Blockchain Technology and Sustainable Higher Education

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Blockchain technology has an influence of motivation on collaborative work, which positively influences learning performance in Higher Education Institutions (HEI). In addition, blockchain technology is correlated with decentralisation, security and integrity, and anonymity and encryption. It can also be perceived as a consensus mechanism, rewarding students, professors, and universities as a smart contract. Therefore, this technology has been used to improve higher education. It also allows less informed people to interact with better-informed peers and mentors.

Keywords: sustainable education (SE) ; blockchain ; massive open online courses (MOOCs) ; artificial intelligence (AI) ; e-learning ; educational platforms ; distributed ledger technology (DLT) ; higher education (HE) ; higher education institution (HEI)

1. Introduction

The concept of “planetary well-being” is a guiding aspiration that establishes an ideal regulation of both humanity and the planet, including an integrated system of sustainability of natural and social aspects [1]. Nevertheless, sustainable education (SE) in the era of millennials, generation Z, and the Alpha generation must be based on the following three pillars as the first is already part of the education system and the latter will enter the system more or less at the same time when blockchain technology will become a part of the education system:

- to be equitable, inclusive, and nudge personal development, even though life-long learning approaches, including digital, transversal, and practical skills, i.e., critical thinking, communication, collaboration, information literacy, analytical skills, metacognitive and reflection skills, and other research skills, as a condition to adapt to the continuous challenges of green market context [2];
- developing digital and transversal competences, investing in people to facilitate their employability, creative work, and resilience required by professions;
- developing innovative curricula, new methods, and technologies in teaching and evaluation, such as MOOCs (Massive Open Online Courses), VR (Virtual reality)/AR (augmented reality), blockchain, videoconferences, etc. [3].

The behavioural changes which emerged in the younger generations inescapably led to the reshaping of learning itself. Consequently, teaching methodologies are being updated to keep up with the evolution of learning and, especially, to train future professionals for both labour and professional careers markets. On the other side, the demand for Higher Education (HE) has increased, and new technologies have been seen as an asset to learning. However, learning is a cognitive process and a social one, which involves interaction. Therefore, from a broader perspective, education must be sustainable in time. In this case, Sustainable Education (SE) is a significant concept that promotes employability and involves continuous, inclusive, and equitable learning. A digital transversal may assist practical skills, new methods and technologies in teaching and assessment. Moreover, SE includes all stakeholders—students, professors, universities, communities, etc.

The learning loss is enormous if we account for the context of disruptive forces, continuously shifting geopolitical powers, and, presently, the pandemic that has affected over 1.6 billion learners. Moreover, 86% of children in low-income countries are effectively out of school due to school closures, compared with only 20% in high-income countries [4]. Nevertheless, any crisis offers new opportunities for sustainable development education. Advanced technologies, such as AI, Robotics, 5G, machine learning, blockchain, e-learning, educational platforms, virtual classrooms, and others, can offer real support [5].

About 6.7 million learners, children, and young people from 3 to 18 years old were impacted by school closures in Spain [6]. As a result, online information sources gained relevance, and new technologies, e.g., virtual reality (VR) or artificial intelligence (AI), may play an important role [7]. The value creation also can be measured by implementing VR/AR simulation [8]. However, according to the authors, only VR consulting firms with a solid academic background, such as university spin-offs, have combined qualitative data to measure cognitive behaviours that influenced participants' performance [7].

More and more areas are emerging in innovative blockchain approaches. Thus, blockchain technology is used to enhance higher education, and developing an educational infrastructure to support learning is part of the present. Innovative science learning relationships often involve sustained individual inquiry, intense social interaction with interest groups, and expert mentoring relationships [8]. Blockchain technology allows less informed people to interact with better-informed colleagues and mentors [9].

2. Blockchain Technology and Sustainable Higher Education

Student motivation has a significant and positive impact on the quality of student collaborative work, as demonstrated by blockchain in Higher Education. Work completed by students in groups has been shown to increase student involvement in the educational process, and more involvement means better learning outcomes for the students involved. Student involvement improved learning outcomes in higher education as a result. Using blockchain-based tools and motivation, teamwork, and student involvement was critical in improving student learning outcomes. Research shows that collaborative work, motivation, engagement, MOOCs, augmented and virtual reality (AR), game-based learning, and online classes are all linked to student learning outcomes in quantitative ways.

