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Non-fungible tokens, decentralized autonomous organizations, Web 3.0, and the metaverse in education: From university to metaversity

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ABSTRACT

The pandemic has accelerated technological advances in higher education. Learning management systems that make use of the persistent platform, a wide range of communication options, and profoundly immersive qualities quickly become the platform of choice for learning management systems. The blockchain enables non-fungible tokens (NFTs) and uses the blockchain architecture to validate college diplomas and transcripts, opening the way for a diverse variety of e-portfolios owned and shared by students and teachers. Another type of blockchain that is relatively new to the education scene is decentralized autonomous organizations (DAOs). Through this, technology courses, certificates, and more can become automated and authenticated on the blockchain. The current state of the web is rapidly evolving into what is known as Web 3.0. It is the emerging evolution of the internet to make it machine-readable, which includes leveraging technologies such as artificial intelligence (AI), the cloud, and distributed ledger technologies such as blockchain. From the perspectives of the university and the metaverse, this paper discusses the shift in education brought about by NFTs, DAOs, Web 3.0, and the metaverse. The powerful mix of Web 3.0 and the metaverse is about to revolutionize the way people learn and teach in the modern world.

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1. INTRODUCTION

The education industry has changed dramatically during the last few decades. Educators have modified their teaching techniques to keep up with the quickly changing technology environment, from word-of-mouth explanations and blackboard drawings/sketches to digital smart classrooms. Today's teaching approaches are primarily focused on student learning, with an emphasis on establishing an engaging and immersive atmosphere in which students may learn topics more effectively. Any technology that can improve learning outcomes is a win [1]–[23]. Teachers may now assign more complicated tasks due to improved interaction within the metaverse's spatial and social structures. Duties that are frequently only learned through on-the-job experience rather than through well-planned upskilling paths. A well-designed setting enables totally new approaches to teaching. Teachers can employ avatars and role-playing strategies to simulate real-life circumstances. These settings may be as realistic as one desires while yet being unique each time-essentially a digital twin paired with the metaverse [24], [25]. Another possibility is to promote collaborative problem-solving, in which students work together to identify solutions. Or how about having the same number of professors as students, with some of them enhanced by artificial intelligence (AI)?

Current hot themes include blockchains, NFTs, DAOs, Web 3.0 and metaverse [24]–[32]. They significantly enhance the prospects for the education sector [33]. They serve a far greater purpose in the future of education than just replacing paper and pencils as shown in Figure 1.

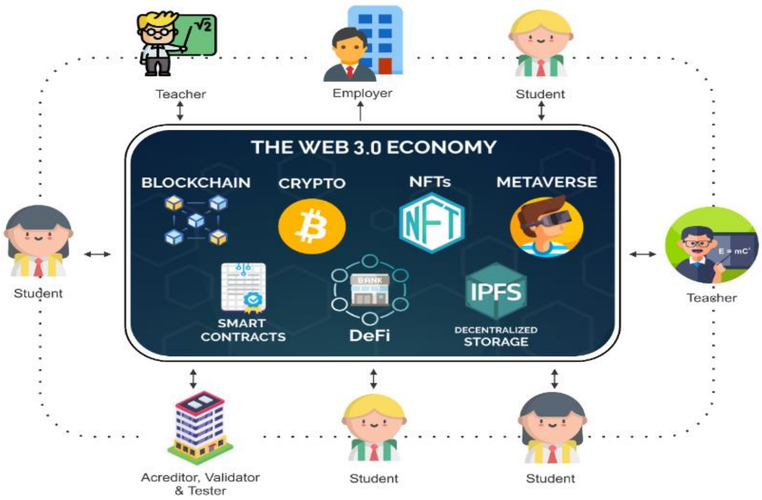

Figure 1. NFTs, DAOs, Web 3.0, and metaverse are transforming education

The education industry is now predominately focused on incorporating immersive technologies into academic curricula to make learning entertaining and engaging. This shift in emphasis is a direct result of the widespread adoption of online learning, which gained popularity, especially after the pandemic. The progression of students' educational attainment can now be evaluated and monitored by teachers as a result of the availability of new tools. What was formerly a multiple-choice test is now supplemented with spatial feedback data such as haptic trajectories or eye-gazing motions. Because of this, the educator is able to make changes to the curriculum and precisely measure haptic activities by using feedback loops. In general, there is a once-in-a-lifetime opportunity to build superior analytics, such as eye tracking, heat mapping, and gesture tracking [34]–[40].

