indicated that they had not heard of blockchain, while a smaller proportion (8.3%) expressed uncertainty by selecting "Maybe."

2. If yes, how did you learn about blockchain? (Select all that apply)

The results indicate that respondents primarily learned about blockchain technology through informal and digital sources. A substantial majority reported online media and news platforms (75%) as their main source of information, followed by social media (66.7%). Formal academic sources such as academic journals were cited by 33.3% of the respondents. In contrast, relatively fewer respondents reported learning about blockchain through conferences or workshops (16.7%), colleagues (16.7%), or other sources (16.7%). As the question allowed multiple responses, the findings reflect overlapping sources of exposure.

3. How would you rate your current knowledge of blockchain technology?
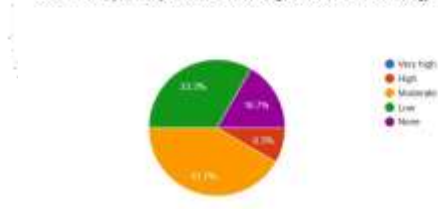
The figure presents respondents' self-assessment of their current knowledge of blockchain technology. The results show that the largest proportion of respondents rated their knowledge as moderate (41.7%), followed by low (33.3%). A smaller proportion reported no knowledge (16.7%), while

only 8.3% rated their knowledge as high. Notably, no respondents reported having very high knowledge of blockchain technology.

These findings indicate that although a majority of respondents are aware of blockchain technology, their perceived level of understanding remains limited. The predominance of moderate and low self-ratings suggests that familiarity with the concept does not necessarily translate into strong or expert-level knowledge. The absence of respondents reporting very high knowledge further reinforces the notion that blockchain remains an emerging and not yet deeply understood technology among the study population.

When interpreted alongside earlier findings on awareness and sources of information, a clear pattern emerges. While blockchain awareness is relatively high and largely driven by online media and social media, such informal exposure appears insufficient for developing advanced or specialized knowledge. Media-driven learning often prioritizes visibility and general narratives over technical depth, which may explain why respondents cluster around moderate or low knowledge levels.

Overall, the results highlight a gap between awareness, exposure, and depth of understanding. This gap has important implications for readiness to adopt or implement blockchain-based systems. Without adequate conceptual and technical knowledge, stakeholders may face challenges in evaluating the relevance, feasibility, or implications of blockchain applications in professional or educational contexts.

4. Blockchain is a distributed ledger technology.

The figure presents respondents' level of agreement with the statement "Blockchain is a distributed ledger technology." The results indicate that a

majority of respondents demonstrated correct conceptual recognition of blockchain's foundational definition. Specifically, 58.3% of respondents agreed and 16.7% strongly agreed with the statement, together accounting for 75% of affirmative responses.

In contrast, 16.7% of respondents selected the neutral option, while 8.3% disagreed with the statement. Notably, no respondents selected the strongly disagree option.

These findings suggest that while a substantial proportion of respondents possess a basic conceptual understanding of blockchain as a distributed ledger technology, this understanding is not universal. The presence of neutral and disagreeing responses indicates uncertainty or misconceptions regarding a core definitional aspect of blockchain. This partial conceptual clarity aligns with earlier findings in the study, which showed that respondents' knowledge levels were predominantly moderate to low and that awareness was largely shaped by informal digital sources.

When interpreted in conjunction with prior results, the findings reinforce the distinction between general awareness and accurate conceptual understanding. Although respondents may recognize the term "blockchain," not all demonstrate confidence in its fundamental technical definition. This suggests that exposure through media and informal channels may support recognition but may be insufficient for developing precise conceptual knowledge.

Overall, the results indicate that while foundational understanding exists among a majority of respondents, targeted instructional interventions are necessary to address remaining gaps and misconceptions. Such conceptual clarity is essential for informed evaluation, acceptance, and effective application of blockchain technologies in educational, administrative, or professional contexts.

5. Blockchain ensures data immutability and transparency.
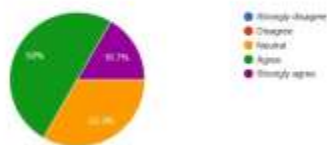
The results depict respondents' level of agreement with the statement "Blockchain ensures data immutability and transparency." Half of the respondents (50%) indicated Agree, while 16.7% selected Strongly Agree, resulting in 66.7% affirmative responses. In contrast, 33.3% of the respondents selected the Neutral option. Notably, none of the respondents selected Disagree or Strongly Disagree.