Using blockchain, the advantage is double for students: On the one hand, a very accurate record is stored in the data source and increases the students' interest to interact with the e-learning platform; on the other hand, the HE Cloud can be stored in many blockchains for different activities [10][11].

According to this research, all variables such as Student Motivation, Student Collaborative Work, Student Engagement, Student Learning Performance and blockchain and their indicators were considered significant. Moreover, the respective relationships were accepted.

Sustainable education in the millennial era must be founded on three pillars: equity, inclusion, and personal development. This requires life-long learning approaches that incorporate digital, transversal, and practical skills (i.e., critical thinking, communication, collaboration, information literacy, analytical skills, metacognitive and reflective skills, and other research skills) [2][3].

Herein found that collaborative work, motivation, engagement, MOOCs, AR, VR, gamification, and online classes were associated with learning performance. In other words, student performance can be improved through these factors. In addition, decentralising Online Learning will ensure real-time online interaction between teachers and students, and the student may have the opportunity to choose between courses from curricula.

In addition, using MOOCs, AR, VR, gamification, blockchain, and videoconferences, it is possible to implement improvements in the structure and duration of content and add learning tools.

Furthermore, the importance of document validation must also be associated, accelerating the process and reducing costs and paperwork. Finally, blockchain is a fully inclusive process, which allows the integration of the most diverse cultures and people and the most varied learning levels. In this way, one can connect blockchain to the concept of sustainability, especially when learning in higher education institutions can be favoured by new technologies.

Blockchain will offer learning alternatives in higher education institutions through this technology. It can be promoted sustainability in the long term. In HEIs, platforms such as Tutellus, SGE, and Edgecoin will enhance the distance learning management process, student collaboration and interaction, student creativity, and higher motivation to obtain transferable skills and international recognition of thought badges. Furthermore, because of its credibility, traceability, and security, blockchain will be increasingly used in all areas: recordkeeping (for students, professors, educational institutions, and file storage), the creation of a new market for digital assets (students' fees, rewards, digital Badges, publishing fees), the creation of a disruptive business model, decentralising online learning, and the creation of better learning platforms. Soon, physical distance will matter relatively little for knowledge sharing and networking, diminishing the importance of spaces, meaning blockchain facilities will be a sustainable solution for HE.

To provide the best education, herein has presented a blockchain that focuses on including HEIs, that can decentralise and provide security and integrity, and that can offer anonymity and encryption, promoting increased transaction rates. In addition, it can be seen as a consensus mechanism, rewarding students, teachers, and universities as a smart contract. Moreover, building an educational infrastructure to support learning from this technology is a must in today's times. Finally, technologies such as MOOCs allow less-informed people to interact with more knowledgeable peers and mentors.

DLT offers many advantages, and it would be beneficial for badgification and the manuscript review process. This is because DLT helps address several problems that come with traditional methods. Online learning has given students more choice, and DLT can assist in tracking, storing, and distributing learning records. Though a well-known company is needed to start a DLT protocol, it should be noted that large corporations are required. In order to maintain the recordkeeping autonomy of the general public, this defeats the purpose of DLT development. This research gap is representative of future research priorities.

Recent research about the opportunities and challenges of artificial intelligence and machine learning [12] concluded that a personalised learning environment is especially accessible to college students these days. Both problems, which involve computers, can be handled by AI. Individualised learning experiences powered by AI, which data have enhanced, will be available to students. Two professors can discover new methods in which students learn while also offering suggestions to assist students in personalising their teaching methods to fit their learning requirements. With new approaches, colleges, universities, other educational institutions, and EdTech companies will benefit greatly from these technologies [12].

Regarding the challenges that some HEIs would need to overcome to adopt a blockchain model, we can see a resemblance to implementing artificial intelligence and machine learning. The challenges for adopting AI as defined by Mc Kinsey are as follows: the lack of a clear strategy, lack of talent with an appropriate set of skills for AI work, limitations in the functionality of end-to-end AI solutions, lack of responsibility of and commitment to AI by leaders, lack of technological infrastructure to support AI, lack of available (i.e., collected) data, uncertainty or low expectations from return on AI investment, insufficient resources for AI, limited data usefulness, personal judgment cancels AI-based decision making, limited relevance of AI insights, and lack of changes in frontline processes after the adoption of AI [13].

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