The metaverse is one such focal point for educators all across the world. It seeks to immerse students in an immersive experience where they can participate in interesting activities, making learning more enjoyable. The days of students imagining textbook scenarios based on teacher explanations are long gone. Today, we live in a digitally connected society where notions like metaverse show themselves through real-world use cases. In such a scenario, it is easy to conceive what dramatic effects this network of virtual worlds known as the metaverse could have on the worldwide education system. In this insight, we will look deeply into the relationship between the metaverse and the education system, and how the latter harnesses the power of the metaverse [24]–[33].

Educators invented the term "metaversity," which is transforming the society into which graduates will be incorporated and is already impacting instructional paradigms. A metaversity is a virtual reality campus that provides a metaverse experience in a classroom setting. A metaversity is a higher education institution reconstructed as a digital twin in the metaverse using virtual reality (or at least the early iteration of what will ultimately become a full, global metaverse) [41]. Creating a metaversity entails creating a digital campus that mimics the physical campus [42]–[47]. Certain metaverses are presently operational, as contrast to the general metaverse, which is simply a theoretical idea. Students may then enroll in classes and participate in immersive virtual reality education experiences, either synchronous or asynchronous, to expand their knowledge on a certain subject [24], [25], [29], [30], [32], [33], [40]. Live lessons taught on a metaversity campus can be recorded and preserved in a content library. The primary goal of higher education is to educate students with the knowledge, skills, and real-world experience they require to succeed in their employment and life [48]–[78]. As a result, we must not only embrace the metaverse's progress but also take the lead in teaching. This paper presents the transformation in education brought about by non-fungible tokens, decentralized autonomous organizations, Web 3.0, and the metaverse, from the viewpoint of the university and the metaversity.

2. NON-FUNGIBLE TOKENS (NFT) IN EDUCATION

Non-fungible tokens (NFTs) have been a popular issue in discussions about new technological developments. Despite the fact that they appear to be new, the first NFT was introduced in 2017 by CryptoPunks. Every day, the use and value of NFTs grow. Many fields of business are beginning to adopt NFTs, and many people are wondering [79]–[94]. What role may NFTs play in education in the future?

NFTs have become a topic of discussion in the educational community [92], [95]–[100]. Bitcoin, cryptocurrency, blockchain, and NFTs have all been studied in Science, Technologies, Engineering, Arts, and Mathematics (STEAM) classes on new technology [80], [82], [101], [102]. Students are interested in studying about NFTs and debating what they signify for the future and education, as well as speculating on what they could develop. NFTs are being used by a number of colleges for certification as well as for working in remote learning environments. Duke University is one such instance. Duke has accepted NFTs as proof of education for its Master of Engineering in Financial Technology program. Other institutions are also investigating novel uses for NFTs. The annual Entrepreneur Hall of Fame Dinner was hosted at Seton Hall University, where graduates were honored with NFT awards. One professor at Pepperdine University has used NFTs to give NFTs to students in a personal finance course. The NFTs are academic tokens that have no monetary value and reflect when a student has completed a course. The NFTs include one-of-a-kind information on student performance. MIT has conducted research and advocated for the use of blockchain for the authentication of college diplomas and transcripts [95].