6. Smart contracts are a key feature of blockchain platforms.

The results reflect respondents' level of agreement with the statement "Smart contracts are a key feature of blockchain platforms." A majority of respondents (58.3%) selected the Neutral option, indicating uncertainty regarding the statement. In contrast, 41.7% of respondents expressed Agreement. Notably, no respondents selected Strongly Agree, Disagree, or Strongly Disagree.

7. Are you aware that blockchain technology is being used for issuing digital certificates/credentials?

The results illustrate respondents' awareness of the use of blockchain technology for issuing digital certificates and credentials. Half of the respondents (50%) reported that they were aware of this application. In contrast, 33.3% indicated that they were not aware, while 16.7% selected the Maybe option, reflecting uncertainty. Overall, the findings

suggest moderate awareness of blockchain-based digital credentialing among the respondents.

8. Have you come across any universities or institutions using blockchain for issuing degrees or certificates?

The results illustrate respondents' awareness of universities or institutions using blockchain technology for issuing degrees or certificates. Only 16.7% of respondents reported that they had come across such institutions. In contrast, 41.7% indicated that they had not encountered any such examples, while an equal proportion (41.7%) selected the Maybe option, reflecting uncertainty. Overall, the findings indicate limited and ambiguous awareness of institutional-level implementation of blockchain-based credentialing.

9. Which of the following best describes your understanding of blockchain-based digital credentials?

The pie chart presents respondents' self-reported understanding of blockchain-based digital credentials. The data indicate that 41.7% of the respondents reported being somewhat knowledgeable about blockchain-based digital credentials, while an equal proportion (41.7%) indicated that they had heard of it but did not understand it. In contrast, only 8.3% of the respondents described themselves as highly knowledgeable, and another 8.3% reported that they had never heard of blockchain-based digital credentials.

Overall, the distribution suggests that awareness of blockchain-based digital credentials exists among a majority of respondents; however, in-depth understanding remains limited.

10. In your opinion, what are the key advantages of using blockchain for digital credentialing? (Select all that apply)

The pie chart illustrates respondents' perceptions of the key advantages of using blockchain technology for digital credentialing. As this was a multiple-response item, percentages exceed 100%. The most frequently selected advantages were reduction in fraud (50%) and global recognition (50%), indicating that half of the respondents perceived blockchain as particularly valuable for enhancing the credibility and portability of credentials.

Additionally, tamper-proof certificates (41.7%), instant verification (41.7%), and lifelong accessibility (41.7%) were identified as important advantages by a substantial proportion of respondents. Notably, 41.7% of respondents also selected "Not sure", suggesting a degree of uncertainty regarding the concrete benefits of blockchain-based digital credentialing.

11. Do you think educators should be aware of blockchain-based credentialing systems?

The pie chart depicts respondents' opinions regarding whether educators should be aware of blockchain-based credentialing systems. A clear majority of respondents (66.7%) expressed agreement that educators should be aware of such systems. Meanwhile, 33.3% of respondents selected "Maybe", indicating conditional or uncertain support. Notably, no respondents (0%) disagreed with the statement.

12. Would you be interested in attending a workshop or training on blockchain in higher education?

The pie chart illustrates respondents' interest in attending a workshop or training program on blockchain in higher education. An overwhelming majority of respondents (91.7%) indicated "Yes", expressing a clear willingness to participate in such training. A small proportion (8.3%) reported "No", while no respondents selected the "Maybe" option.

13. What are your concerns about using blockchain in higher education? (Select all that apply)
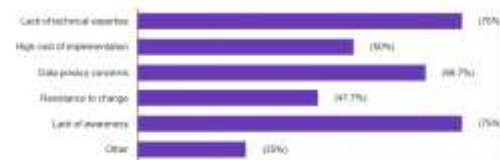
The pie chart presents respondents' concerns regarding the use of blockchain technology in higher education. As this was a multiple-response item, percentages exceed 100%. The most frequently reported concerns were lack of technical expertise (75%) and lack of awareness (75%), indicating that three-fourths of the respondents perceived human capacity and knowledge gaps as major barriers to blockchain adoption.

Concerns related to data privacy (66.7%) were also prominently reported, reflecting apprehensions about the security and ethical management of academic data. Additionally, high cost of implementation (50%) was identified as a significant constraint, followed by resistance to change (41.7%). A smaller proportion of respondents (25%) selected "Other" concerns.

