NFTs in Education: A Model for Creation of NFTivized Course Completion Certificates

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Abstract

The field of higher education in India is plagued by various fraudulent institutions and actors who profit at the expense of students and parents, for example, by issuing fake course completion certificates, which adversely affect the quality of teacher education. This paper presents a possible solution in the form of a model in which a digital record of the student's academic progress is created on the blockchain, which is then used to create a non-falsifiable tokenized version of the student's certificate of completion with a QR code-based mechanism that helps to improve the quality of teacher education in the course completion certificate process. Through this model, cases of certificate fraud can be reduced, and confidence in the quality of education that students receive in the institutions can be ensured.

Keywords:

Teacher education, non-fungible tokens, green blockchain, credential Fraud, cryptocurrency

Introduction

The higher education sector of India is one of the most dynamic sectors in the country, with lakhs of institutions hosting millions of students studying to secure a good future ahead. The usage of technology and technological innovations in education is rising in India, with many institutes giving students e-learning aides such as tablets, internet dongles, etc. (Mohamedbhai, 2016). Of late, many cases of fraud and duplicity in the education sector have been reported in India, with candidates attempting to use fake degree certificates for various purposes or students getting duped by fake educational institutions, leading to a sense of crisis in the country, which hampers the credibility of the teacher's education system.

There are many reasons for this racket, such as the commercialization of education leading to the dignity of education being sold at cost, the

dilution of the end value of education received due to mushrooming institutes, institutes making money at the expense of students, etc. The end result of this unholy nexus is that the student receives an inferior education, which leads to some students or the institutes themselves trying to cheat the system by creating fake course completion certificates, adversely affecting the future of the students (Pathak, 2022). Digitization of education is one of the ways wherein this miasma of corruption in the education system can be checked by increasing transparency via the creation of a proper digital trail, more open and useful ways for teaching and learning, and can enable accountability for the *teacher education* communities to create a more transparent, corruption free society (Santiso, 2021) and by means of Non-Fungible Tokens, systems can be created for assuring integrity and transparency in the quality of education received by the students (Wu & Liu, 2022).

The purpose of the paper is to develop a model for the creation of an NFT (Non–Fungible Token) Version of a Course Completion Certificate to be issued to students passing out from institutes, colleges, and universities so that the cases of fraud and malpractice, regarding the issue of the course completion certificate, can be reduced and if possible, eliminated, if the same is issued as an NFT, the code of it is printed on the certificate as a QR Code, which due to its design, remains unique. NFT is more effective as an agency for verification and authentication purpose of the student's course completion certificate, by any third party through the means of computer-or smartphone-based QR Code verification app or software (Far et al., 2022). In addition to its usage so described, the technology can also be used for the issue and verification of proof of record for the significant applications, such tickets, receipts, etc., and its use in academia goes beyond simple verification and authentication of significant documents, which can improve the educational system's outcome (Umashanker, 2021). Explorations regarding the issue and usage of NFTs as a mechanism for ensuring the integrity of course completion certificates remain more on paper than in real life, as few institutions have made use of this technology for reducing fraud and increasing the integrity of the course completion certificates (Chiu & Allen ,2022). Sarkar (2021) claims that NFTs will be most useful for educational institutions in developing countries such as India where many cases of credential fraud have been reported .

Hence, this research aims to explore the applications of NFTs as a mechanism for authentication/ verification of course completion certificates in the middle and higher educational institutions in India to increase the trust, faith, and belief in the quality of education imparted in these institutions. It is hoped that this paper can lead to pioneering work in this regard and enhance the image and value of Indian education system in the world by issuing NFT versions of course completion certificates exemplified by the model presented in this paper.