At the high school level, consider instances when we employ assessments for learning or when we provide proof of student effort, whether it is in the form of a certificate, preserving student records, accessing standardized test results, or recording other academic achievements. These take time to collect and preserve and, in some situations, can be readily falsified. With so much technology available, we can make certificates and other papers appear legitimate. However, given NFTs and the impossibility of fabricating them, schools are likely to consider employing NFTs for a variety of reasons. When a student or teacher excels, the academic sector may now construct and design an NFT to make it unforgettable. The usage of NFTs as diplomas and resumes may help students better monitor and access what they have achieved throughout their academic careers. Because the token acts as a permanent, unchangeable, and unique “transcript,” the usage of NFTs prevents students from faking their academic certificates. The NFT experience will include textbooks. Digital textbooks may be resold with royalties collected for each sale. Teachers can also offer NFTs to students who effectively demonstrate their understanding of the class subject. NFTs and schooling might become a new trend. NFTs and verifiable credentials (VC) both provide methods of uniquely identifying things in the digital domain. NFTs are publicly visible digital facts, whereas VCs are privately owned digital facts. Each of these areas, however, provides more security and authenticity and may be monetized [26], [81], [95], [96], [98], [102], [82], [83], [85]–[87], [89], [92], [94].

3. DECENTRALIZED AUTONOMOUS ORGANIZATION (DAO) IN EDUCATION

The COVID-19 epidemic has prompted a huge transition to e-learning, driving students, teachers, and many industry personnel online. A decentralized autonomous organization (DAO) is a new type of legal structure with no central governing body and members who share the shared purpose of working in the best interests of the company or institution. As online information in numerous disciplines becomes more widely available, the idea of unique DAOs for e-learning becomes a reality. Learners in such an organization would collaborate in their learning quest by assisting one another in understanding numerous complicated topics in a certain domain [103].

The first DAO was an experiment with a novel organizational architecture known as “Decentralized Autonomous Organizations (DAOs),” and the DAO was the first organization to use this generic name . The primary purpose of the initial DAO creators was to establish organizations that do not require managers or hierarchies; hence, they are replaced with automated duties based on smart contracts in blockchain technology. This first DAO was based on Ethereum, a smart contract coding system built atop a blockchain platform, and was established in July 2015 utilizing the Ethereum coin ether (ETH). Its purpose was to build a crowdfunding network to further extend the Ethereum ecosystem with new companies by establishing a digital, collaborative peer-to-peer (P2P) community of investors and entrepreneurs [104]–[115].

DAO is a revolutionary educational approach. DAOs will offer the necessary infrastructure for a decentralized educational experience. The capacity to gather and reward instructors and learners will transform how and where we offer education. DAOs can function as decentralized learning centers. Students can join a community to study any topic that interests them. They may then apply their knowledge and work for the DAO, earning money in the process. DAOs also bring us one step closer to genuinely tailored learning. For example, a talented young artist may connect and interact with other artists while receiving real-time criticism from peers. Furthermore, a young lady who is extremely intellectual may feel better when she is among other engineers who share her interests. They can discuss research methods and take part in various proposals or assignments .

4. WEB 3.0 IN EDUCATION

Web 3.0 is built on the idea of developing a completely decentralized ecosystem using artificial intelligence (AI), machine learning, and cutting-edge technologies such as blockchain to tackle today's online ecosystem challenges. AI, on the other hand, is nothing more than intelligent machines that think like people and are designed to do tasks and make life more sophisticated. Artificial intelligence refers to self-learning algorithms that can learn and improve on their own, such as tracking user behaviors and delivering search results that are tailored to their interests. Artificial intelligence has infiltrated every business, including education [116].

For many years, we have used the traditional classroom approach to instruction. That changed 180 degrees during the epidemic. Everything, including the school system, has shifted online. During the pandemic, the educational technology sector advanced, allowing learners to become more flexible and autonomous in their studies. At the same time, teachers began to improve their online teaching skills on a daily basis. AI and Web 3.0 have the potential to transform the online education business. Web 3.0 is an open-source initiative that allows students to engage directly with one another without the use of an intermediary. This would allow students to speak with the world's top minds. As a result, mastering this talent is difficult yet very rewarding. It offers a change of pace and the chance for millions of people to have a more fulfilling working life [100], [117]–[156].