14. Do you believe blockchain has the potential to transform how academic records are issued and verified?
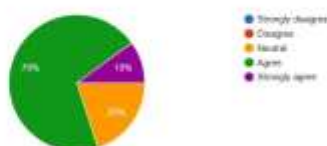

expressed a positive perception regarding blockchain's role in enhancing the security of digital credentials.

Meanwhile, 20% of respondents selected the neutral option. Notably, no respondents reported disagreement or strong disagreement with the statement.

The pie chart illustrates respondents' perceptions regarding the potential of blockchain technology to transform the issuance and verification of academic records. The findings show that a majority of respondents expressed positive perceptions, with 41.7% agreeing and 25% strongly agreeing that blockchain has transformative potential in this domain. Together, 66.7% of respondents endorsed a positive stance toward blockchain-enabled academic record management.

Additionally, 33.3% of respondents selected the neutral option. Notably, no respondents expressed disagreement or strong disagreement with the statement.

RO2: To examine the perceptions of educators regarding the blockchain technology used in digital credentialing in higher education.

1. Blockchain technology enhances the security of digital credentials.

The analysis illustrates respondents' perceptions of the statement "Blockchain technology enhances the security of digital credentials." The findings indicate strong agreement with this assertion. A substantial majority of respondents (**70%**) agreed with the statement, while an additional 10% strongly agreed. Collectively, 80% of respondents

2. Blockchain can prevent the forgery of academic certificates.

The analysis presents respondents' perceptions of the statement "Blockchain can prevent the forgery of academic certificates." The findings indicate a predominantly positive perception. A majority of respondents (60%) agreed with the statement, while the remaining 40% selected the neutral option. Notably, no respondents reported strong agreement, disagreement, or strong disagreement.

3. Blockchain-based credentials are easier to verify by employers and institutions.
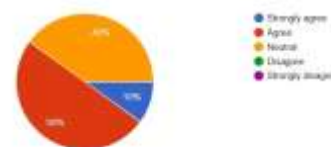
The analysis of responses to the statement "Blockchain-based credentials are easier to verify by employers and institutions" reveals an overall positive perception among respondents. A majority of participants (60%) expressed agreement with the statement, with 50% agreeing and 10% strongly agreeing. Additionally, 40% of respondents selected the neutral option, indicating neither agreement nor disagreement. Notably, no respondents disagreed or strongly disagreed with the statement.

These results indicate that respondents generally perceive blockchain-based credentials as facilitating easier verification processes, while a substantial proportion remains undecided or insufficiently informed about their practical utility.
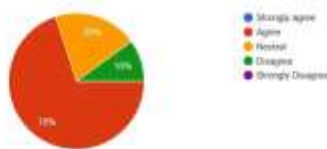
4. The use of blockchain in credentialing increases trust in higher education systems.

6. The implementation of blockchain technology requires significant technical expertise.

The responses to the statement "The use of blockchain in credentialing increases trust in higher education systems" indicate a predominantly positive perception among respondents. A majority (60%) of participants agreed with the statement, while 30% selected the neutral option. A smaller proportion (10%) disagreed with the statement. Notably, no respondents strongly agreed or strongly disagreed.

Overall, the findings demonstrate that most respondents perceive blockchain-based credentialing as a mechanism that enhances trust within higher education systems, although a segment of respondents remains uncertain or unconvinced.

The responses to the statement "The implementation of blockchain technology requires significant technical expertise" indicate a strong consensus among respondents regarding the technical complexity associated with blockchain adoption. Half of the respondents (50%) agreed with the statement, while a substantial proportion (40%) strongly agreed. Additionally, 10% of respondents selected the neutral option. Importantly, no respondents disagreed or strongly disagreed.

Overall, the results demonstrate that an overwhelming majority (90%) of respondents perceive blockchain implementation as technically demanding.

5. Blockchain can make credentialing more efficient and cost-effective in the long run.

7. There is a lack of awareness about blockchain among educators.

The responses to the statement "Blockchain can make credentialing more efficient and cost-effective in the long run" indicate a strong positive perception among respondents. A substantial majority (70%) of participants agreed with the statement. Additionally, 20% of respondents selected the neutral option, while 10% disagreed. Notably, no respondents strongly agreed or strongly disagreed.