Literature Review

Non-Fungible Tokens

NFT or a non-fungible token is a cryptographic asset that is associated with a specific blockchain. It has its own identity in the form of an identification code that distinguishes it from any other digital asset. NFTs are based on distributed ledger technologies (blockchain) in which the actual 'code,' the NFT, is stored, and the stored data is used to create/authenticate a created NFT (Nofer et al., 2017). This technology was used for creating cryptocurrencies like Ethereum, Bitcoins, Dogecoins, etc. which are individual units of cryptographic code for which a monetary term of value is assigned. (Lizcano et al., 2019). NFTs are similar but not like cryptocurrency, NFTs are based on the same fundamentals. However, their form differs from those of cryptocurrency because they are not fungible or able to be split or divided into smaller units than the existing entity. Further, security can be assured through means of 'tokenization,' wherein a short series of random numbers are generated for the data field, which, due to its random nature of generation, makes it extremely difficult to crack or decode, making it possible for security assurance of NFTs using code tokenization, guaranteeing the NFT's security if it contained sensitive data. (Bamakan et al., 2021). An NFT is not designed to be duplicated, as any attempt at duplication will be registered in the blockchain and an alert will be sent to the nodes. An NFT is officially assigned to the creator in a contract publicly accessible on the blockchain. It is possible to document and track the ownership history of NFT on the blockchain, which can be useful in case one wishes to create important items such as tickets, receipts, or certificates to maintain their uniqueness and authenticity (Swain et al., 2022).

In the academic world, the value of proper ID is extremely important, and there have been many cases, especially in developing countries, where fraud and foul play in this area have often been exposed, with cases of false/fake certificates being issued for sums of money. NFT as a technology can be used to authenticate the integrity of the certificate as an NFT, which, not only contains a proper digital trail but also cannot be duplicated. Hence, making it secure for the student, institution, and other third parties. Through technological frameworks that connect blockchains and end users, the entire certificate creation process can be NFTivized, making it more secure and convenient for end users (Zhao & Si, 2021).

The importance of the creation of an NFTivized course completion certificate comes in the maintenance of records and documents. Ordinary records and documents are made and prepared on paper in the majority, which has the risk of damage (due to age, fire, or other hazards), theft, or misplacement whereas NFTivized records do not have this risk as barring physical damage, or hacking, data cannot be harmed or damaged in a way which can physically damage the records. Creation of NFTivized certificates using the model presented in this paper is a way to store and retrieve academic certificate data on demand and in a safe way, which is convenient for all parties involved in the long run (Gräther et al., 2018).

Application of this technology can assure other countries, companies, and individual/corporate entities and persons about the quality of the education system in India and can help millions of students/graduates studying abroad to assure their employers/business partners about the integrity of their education (course completion certificates), if the same is rendered as an NFT and made available for verification on demand. The application of this technology can assure other countries, companies and individuals of the quality of the Indian education system and help millions of students/graduates studying abroad to assure their employers/business partners of the integrity of their education (course completion certificates) if provided as NFTs and made available for verification when required via blockchain, tokenization and other related technologies such as the IPFS filing system, providing convenience and security to the parties involved in the transaction (Kumar et. al, 2022). The model proposed in this paper enables on-site verification using QR codes by both parties, which is convenient for the parties involved in the transaction.

Figure 1

A typical example of an NFT as per popular Google search results.

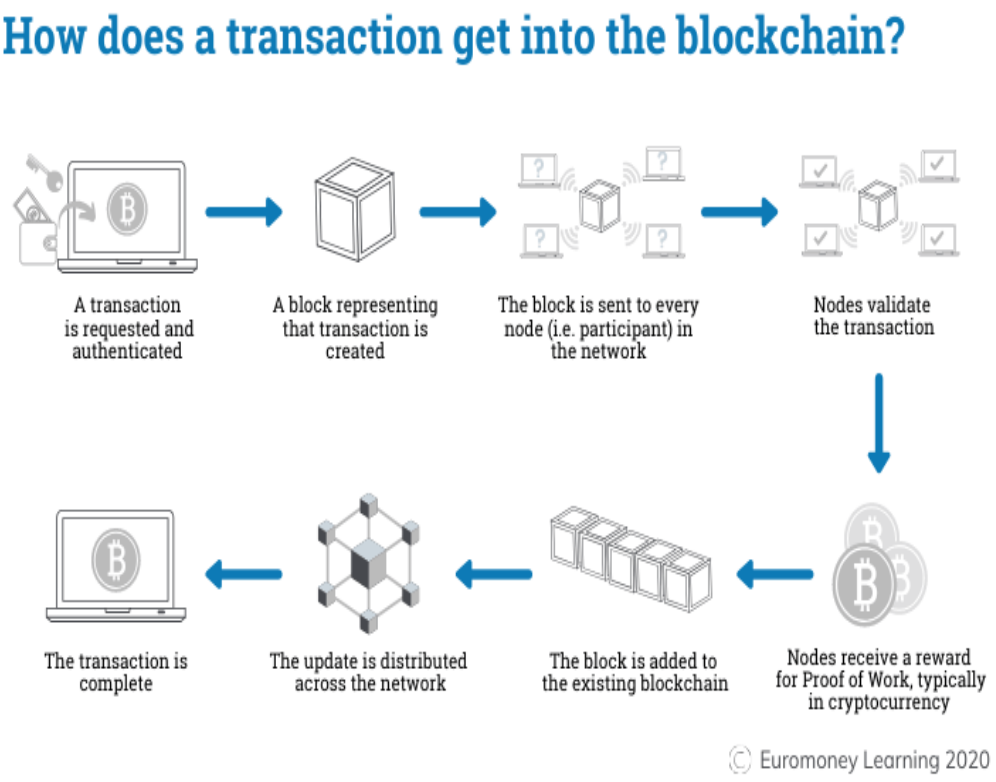
Note: Opensea (#7698, Bored Ape Yacht Club, May 01, 2021, Opensea NFT Market, Accessed on: 11 December 2023, Available at: https://opensea.io/assets/um/0xbc4ca0eda7647a8ab7c2061c2e118a18a936f13d/7698.) (Copyright 2023 by OpenSea)