Data access and user-specific token handshakes will become widespread with the advent of 5G. Then, each node will be linked to a huge network of blockchain hosts, producing assets and dramatically improving user-specificity in search results. Web 3.0, like any substantial innovation, may have drawbacks and adversaries. The benefits of a fairer and more open society, on the other hand, are intriguing. It can help students decide on their future academic and career paths. By assessing the student's learning aim and location, Web 3.0 may also offer relevant material. Web 3.0 in education assists students in making prudent decisions about their future, which is incredibly advantageous because expert knowledge is integrated with various factors to define students' life.

5. METAVERSE IN EDUCATION

The word "metaverse" was first used in Neal Stephenson's science fiction book "Snow Crash" in 1992. Since then, video games and movies like "Avatar" have looked into the idea. Aside from that, Mark Zuckerberg changed the name of Facebook to Meta in October 2021. Since then, the word "metaverse" has become popular. The term "metaverse" may refer to an interconnected network of 3D virtual worlds; these worlds may be accessible via a virtual reality headset, with users navigating the metaverse via eye movements or voice instructions. The teacher takes the students on a virtual tour of a dinosaur museum, where he educates them about several types of dinosaurs in 3D space. The students walk around the dinosaur models, asking questions and learning more about them with the assistance of their lecturer, who appears in the form of a 3D avatar. That is how schooling will appear in the metaverse. A virtual world in the form of a metaverse has a lot of promise to give a platform for students, instructors, and staff to engage in an environment that can be completely adjustable to fit varied demands. At a time when the current educational system is under fire for being divorced from the actual world, the metaverse can assist develop virtual worlds that can enable teachers to engage with students regardless of geographical barriers. The metaverse enables educators to design more immersive learning experiences [24], [25], [28], [41].

The metaverse has enormous potential for higher education. Virtual college visits, for example, make more universities available to students. Such trips are more accessible to low-income and minority students, who may not have the time or funds to travel for a tour. During the pandemic, the conventional college trip was transformed into an online experience. These virtual tours are now migrating to the metaverse, allowing students to experience a virtual version of college or campus life. Some institutions and colleges are already looking into methods to create metaverse-enabled learning experiences. Medical students may learn how to administer anesthesia in a virtual operating room through the extended reality (XR) program. During the COVID-19 epidemic, when physical schools and colleges were closed, higher education institutes employed modern technologies to increase access and reach. Many educational institutions studied the feasibility of metaverse and associated XR techniques. The changing responsibilities of instructors and technology in the middle of the epidemic have already demonstrated how the metaverse might be explored for higher education. It claims to revolutionize education with new technologies that will coexist on a single platform in a 5G scenario [41].

The metaverse is hastening the unbundling of higher education and will alter our perceptions of remote learning. Many regard the metaverse as the internet's future, yet it promises to be much more. Although technology has the potential to alleviate many issues, it also presents certain drawbacks. For example, one of the primary issues in the metaverse ecosystem is interoperability. One of the most important aspects of its acceptance will be ensuring that digital assets developed in one metaverse may be utilized in another. Despite these obstacles, the metaverse has enormous potential to affect a variety of industries, including education. The next several years will determine the usefulness of virtual reality world learning and how it integrates with existing educational frameworks. The metaverse, with important implications for education, will make higher education more immersive. Additionally, organizations and industries will soon be searching for a well-educated workforce capable of meeting the difficulties that these new virtual environments provide.