Overall, the results suggest that most respondents perceive blockchain technology as a viable solution for improving efficiency and reducing long-term costs in credentialing processes.
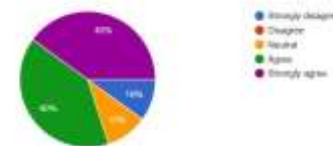
The responses to the statement "There is a lack of awareness about blockchain among educators" indicate a strong perception of insufficient awareness within the teaching community. A substantial majority (80%) of respondents endorsed the statement, with 40% agreeing and 40% strongly agreeing. In contrast, 10% of respondents were neutral, while 10% strongly disagreed. Notably, no respondents selected the "disagree" option.

Overall, the findings suggest that most respondents perceive a significant awareness gap regarding blockchain technology among educators.

8. Using blockchain for digital credentialing raises data privacy concerns.

The responses to the statement "Using blockchain for digital credentialing raises data privacy concerns" reveal a divided perception among respondents. Exactly 50% of the respondents agreed with the statement, while the remaining 50% selected the neutral option. Notably, no respondents disagreed or strongly disagreed, and no respondents strongly agreed.

These results indicate that while half of the respondents perceive data privacy as a concern in blockchain-based digital credentialing, the other half remain uncertain or undecided.

9. The high cost of implementation may limit the adoption of blockchain in higher education.

The responses to the statement "The high cost of implementation may limit the adoption of blockchain in higher education" reveal a divided perception among respondents. Exactly 50% of respondents agreed with the statement, while the remaining 50% selected the neutral option. Notably, no respondents disagreed or strongly disagreed, and no respondents strongly agreed.

These results indicate that while half of the respondents perceive implementation cost as a limiting factor for blockchain adoption in higher education, the other half remain uncertain or undecided.

10. Resistance to technological change is a major barrier to adopting blockchain.

The responses to the statement "Resistance to technological change is a major barrier to adopting blockchain" indicate a predominantly positive endorsement of this view. A majority of respondents (60%) agreed that resistance to technological change constitutes a significant barrier. Additionally, 20% of respondents selected the neutral option, while 20% disagreed. Notably, no respondents strongly agreed or strongly disagreed.

Overall, the results suggest that most respondents perceive human and organizational resistance to change as an important impediment to blockchain adoption, although a minority do not share this perception.

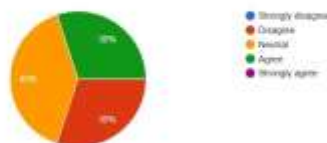11. Educators should be informed about blockchain applications in education.
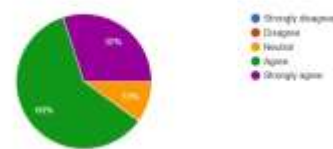
The analysis of responses to the statement "Educators should be informed about blockchain applications in education" reveals a strong positive inclination among respondents. A majority of participants (60%) indicated agreement, while a substantial proportion (30%) expressed strong agreement, resulting in an overall 90% positive response rate. The remaining 10% of respondents selected the neutral option. Importantly, no respondents reported disagreement or strong disagreement with the statement. These findings indicate a near-unanimous endorsement of the need for educator awareness regarding blockchain technology in the educational sector.

12. I believe blockchain has the potential to transform digital credentialing in higher education.
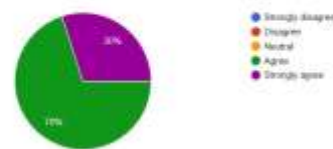

14. I am interested in receiving professional development or training on blockchain in Higher education.

The responses to the statement "I believe blockchain has the potential to transform digital credentialing in higher education" indicate a predominantly positive perception among respondents. Half of the participants (50%) reported agreement, while 30% expressed strong agreement, resulting in a combined 80% positive response rate. A smaller proportion of respondents (10%) selected the neutral option, and an equal percentage (10%) expressed disagreement. Notably, no respondents strongly disagreed with the statement. These results suggest substantial confidence in blockchain's transformative potential within the domain of digital credentialing in higher education.

The responses to the statement "I am interested in receiving professional development or training on blockchain in higher education" indicate an overwhelmingly positive inclination toward capacity building. A substantial majority of respondents (70%) reported agreement, while the remaining 30% expressed strong agreement. Notably, no respondents selected neutral, disagree, or strongly disagree options. This reflects a 100% positive response rate, demonstrating unanimous interest in professional development related to blockchain in higher education.

13. I feel confident in discussing blockchain technology with my peers/students.

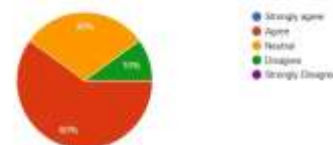15. My institution is prepared to adopt blockchain-based digital credentialing.