Green Blockchains and NFTs

Blockchain technology refers to a technology that serves as the basis for cryptocurrency transactions and other related activities. A simple way to think of blockchain is as a 'distributed, intelligent database' where everyone in the database is notified of any changes or developments in the database, such as new transactions (Gupta & Gupta, 2018). Blockchains are characterized by the fact that any two nodes (members of the blockchain) are simultaneously informed of any transaction between any two members, making this technology extremely valuable when integrity, transparency, and openness are essential (Wuest & Gervais., 2018). The reason why an NFT is unique and different from all other digital objects and entities lies in its connection to the blockchain. The blockchain is a technology that has become fashionable in one form or another. A good example of this is the Rai stone coins from Yap, an island in Micronesia. A blockchain is a technology that can be thought of as a "distributed

Figure 2

Illustration of How a Transaction Takes Place in a Blockchain



Note: Euromoney Learning (Euromoney Learning, How does a transaction get into the blockchain, February 29, 2020, Accessed on 11 December 2023, Available at: https://www.euromoney.com/learning/insights/blockchain/blockchain-explained/how-transactions-get-into-the-blockchain). Copyright 2023 by Euromoney learning.

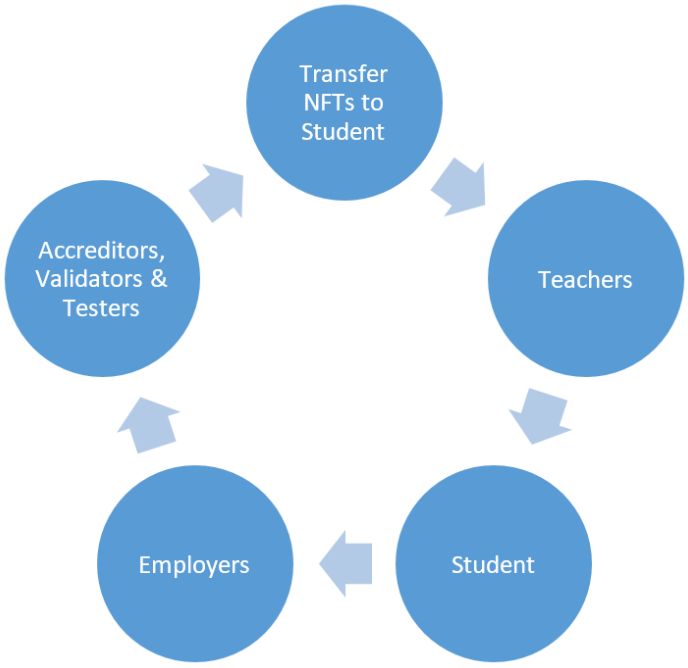
ledger" or general ledger over a particular computer network, where information is stored and changes to the stored information are communicated to all participants in the network, known as "blocks".