6. RESULTS AND DISCUSSION: FROM UNIVERSITY TO METAVERSITY

Technology has always been at the forefront of human learning and knowledge acquisition. NFTs, DAOs, Web 3.0, and the metaverse assist to connect world-class institutions, foreign students, professional learning seekers, and, most crucially, disadvantaged learners all over the world. The NFTs, DAOs, Web 3.0, and metaverse provide several higher education advantages, including [87], [95], [96], [98], [102]: i) Providing a lifelong immersive cyber-physical experience; ii) Ensuring the validity and credibility of diplomas, degrees, and certifications that students can store as a respectable educational profile token by automating, validating, and ensuring their authenticity and credibility; iii) Sharing blockchain courses and educational resources; iv) Capturing experiential learning moments that aid in the development of trust and skill validation; v) Students can create and present authentic digital portfolios to educators and recruiters; and vi) Creating a global higher education community where learners and educators from all around the world can come together to share their knowledge and experiences.

6.1. The NFT and the future of education

In 2021, NFTs have skyrocketed. An NFT is essentially a unit of data kept on a blockchain that verifies a digital asset to be unique and hence not transferable. This is the key and the source of the "non-fungible" component of the term. So, how does this relate to education? Probably in more ways than we realize, as blockchain will eventually replace the cloud as the repository for all types of contracts, data, and long-term documentation. Here are three of the most significant ways that NFTs will impact the education sector [157]–[160]:

6.1.1. How will we distribute student artwork?

This is the obvious one, but it will completely transform the world of student painting. Schools (and students) may now sell their digital art as NFTs to a worldwide audience eager to support emerging artists and content producers. This not only empowers young content producers, but it may also help them acquire entrepreneurial skills and gain knowledge in marketing, public relations, and cryptocurrencies. It is also important to remember that an NFT might take many different shapes.

6.1.2. How will student records be stored and shared?

Documents may be saved on the blockchain, and modifications can be easily traced. Permanent student data will almost certainly end up on the chain as some kind of NFT that can be readily moved to multiple schools and examined at any time by anybody who requires access. There will be no more data loss or delay. It is present and accessible.

6.1.3. Examination results and other accomplishments

Keeping legitimate certificates on the chain is not only obligatory, but also necessary. If examination bodies and institutions kept copies of exam results, degrees, and other accomplishments on the chain, they would always be able to be shown as the original, legitimate source. Professionals can display their digital badges on Google Scholar, LinkedIn, or ResearchGate, and anybody seeing their profile can confirm the provider's validity. All university degrees will be distributed on the chain far sooner than we anticipate.

6.2. The DAO and the future of education

When we think of education, we picture a room that is around 8 by 10 meters with three to four dozen students and a person in front of the group directing the students on what to do, learn, and know as well as how to behave, execute, or perform. Imagine, though, if we could create it all from the beginning. What if distributed ledger technology and the blockchain could be created to develop education? What if smart contracts could be used?

In many nations, education is a multifaceted field. Every educational profession has its own representation groups, employer representatives, student unions, and content and quality restrictions. If someone wants to modify the way a section of this complicated system operates, a great deal of debate, effort, and time will be required in the hopes of changing what we wish to change. Assume we wish to modify a minor portion of the mathematics curriculum in middle school. We would require the assistance of the Department of Education, algebra teacher associations, publishers, testing companies, schools, parent representation organizations, student unions, and other teachers to execute the changes. And if one of the contraptions' cogs fails, the whole affair will fail and result in disappointment. However, education is fundamentally a decentralized system: a teacher teaches a student something, assists the student with his learning, and assesses the student's knowledge and skill level. Teachers have colleagues in their school and (online) networks to ensure that they teach the correct skills, the right style, and at the right level. In some ways, many judgments are automated: when we finish topic A, we are ready for subject B; when we complete a set of learning objectives, we have mastered a given level [96], [110], [112].