The responses to the statement "I feel confident in discussing blockchain technology with my peers/students" indicate mixed levels of confidence among respondents. A total of 30% of participants reported agreement, while 40% selected the neutral option. In contrast, 30% of respondents expressed disagreement. Notably, no respondents selected strong agreement or strong disagreement. These findings suggest moderate confidence levels overall, with a substantial proportion of respondents exhibiting uncertainty or lack of confidence in discussing blockchain technology.

The responses to the statement "My institution is prepared to adopt blockchain-based digital credentialing" reveal moderate perceptions of institutional readiness. A majority of respondents (60%) indicated agreement, while 30% selected the neutral option. In contrast, 10% of respondents expressed disagreement. Notably, no respondents reported strong agreement or strong disagreement. These findings suggest that while more than half of the respondents perceive their institutions as prepared, a considerable proportion remains uncertain, and a small segment perceives a lack of readiness.

Interpretation:

RO1: To check the awareness among educators regarding the blockchain technology used in digital credentialing in higher education.

The integrated findings from Questions 1 to 8 reveal that respondents demonstrate basic conceptual awareness of blockchain technology, but limited understanding of its policy-driven educational applications envisioned in Indian national frameworks.

While respondents largely recognized blockchain as a distributed ledger and acknowledged its potential for transparency and data security (Q1–Q5), awareness significantly declined regarding actual institutional usage of blockchain for issuing academic credentials (Q7–Q8). This decline is particularly noteworthy in the Indian context, where national policies strongly advocate digital credentialing systems.

Despite the existence of policy mechanisms such as the Academic Bank of Credits (ABC) and DigiLocker, respondent uncertainty suggests that policy intentions have not yet translated into visible, institution-level practices. The data therefore indicate a gap between policy articulation and stakeholder-level awareness, rather than a rejection of blockchain-based systems.

The integrated analysis of Questions 9–14 provides a comprehensive picture of respondents' awareness, perceptions, readiness, and concerns regarding blockchain-based digital credentialing in higher education.

The findings indicate that respondents exhibit moderate awareness but limited depth of understanding of blockchain-based digital credentials. While most respondents had at least heard of blockchain credentials, only a small proportion identified themselves as highly knowledgeable. This gap between awareness and expertise is further reflected in respondents' mixed confidence regarding the advantages and implementation of blockchain systems.

Despite this limited understanding, respondents demonstrated strong recognition of blockchain's functional advantages, particularly in relation to fraud reduction, tamper-proof certification, global recognition, instant verification, and lifelong accessibility. However, a notable proportion of respondents also expressed uncertainty about these benefits, suggesting conceptual familiarity rather than experiential knowledge.

Attitudinal responses revealed strong normative support for blockchain adoption in education. A clear majority believed that educators should be aware of blockchain-based credentialing systems and expressed very high willingness to attend training or workshops on blockchain in higher education. This indicates substantial openness to capacity building and professional development.

At the same time, respondents identified significant implementation concerns, with lack of awareness, lack of technical expertise, data privacy issues, and high implementation costs emerging as dominant barriers. Resistance to change, while present, was comparatively less pronounced.

Finally, perceptions regarding blockchain's transformative potential were largely positive. A majority agreed or strongly agreed that blockchain could transform how academic records are issued and verified, and no respondents expressed outright disagreement—although a sizeable neutral group remained cautious.

RO2: To examine the perceptions of educators regarding the blockchain technology used in digital credentialing in higher education.

The integrated analysis of Questions 1 and 2 examines respondents' perceptions of blockchain technology in relation to security enhancement and prevention of academic certificate forgery. The findings indicate a strong consensus regarding blockchain's role in strengthening the integrity of digital credentials.

A substantial majority of respondents agreed that blockchain technology enhances the security of digital credentials, with an additional proportion expressing strong agreement. No respondents expressed disagreement with this assertion, although a minority adopted a neutral stance. Similarly, perceptions regarding blockchain's

ability to prevent the forgery of academic certificates were predominantly positive, with a clear majority agreeing with the statement and the remaining respondents indicating neutrality. Notably, no negative responses were recorded for either item.

Overall, the results reflect high perceived trust in blockchain's security and anti-fraud capabilities, albeit accompanied by a degree of cautious neutrality among some respondents.

The combined analysis of responses from Questions 3 to 10 reveals a nuanced and application-oriented understanding of blockchain adoption in higher education credentialing. Overall, respondents demonstrated strong conceptual acceptance of blockchain's functional benefits, particularly in terms of ease of verification, trust enhancement, and long-term efficiency, while simultaneously acknowledging significant implementation challenges related to technical expertise, awareness, cost, privacy concerns, and resistance to change.