Every block has a defined storage capacity for retaining sets of information, which gets closed when the block gets full and is linked to previously filled blocks, forming an interconnected chain. Being that any change/modification is immediately notified to the entire network, it is considered a very secure way to store/manage data and information (Sharma et al., 2022). Blockchains work using 'hashing'. A hash is a mathematical function that converts an input of arbitrary length into an encrypted output of a fixed length (in multiples of 32 bits up to 256). The length of the hash remains the same, irrespective of the original data or the file size and it cannot be reverse-engineered as the hash function is designed to work in a single direction only, thus ensuring the sanctity of the data, digital items, records and transactions done using the hashing system (McGiffen et al., 2022).

An NFT derives its value from its ability to transform any run-of-the-mill digital good which can be copied or duplicated innumerable times into something that is unique and is designed to be NOT copied. An NFT that is placed on sale is unique. You can copy the visible image of the NFT by taking screenshots or clicking CTRL S, but you cannot copy the NFT itself as it is tied to a particular blockchain wherein the purchase/sale transaction of that particular NFT is recorded, bringing in an element of objectivity of digital codes into a field known for being subjective

Figure 3

Connection between NFT Version of the Course Completion Certificate and its End Users



and can act as a form of a virtual record having the same weightage of an actual one such as property deeds, etc. (Trautman, 2021).

There is scope for exploring the educational applications of NFTs to enhance the credibility and integrity of teacher education and provide better quality of education to students, especially in developing and underdeveloped countries where many cases of cheating, duplication, and other illegal means in education and education systems have been reported. The need of the hour is to develop a way to make cryptocurrencies and bitcoins "greener" and more energy efficient, so that cryptocurrencies and blockchain in general consume less energy and allow more savings in terms of energy and electricity, which is possible by "changing the code" (Das & Dutta, 2020).

An illustration depicting the connection between the end users of the NFTs created using the model depicted in this paper. Source: Author's own creation.

Educational Applications of NFTs and Role of Teacher Education

The emergence of Non-Fungible Tokens (NFTs) has caused the world of education to evolve on a constant basis with the changing times and the teacher-education communities have to change their ways with the emergence of the new paradigms, created as a result of the evolution in technology. NFTs are unique, because of their design, which prohibits duplication and are ideal for securing the sanctity of educational documents. By digitizing educational certificates and creating interactive learning experiences, NFTs are transforming the education landscape. Using NFTs in education and their benefits to students and the teacher education communities depicted in Table 1 with the existing blockchain.

The idea proposed by the authors in this paper envisages the use of printed QR codes on the actual corpus of course completion certificates in which the code of the NFT is embedded, so that third parties can verify the authenticity of the certificates via QR code-enabled scanning apps. This idea is not found in the literature cited above and was proposed by the authors in this paper.

Table 1

Comparison of Existing and NFT-based Educational Use System

Sl No	Research Paper title	Author & Year	Primary objective of the paper	Whether the idea purported by the author is in support of the usage of Blockchain for educational purposes?	Whether the idea purported by the author is in support of the usage of NFTs for educational purposes?	Whether the author has proposed usage of QR code-based authentication for NFTs?
1	Does competency-based education with blockchain signal a new mission for universities?	Williams (2019)	For Payment (fees, remittances, and other payments) management	Yes	Yes	No
2	Blockchain-Based Applications in Education: A Systematic review	Alammary et al. (2019b)	For educational content creation & management	Yes	Yes	No
3	A Blockchain Ethereum Technology-Enabled Digital Content: Development of Trading and Sharing Economy Data	Khan, , Zhang, & Imran (2020)	For issue and management of textbooks and educational reference materials	Yes	Yes	No
	Applications of Blockchain Technology to Higher Education Arena	Reis-Marques, Figueiredo, & Neto (2021)	For issue of micro-credentials for online courses and other related uses			
4	Blockchain technology enhances sustainable higher education	Bucea-Manea-Țoniș et. al. (2021)	For other purposes (Sale of college merchandise and branded items)	Yes	Yes	No
5	Privacy challenges of IoT-based blockchain: a systematic review	Liang and Nan (2021)	For identity cards and credentials management	Yes	Yes	No
6	Blockchain in Education - the case of language learning	Panagiotidis (2022)	For issue and management of scholarships and endowments	Yes	Yes	No
7	Patents and intellectual property assets as non-fungible tokens; key technologies and challenges	(Bamakan et al. (2021).	For Intellectual Property Management	Yes	Yes	No
8	Enhancing E-Learning with Blockchain: Characteristics, Projects, and Emerging Trends	Bidry , Ouaguid , & Hanine (2023)	For issue of Academic transcripts, certificates and records	Yes	Yes	No
9	Does competency-based education with blockchain signal a new mission for universities?	Williams . (2018)	For Payment (fees, remittances and other payments) management	Yes	Yes	No