A lot of processes in education, and a lot of the workload for teachers and school staff members, are centered on administrative operations and managing groups of students. We constructed a complicated framework around the basic link between teacher and student to institutionalize trust for society (diplomas and standardized testing), participants (parents require trust to enroll their child in school), and investors (governments and private citizens paying for an education). Let's sketch out a decentralized alternative. A pupil learns English from his instructor, whom he found through an online teaching platform. Similarly, he has appointed professors for a variety of different topics, both necessary and optional. We master skills and achieve learning objectives, and the outcomes are kept on a blockchain. In addition, the student's attendance at school or with particular teachers is recorded. When we meet pre-set targets, we receive certificates and additional chances [161]–[181].

A decentralized autonomous organization (DAO) is a form of organization that makes use of blockchain technology and smart contracts. There is no board; anybody may join and participate by investing in the cryptocurrency that drives the group, and members can vote on the organization's fate using tokens. The DAO has several benefits, including decentralized and automated decision-making, which expedites decision-making. The DAO does not require employees to do administrative or organizational tasks, which reduces overhead costs. Education might become a DAO. Education contains all of the qualities that make the DAO a suitable organizational model. We can reshape education as a DAO [103], [104].

The first step toward transforming education into a DAO is to centralize raw data. And that raw data is widely available: through educational applications, learning management systems (LMS), student information systems (SIS) in schools, teacher administrations, regional or national databases, and so on. When we put this sort of information on blockchain and provide it to the owner, the student, we have a real possibility to transform the way education operates. Because a student can understand what he can and cannot achieve utilizing the power of raw data, what to build next, and what path to take to get to where he wants or needs to be, it empowers the individual student. Transparency regarding raw data to students also benefits instructors, as it allows them to demonstrate what they have taught or attempted to educate the students. The student-teacher connection, rather than the clutter we have built around it, becomes a key feature of the educational system once more. The DAO assists us in rethinking what we are doing, getting rid of nonsense employment, and making what we do truly meaningful. The most essential factor, of course, is our reliance on technology: the way a blockchain ecosystem is controlled and built determines the consequences.

6.3. The Web 3.0 and the future of education

Web 3.0 technology, often known as "semantic web" technology, is an improved version of Web 1.0 and Web 2.0. Web 3.0 is decentralized Internet that runs on blockchain technology to offer high-end security, transparency, and immutability. Web 3.0 entirely rejects the idea of unstructured search engine results, exposing a person to content based on their search patterns and interests. Simply said, content finds its target audience on its own in the Web 3.0 age rather than being sought after by users. This is a fascinating feature that is made possible by the internet of things (IoT), AI, blockchain, virtualization, and personalization. Without having to go through the tiresome process of searching for them on the web, educators will be able to use a vast array of educational technology (EdTech) resources to assist them to make classes more interesting. With the use of Web 3.0 technology, students may access material directly. As a result, instructors will have plenty of time to complete their tasks, which will further increase student engagement in the classroom. In contrast to Web 1.0 or 2.0, Web 3.0 in education enables students to become independent learners and study the subjects they wish to take up as a second online course. With the aid of speech recognition, students will occasionally use Web 3.0 technologies to help them comprehend particular ideas. This eventually reduces the strain on teachers [21].

Smart search supports students in building knowledge as Web 3.0 in education has a great impact. Web 3.0 technology can assist students who are interested in a certain subject by recommending various blog posts and videos that can teach them more about the subject's numerous facets. Additionally, uninvited online content relating to their tasks will be provided according to their searches, which may be very helpful for students to learn topics outside of the scope of their searches and topic restrictions [156], [161], [181].

A semantic, or Web 3.0, in education, can assist students in making decisions about their future academic and professional routes. Web 3.0 may also suggest pertinent material by determining the student's location and learning objectives. With the aid of Web 3.0 in education, students choose their own destinies. This is very helpful because the student's life is dictated by a variety of elements, including expert knowledge. Without a doubt, their choice turns out to be precise and wise [126].

Web 3.0 in education is making significant strides by reducing all such expenditures associated with education by simply substituting it with Web 3.0 technology, as opposed to the conventional model of education where study materials, resources, and a lot of infrastructures were necessary to set up. Since digital learning is the current trend, everything will be connected digitally, allowing for the regulation of education without having to worry about increased resource expenditures. The availability of almost all necessary equipment via Web 3.0 has empowered EdTech like never before.