A majority of respondents perceived blockchain-based credentials as easier to verify and capable of increasing trust in higher education systems. Strong agreement was also observed regarding blockchain's potential long-term efficiency and cost-effectiveness, indicating recognition of its strategic value. However, respondents concurrently highlighted substantial barriers, including the need for advanced technical expertise, limited awareness among educators, data privacy concerns, high implementation costs, and organizational resistance to technological change.

Collectively, the results suggest that while blockchain is viewed as a transformative enabler, its adoption in higher education is constrained less by perceived usefulness and more by institutional readiness, human capacity, and governance mechanisms.

The integrated analysis of Items 11 to 15 reveals a strong positive orientation toward blockchain adoption in higher education, particularly at the level of awareness, perceived utility, and

professional readiness, alongside relatively moderate perceptions of institutional preparedness.

Across the items, educators demonstrated overwhelming agreement that they should be informed about blockchain applications in education (Item 11), with near-universal positive responses. Similarly, a substantial majority perceived blockchain as having the potential to transform digital credentialing in higher education (Item 12), indicating recognition of its relevance for secure, transparent, and verifiable academic records.

However, responses to Item 13 revealed a confidence gap, as a significant proportion of respondents reported neutral or low confidence in discussing blockchain technology with peers or students. This suggests that while awareness and perceived value are high, communicative and pedagogical competence remains underdeveloped.

Item 14 recorded unanimous interest in receiving professional development or training on blockchain in higher education, indicating strong demand for structured capacity-building initiatives. In contrast, Item 15 showed mixed perceptions of institutional readiness, with a majority agreeing that their institutions are prepared to adopt blockchain-based digital credentialing, but a sizeable proportion expressing neutrality or skepticism.

Taken together, the results indicate a pattern of high individual readiness and motivation, juxtaposed with partial institutional preparedness.

Educational Implications:

1. Students:

- Ownership of Credentials:

  - Students can have lifelong ownership of their academic credentials (diplomas, degrees, certificates) stored securely on a

blockchain.

- ○ No dependency on institutions to verify or maintain records.

● **Portability of Records:**

- ○ Students can port academic records seamlessly between schools, universities, or across countries, aiding international education and migration.

● **Micro-Credentials & Lifelong Learning:**

- ○ Blockchain supports micro-credentialing (badges, skill tokens), allowing learners to accumulate and showcase specific competencies from different providers.

- ○ Encourages lifelong and informal learning recognition.

● **Enhanced Employability:**

- ○ Verified records reduce resume fraud and boost trust between graduates and employers.

● **Cost & Time Efficiency:**

- ○ Quicker access to verified credentials saves students money and time during application or employment processes.

2. Educators:

● **Recognition of Teaching Credentials:**

- ○ Teachers' qualifications and professional development records can be stored and verified on blockchain, easing inter-institutional

mobility.

● **Token-Based Incentives:**

- ○ Blockchain could be used to issue incentive tokens for educators based on performance, contributions, or peer reviews.

● **Digital Intellectual Property Protection:**

- ○ Educational content (lesson plans, courses, assessments) can be timestamped and stored, ensuring ownership and protection of intellectual work.

● **Professional Networks & Reputation Systems:**

- ○ Reputation systems based on verified feedback and credentials can improve educator credibility and networking opportunities.

3. Educational Institutions (Colleges and Universities:

● **Credential Verification & Issuance:**

- ○ Institutions can issue tamper-proof digital diplomas on blockchain, reducing administrative burden and fraud.

● **Streamlined Student Records Management:**

- ○ Simplifies transcript handling, attendance tracking, and academic progress reports.

● **Reduced Administrative Costs:**

- ○ Automated verification processes minimize paperwork and staffing

requirements.

- **Brand   Integrity:**
  - Verified records prevent counterfeit diplomas, protecting institutional reputation.

- **Decentralized Autonomous Universities (DAUs):**
  - Blockchain enables new institutional models like DAUs, where governance, accreditation, and credentialing can be distributed.

4. Employers:

- **Instant   Credential   Verification:**
  - Employers can instantly verify an applicant's degrees, skills, or certifications, enhancing hiring efficiency.

- **Skills-Based   Hiring:**
  - Blockchain allows access to detailed micro-credentials, helping employers evaluate specific skill sets beyond general degrees.