Methodology

The main objective of this work was to develop a model to create NFT versions of course completion certificates and deliver them to the students completing the courses in the institutes, colleges, and universities. The researchers examined many different websites/ portals for creating NFTs and then identified the 'NFT creation portal 'OpenSea' as the best website for this. The NFT portals were examined on the basis of convenience, cost-effectiveness and timeliness so that the best option could be secured for the convenience of the students. OpenSea offers the ability to create up to 30 different NFTs in bulk (Bannermanquist, 2022), which can be scaled up depending on negotiations with the company and could cover a larger sample of students. Student data has been stored on the blockchain for security and convenience and can be used in the process of creating NFTs.

The institution may create a PDF file of the student's actual course completion certificate and save it to the institution's file management system (FMS) with a unique content ID created for the file and required to access the saved file from the FMS. For the creation of NFTs, a crypto wallet needs to be created, such as ZenGo, Coinbase, Electrum, etc., which can be done by the student on an individual basis or by the institution on a bulk basis so that the process of minting the NFTs of the saved course completion certificate PDF files can be started by the institution and completed within a reasonable period of time. At the time of admission and registration formalities, a fee (in Indian Rupees) based on the expected average price of Ethereum over the next three years will be charged from the student, which will be used to purchase Ethereum for minting the NFTs.

In case the price of Ethereum exceeds the projected price, an additional amount will be collected to make up for the gap. The NFT version of the course completion certificate will be sent as a downloadable code to the participant's email ID after it is generated. A copy of the actual NFT code will be printed on the actual course completion certificate (paper version), which will be given to the student at their graduation ceremony as a QR code for verification/download at a later date, so that they can use their smartphone to download the NFT immediately. Gomez (2022) relates an outsiders (other academic institutions, corporate recruiters, recruitment agencies, etc.) can verify the NFT by visiting any NFT verification portal or website (such as EtherScan), where they can click on the wallet address (where the actual data of the NFT is stored) and select the transaction hash data of the associated NFT to verify the NFT, or by using an NFT verification app (such as TokenProof) to verify the printed QR code (Niccole, 2022). Being that every NFT exists on the blockchain, this way can ensure confidence and integrity for the NFT version of the Course Completion Certificates.

Model Illustrating a Process for the Creation of an NFT Version of the Course Completion Certificate

The researchers have proposed a model that illustrates a process showing the different steps involved in creating an NFT version of the course completion certificate. A student can create their NFT version using the steps illustrated below. The model relies on the information stored/updated in the blockchain, which is used to validate the NFT creation request. The institution partners with an NFT market create NFT versions of course completion certificates in bulk for the convenience of students and to protect teacher education communities from future fraud during the student verification process when applying for employment or higher education.

Steps in the Process for creation of NFT version of Course Completion Certificates:

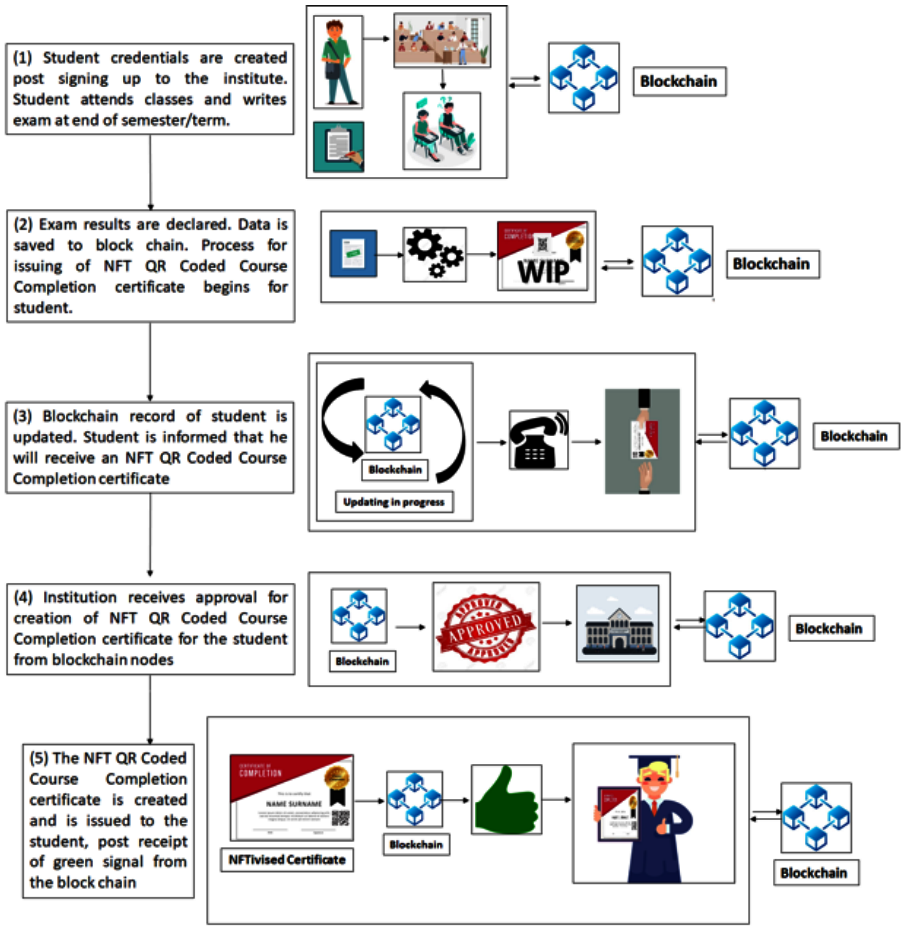
In step 1, the student registers for the course. Their login details are created and saved in the blockchain. The student starts the course and writes an exam at the end of the study part, completing the written part of the course. During these steps, data is sent to the blockchain and stored there.

Step 2 begins after the student has written the examination and the results are declared, the information is saved to the blockchain. Step 3 will begin for the student who has cleared the examination, whereas the students who fail will be given an option for retaking the course, leading them to go back to Start or if they choose not to, to the end of the process. The blockchain is notified/updated during the steps in this process.

In Step 3, the Institution updates the blockchain record of the student who has cleared the examination and notifies him that he will be issued an NFT Course

Figure 4

Depicting the Steps in the Process of Making NFT Version of a Course Completion Certificate



Completion Certificate, via the NFT Creation portal/ service provider, the Institute has tied up with along with updating the blockchain records with the above information.

In Step 4, the student responds to the institution's notification that they are ready to receive their NFT course completion certificate and requests the creation of the NFT. The institution receives this message and checks it with the blockchain nodes for validation (based on the rules/regulations assigned by the institution regarding the formalities to be completed for course completion, absence of fees, etc.) so that the NFT can be created.

In Step 5, The Institution starts the actual process of the creation of the NFT Course In Step 5, after receiving the green signal from the blockchain, the institution begins the actual creation of the NFT course completion certificate using the NFT market/ portal, whereupon the NFT is created and minted and issued to the student on the day of their graduation, completing the process. In case the blockchain does not give a green signal, the NFT is not created and the institution contacts the relevant departments of the institute or the student to identify the loopholes due to which the NFT could not be created. During this step, the blockchain is kept up to date so that proper records can be maintained during the process.

An NFT version of a course completion certificate can be created, by following the steps depicted in this model.

Results

The present study investigates the types of NFT applications used in the education industry through a case study. We performed individual analyses of different education industries as case studies to understand the impacts, value, and challenges of NFT applications and to relate the application of NFT in education.

Comparing Current Education with Education Combined with NFT

In education, NFT can be used for a variety of purposes, including certificate of recognition, transcripts and records, scholarships, content creation, learning experiences, registrations, patents, art, payments, and deposits (Cheng, 2021). Table 2 shows the comparison between the current educational applications and the NFT educational applications.