6.4. The metaverse and the future of education

The emergence of XR-devices and the (3D) metaverse today has the potential to rival, if not exceed, the societal implications of the smartphone and the (2D) internet. The metaverse also eliminates physical boundaries. We may enter immersive environments for any reason, no matter where we are as learners. These are frequently spatially persistent, which means that learners and teachers from all over the world may control and move around the same collection of items [24], [30], [31], [41]. The metaverse will undoubtedly boost the e-learning sector. E-learning applications are transforming the way of learning from offline to online models. With the introduction of virtual reality (VR) and augmented reality (AR) technology into these apps, we can go one step closer to designing the metaverse [24], [25], [30].

6.4.1. Improved e-learning and play environment

In today's world, a student prefers to learn using his smartphone rather than a book. metaverse applications may provide a virtual place for students to stroll, take notes, and engage with other students, changing the e-learning business. They can also play games in a virtual environment that closely resembles reality. Students can use the applications recommended to modify their attire, hairstyles, and facial expressions, among other things.

6.4.2. Improved illustrations by teachers for students

Instructors frequently utilize video-calling applications, but they cannot provide a proper representation of real-life items through them. Instructors can efficiently convey such drawings to their students using technologies such as AR. For example, if a teacher wishes to illustrate automotive parts, they may utilize holographic software to reflect a 3D picture. Students will get a greater grasp of scientific and mathematical experiments.

6.4.3. Improved parent-teacher interactions

The metaverse can help parents with their children's performance in institutions such as schools. Parents can visit their children's lessons and be assured of the institution's educational excellence. Parents may also connect with teachers from faraway locations and assess the quality of the games their students play using Virtual Reality applications. Similarly, parents may schedule frequent meetings with instructors and prepare better e-learning for their students.

6.4.4. Improved learning resources using 3D visualizations

The resources giving comprehension will be more effective with 3D visuals when using the metaverse. Books may be VR-enabled, allowing students to immerse themselves in them, hear the text, and view diagrams in 3D. For historical subjects, VR may offer animated movies to students for enhanced learning. Exams can become more engaging when integrated with metaverse apps. Exam questions, for example, might be interactive, and students can be given virtual but realistic case studies. In this way, the metaverse may change learning resources, bringing them closer to reality and fostering a stronger e-learning sector. Figure 2 shows some of the ways that the education sector can use the metaverse to its advantage. These include virtual 3D classrooms, digital learning, virtual campus activities, interdisciplinary learning, creating simulations of real-life situations, raising awareness, virtual tours, and events and people [24], [25], [30], [33], [41].

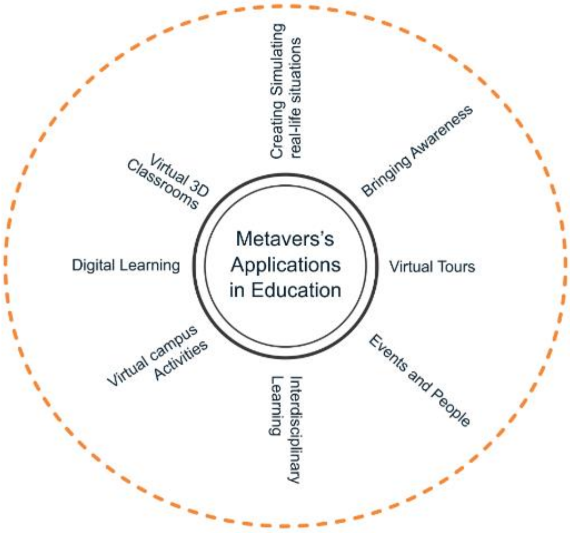

Figure 2. Several ways in which the education sector leverages the benefits of the metaverse

a. Creating a simulation of real-life situations

Learning in the metaverse is beneficial because it engages students by simulating real-life circumstances in which they may conduct scientific experiments, demonstrate prototypes, and even participate in a documentary movie, such as one about World War I. Subject-specific 3D environments may exist in the future to assist students and teachers explain what they are learning.