- **Reduced   Hiring   Fraud:**
  - Reduces risk of falsified qualifications or experience claims.

5. Governments & Regulatory Bodies:

- **Standardization   of   Credentialing:**
  - Governments can develop national blockchain education registries to standardize and centralize credential verification.

- **Cross-Border   Academic   Recognition:**
  - Blockchain can facilitate global recognition of degrees, supporting student mobility and migration policy.

- **Transparent Funding & Accreditation:**
  - Public funding, grants, and institution accreditation processes can be tracked on blockchain for transparency and accountability.

- **Combating   Diploma   Mills:**
  - Helps identify and eliminate fake institutions or unaccredited programs.

6. EdTech Companies & Content Providers

Implications:

- **Verified   Course   Completion:**
  - Online course platforms can issue blockchain-based completion certificates, boosting learner trust.

- **Monetization   Models:**
  - Blockchain allows for new models like pay-per-use, subscription, or token-based learning economies.

- **Open   Learning   Ecosystems:**
  - Support interoperable learning records, enabling learners to collect credentials from multiple providers into a single verified profile.

- **Smart   Contracts   for   Licensing:**

- ○ Content licenses, royalties, and usage rights can be managed through smart contracts, automating compliance.

7. Parents:

- **Real-Time Academic Monitoring:**

  - ○ Access to real-time, verifiable data on their child's performance, attendance, and achievements.

- **Trust in School Systems:**

  - ○ Transparent records build greater confidence in institutional integrity and academic honesty.

8. International Agencies & NGOs:

- **Education for Displaced Populations:**

  - ○ Refugees and migrants often lack documents; blockchain enables them to retain academic records and skills profiles.

- **Global Credential Portability:**

  - ○ Supports UNESCO and other bodies in building global education systems that cross borders seamlessly.

- **Tracking Educational Aid:**

  - ○ Use blockchain to track distribution of scholarships, funding, and support services with full accountability.

Recommendations:

Integrating Blockchain in Education

To enhance understanding and application of blockchain technology within education, several strategic recommendations are proposed. These align with the National Education Policy (NEP) 2020 and the Digital India initiative.

Key Points:

1. Policy-Driven Capacity Building: Introduce structured capacity-building programs for educators and learners to improve knowledge of emerging technologies like blockchain.

2. Curricular Integration: Add introductory courses on blockchain and related technologies in school and higher education curricula to prepare students for future technological landscapes.

3. Teacher Professional Development: Implement ongoing training for teachers to enhance their digital skills, making them effective facilitators between policy and classroom practice.

4. Awareness Before Implementation: Conduct structured awareness programs about blockchain applications in education before actual deployment, fostering informed digital participation.

5. Strengthening Learning Channels: Encourage deeper engagement with academic resources through seminars and workshops focused on blockchain technology.

6. Structured Learning Opportunities: Develop formal training programs that offer hands-on experiences with blockchain concepts beyond just theoretical awareness.

7. Practical Applications and Case Studies: Utilize real-world examples of blockchain applications, such as in credentialing, to help bridge theoretical knowledge and its practical uses.

8. Focused Instruction on Smart Contracts: Educational initiatives should explicitly cover smart contracts, emphasizing their functions and relevance within blockchain systems.

9. Stakeholder Sensitization: Before implementing blockchain systems, ensure that stakeholders understand the technology's purpose and benefits to facilitate effective use.

10. Institutional Readiness and Policy Frameworks: Educational authorities should assess infrastructure readiness and establish clear policies to support the adoption and Standardization of blockchain credentialing systems.

These recommendations aim to equip institutions, educators, and students with the knowledge and skills necessary to effectively implement and utilize blockchain technology in educational settings, leading to improved learning outcomes and operational efficiencies.

Conclusion:

The findings of the study reveal a significant gap between surface-level awareness and deeper comprehension. Many respondents recognize blockchain as a type of distributed ledger technology, understanding its functions like data immutability and transparency. However, this awareness is often shallow, lacking in-depth knowledge.
The study indicates that self-reported knowledge levels are mostly moderate to low, with few individuals claiming expert-level knowledge. There is substantial uncertainty regarding key features such as smart contracts and practical applications like digital credentialing.

Awareness is primarily shaped by informal and digital sources, with limited reliance on academic or professional channels, which may weaken conceptual understanding. While respondents generally perceive blockchain positively for its security and efficiency in academic credentialing, many acknowledge limited familiarity with its actual applications in higher education. There is a clear call for structured learning initiatives to enhance comprehension among stakeholders. Respondents are receptive to professional development opportunities that can enhance their knowledge of blockchain.