Table2

Comparison between non-NFT-based Education and NFT-based Education System

	Current Education	NFT combined with education
Certificate	Printed on paper, whose authenticity cannot be verified	Easy verification with unique electronic code (QR Code, Barcode)
Transcripts and records	Applications difficult to retain for long term storage	Process for storing long-term data is easy
Registration Details	Identification details about the students (ID Cards) can be faked, thereby raising questions about their authenticity	In order to prevent identity theft, registration is performed using the NFT method, and data is displayed in detail

A Sample Use Case of NFT in the Educational Process

The authors have cited an example from the e-learning company Eduloco which is assisting students in learning in foreign countries. Studying abroad can be a more challenging process than studying locally as a student needs to be aware of the content he wishes to study in a foreign country, for which he is expected to be prepared to face the realities in other countries, such as the process for application of an educational visa, the process for securing a job (within the limits of the visa), a place to live on or near the university campus, etc. which is not seen in case of many applicants, keen to study in the top universities like Stanford and Harvard. With NFT, students are guided through the entire application process, informed of the necessary documents they need to provide, able to evaluate suitable colleges and universities, and able to apply for a visa. A student using Eduloco has the choice of different subjects and schools of their choice, and the service provides detailed information about the school they want to attend, such as the campus environment, the number of students, living expenses, and facilities that will be available (Cheng, 2021).

Eduloco's use of metaverse during the COVID-19 outbreak led to a rapid rise in digital teaching methods. At the Korea Advanced Institute of Science and Technology (KAIST), live Zoom courses are matched by pre-recorded courses in a 60:40 percentages. The metaverse is a virtual space available to students and parents, so they don't have to travel far to attend the campus. As virtual campuses are slowly implemented, students from across the globe can attend classes from home regardless of distance. It may take some time for craft-based subjects to enter the metaverse at this stage. Virtual classrooms also offer the opportunity for more students to take part in the same lecture, which can provide a more diverse learning experience. This could also help reduce the cost of education due to the reduced need for physical infrastructure. Finally, virtual campuses can help reduce the environmental impact of education, as it eliminates the need for travel (Cheng, 2021).

NFT Fraud Detection and Prevention

In the same way that cryptocurrencies are fungible, NFTs are unique and cannot be exchanged. NFTs are based on blockchain technology, but they aren't fungible like cryptocurrencies. In order to authenticate ownership of a digital asset and its origin, smart contracts are used. In addition to retaining ownership, owners of NFTs can control their digital creations by using unique metadata. This allows them to stand out from other tokens.

Conclusion and Implications of the study

Many educational institutions and companies have been on the receiving end, after encountering cases of duplication and fraud in Course Completion Certificates. The model that is proposed in this paper, seeks to issue the Certificate as an NFT, along with the printed version so that the issue of fraud and duplication can be reduced to a large extent, as NFTs by nature cannot be duplicated and can increase the confidence level in the student as the third party (company, corporate entity, etc.) can check with the institute that has issued the NFT version of the Course Completion Certificate for verification of its genuineness, during the time of recruitment process or some other process where verification is required. Further, an NFT can be stored in a convenient way in a smartphone and can be produced on demand, if necessary increasing the convenience for both parties. Regarding the implications of the research, we can state that every digital image, every created document PDF, MP3 audio file, MP4 video file, etc. (Subject to the NFT creation MB limit), can be created as an NFT. As an example, we can state that important documents such as – AADHAR Cards, PAN Cards, PDS Ration Cards, Licencing related Documents, Property papers, etc. can be created as NFTs. This can result in more secrecy, security, convenience, and confidence as innumerable cases of falsification of documents and fraud are often reported in developing countries such as India.

By this method, more transparency can be assured, reducing and eliminating the illegal nexus involving middlemen and unscrupulous government officials leading to the reduction and possible elimination of corruption from the country. However, only a small percentage of the population is aware of the true implications of NFTs and there is a need to increase their education in this regard. The NFT contributes to education in several ways, including: (1) issuing and managing certificates, (2) protecting rights, (3) rewarding for the teacher education community, (4) impact beyond the classroom, and (5) maintaining privacy (Vilchis, 2022). Diplomas, recognition, or certificates can be securely verified with NFTs, which can be used for diplomas, recognition, or certificates. Students' records and credits are verified with NFTs using tokens of blockchain technology, which reduces the possibility of falsification.

Limitations and scope of the future research

This research paper has developed a process to apply NFT in higher education certifications to help teacher education communities to help them during the course completion process. The researchers have discussed an application of NFTs (Non-Fungible Tokens) as a possible solution and deliberated the applications of NFTs in the Metaverse as a medium for enhancing the quality of education. However, the application of NFT in certifications has not been tested. This research opens a new direction for other researchers to apply the complete process in their institute and can avoid any unethical practices in creating a better image in the teacher education community. Also, researchers can take this process as a base and develop further advanced processes in the complete cycle of any academic institution.

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Disclosure Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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