b. Bringing awareness

The metaverse may be utilized in classrooms to raise students' humanitarian understanding of societal concerns such as starvation, pollution, and climate change. Students, for example, may be shown a documentary on famine in Somalia or poverty in Burundi to better understand how these issues affect the people who live there. Students will leave with not only theoretical knowledge but also a profound emotional grasp of what is going on around them.

c. Virtual tours

Consider reading about a nation or location in a classroom and then immediately visiting that location. Would not it be a fantastic experience? Although this is not possible in the actual world, the metaverse provides such opportunities by providing virtual world tours. The metaverse helps students learn more about the world by allowing them to visit any location they wish in a virtual environment in only a few minutes.

d. Events and people

Educators can invite notable personalities or persons of wisdom and knowledge into the virtual realm of the metaverse to share their life experiences with students. They can participate in interesting symposiums, seminars, and lectures. Different activities, such as fairs and exhibits, might be conducted to assist people to clear their thoughts.

e. Interdisciplinary learning

The metaverse has the ability to break down subject borders and encourage interdisciplinary learning. It enables teachers to mix courses that are often taught separately, such as math and science. This makes studying more enjoyable and offers students a greater understanding of how various theories function in practice.

f. Virtual campus activities

The metaverse enables students to participate in extracurricular activities such as sports and the arts in a virtual setting. Students can participate in interesting activities such as music or mathematics groups, which are equivalent to physical campus activities. They may even roam about their virtual campus from the comfort of their own home.

g. Digital learning

When smart courses were introduced into the school curriculum, they improved students' learning by projecting videos on a variety of subjects. The metaverse intends to make these classrooms smarter by allowing students to completely immerse in such movies, allowing them to experience all of the information more intimately. Furthermore, it allows people to try, fail, and learn from their mistakes in subjects that need real experimentation. Even physical classrooms can benefit from 3D virtual learning to achieve desired learning results.

h. Virtual 3D classrooms

With the rise of online schools and universities, students have begun to notice a disparity between immersive physical classrooms and virtual classrooms. The metaverse can bridge this divide by allowing students to digitally meet and engage with their peers and teachers in 3D virtual classrooms. Students from any geographical place may participate in this metaverse-powered learning environment and go much beyond what a conventional classroom can offer.

7. CONCLUSION

This paper presented the impact of non-fungible tokens (NFTs), decentralized autonomous organizations (DAOs), Web 3.0, and the metaverse on higher education from both traditional and virtual perspectives. NFTs, DAOs, Web 3.0, and the metaverse have all gained prominence in recent years. These blockchain technologies, which will be used in future education, will have made substantial progress in the validation of student records. Many educators are interested in integrations with non-fungible tokens, decentralized autonomous organizations, Web 3.0, and the metaverse. The metaverse is a virtual world created by individuals that exist on the internet. It is a 3D universe that users may explore and interact with. Web 3.0 is the next version of the internet, allowing users to connect to the metaverse via decentralized apps. The metaverse represents a significant advancement in educational technology as a tool for accelerating and improving student learning. It enhances problem-solving abilities and makes learning more pleasurable and clear. It also improves the entire educational experience of the user by delivering real-time feedback. The metaverse provides several advantages, including making the user's learning path more pleasurable and simple, making educational resources more affordable, improving student performance, making virtual interactions more like real ones, allowing experimentation with difficult-to-create phenomena, increasing accessibility for remote students, and appealing to a younger demographic. The metaverse is always expanding and changing. New features and applications are regularly added. This results in an exciting and constantly changing environment for exploration and learning. All of this is possible in the future metaverse.

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