The study highlights the need for continuous efforts to improve both awareness and understanding of blockchain technology in India, especially in educational contexts, to enable informed and effective adoption. The analysis reveals that most respondents view blockchain as a secure method for safeguarding digital academic credentials and preventing fraud, with minimal skepticism. This indicates a strong case for blockchain in higher education, particularly for credential management. Despite recognizing its benefits, challenges like institutional and governance barriers hinder adoption. Furthermore, educators are generally aware and motivated about blockchain, but gaps in confidence and institutional readiness remain. Successful implementation will require proper training and alignment with national policies.

References

- Caramihai, M., & Severin, I. A., (2023). Blockchain-based solution for diploma management in universities. Sustainability 2023, 15, 15169. https://doi.org/10.3390/su152015169

- Chae, Y. (2023). Blockchain Technology in Education: A Comprehensive Review in Transparency. 2023 Congress in Computer Science, Computer Engineering, & Applied Computing (CSCE), Las Vegas, NV, USA, 850-857, https://www.doi.org/10.1109/CSCE60160.2023.00144

- Chivu, R.G., Popa, I.C., Orzan, M.C., Marinescu, C., Florescu, M.S., & Orzan, A.O. (2022). The Role of Blockchain Technologies in the Sustainable Development of Students' Learning Process. Sustainability, 14, 1-16, 1406. https://doi.org/10.3390/su14031406

- Delgado-von-Eitzen, C., Anido-Rifón, L., & Fernández-Iglesias, M. J., (2021). Blockchain Applications in Education: A Systematic Literature Review. Appl. Sci., 11, 11811.
- https://doi.org/10.3390/app112411811

- Dewangan, N.K., Chandrakar, P., Kumari, S. & Rodrigues, J.J.P.C. (2023). Enhanced privacy-preserving in student certificate management in blockchain and interplanetary file system. Multimed Tools Appl 82, 12595–12614 . https://doi.org/10.1007/s11042-022-13915-8

- Dubey, S., & Tiwary, A. K. (2023). Smart Education based on Blockchain Technology. 2023 International Conference on Sustainable Computing and Smart Systems (ICSCSS), Coimbatore, India, 2023, pp. 1485-1490, https://www.doi.org/10.1109/ICSCSS57650.2023.10169579
- Dziatkovskii. A. (2022). Blockchain In Education: Problems And Prospects. Journal of Science. Lyon, 34, 17–20. https://doi.org/10.5281/zenodo.7049880

- Gutowski, P., Markiewicz, J., Niedzielski, P., & Klein, M. (2022). Blockchain in Education: The Best Teaching Models. European Research Studies Journal, 15(4), 253-266, https://www.doi.org/10.35808/ersj/3080

- Iyer, S. S., (2022). Adopting a Student Centric Education Blockchain System. International Journal of Information and Communication Sciences, 7(3), 48-65. https://www.doi.org/10.11648/j.ijics.20220703.11

- Kaur, K. (2024). Blockchain Technology in Education: Applications and Challenges. Cross-Currents An International Peer-Reviewed Journal on Humanities & Social Sciences, 10 (4), 128-133. https://www.doi.org/10.36344/ccijhss.2024.v10i04.003

- Leung, A. C. Y., Liu, D. Y.W., Luo, X., & Au, M. H., (2024). A constructivist and pragmatic training framework for blockchain education for IT practitioners. Education and Information Technologies, 29, 15813–15854. https://doi.org/10.1007/s10639-024-12505-5

- Meyliana, W., Surjandy, Chandra, Y.U., Cassandra, C., Fernando, E. (2020). The Recent Open Problem, Benefit and Challenge of Blockchain Technology in Education. International Journal of Recent Technology and Engineering (IJRTE). 8(5). 2188-2192. https://www.doi.org/10.35940/ijrte.E6250.018520

- Mihus, I. (2020). The Main Areas Of The Blockchain Technology Using In Educational Management. Economics, Finance And Management Review. (4), 84-88. https://www.doi.org/10.36690/2674-5208-2020-4-84

- Palanichamy, N., Haw, S. C., Anaam, E.A., & Ng, K.W., (2024). Blockchain for E-certificate verification education records: Review paper. AIP Conf. Proc. 3153, 040003. https://doi.org/10.1063/5.0218801