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Review

MOOC 5.0: A Roadmap to the Future of Learning

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Abstract: Industry 4.0 has created a whole new world for us to explore, and its effects can be seen in every facet of our lives, especially in the workplace where it calls for technology-driven employment. There is a growing need to teach individuals and assist them in transitioning to longer-term employment prospects to execute Industry 4.0 effectively. Although MOOCs revolutionized the way learners study, it is critical to investigate teaching techniques using Education 4.0 at this time. This article explores how the technologies of Industry 4.0 can be incorporated into MOOCs. This paper proposes MOOCs 5.0, whose features include better universal access, better learner engagement, adaptive learning, greater collaboration, security, and curiosity, which is being developed using Industry 4.0 technologies of the Internet of Things, Cloud Computing, Big Data, Artificial Intelligence/Machine Learning, Blockchain, Gamification Technologies, and the Metaverse and would incorporate the zones of ethics and humanism, while at the same time providing learners with a richer and more individualized experience.

Keywords: MOOC; education technology; IoT; big data; artificial intelligence; blockchain; Metaverse

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1. Introduction

Humans have been learning and adapting to new environments since the dawn of civilization. This trend has been going on for thousands of years in many aspects of human existence, but the introduction of information technology accelerated the process of learning and adaptation rapidly [1,2]. Education not only prepares individuals with better values to live within society but at the same time assists them to procure the abilities and skills required for sustainable development. The United Nations 2030 agenda has acknowledged education as a critical component of sustainable development. One of the United Nations' Sustainable Development Goals is to improve education and has been stated as: "Sustainable Development Goal 4 (SDG4): Quality Education—Ensure inclusive and equitable Quality Education and promote lifelong learning opportunities for all" [3] and "Sustainable Development Goal 9 (SDG9) of Industry, Innovation, and Infrastructure".

Interestingly, the education structure of the 21st century has transformed drastically. It is difficult to believe how drastically different the situation was only a few years back since the world we live in is changing so quickly and unpredictably. In the last few decades, the Internet and how people use it have also undergone significant transformations. One of the major areas where this transformation can be seen is in the teaching–learning process. Technology, pedagogy, implementation strategies, and institutional frameworks can all be used to implement flexible learning in higher education [4]. Imparting education through classroom teaching is now challenged by the growing popularity of the Internet [5,6].

One of the best ways of flexible learning is through Massive Open Online Courses, also known as MOOCs. Ever since it began in 2008, it has become the primary display for open

educational resources and has revolutionized the educational environment within a few years [7]. MOOCs have grown in popularity not only in the academic world but also in the business sector for a variety of reasons, including flexibility and cost effectiveness [8]. While MOOCs provide educational data on a new level, their high dropout rates have concerned many instructors [9]. With Online Education being the new normal after the COVID-19 pandemic, enrolment in MOOCs has gained tremendous momentum. The higher education system must alter its environment, instructional methods, and the roles of instructors and learners, in light of Industry 4.0's technological breakthroughs [10]. Changes are inevitable and expected to occur in all facets of education, and MOOCs too will transform. It will be challenging for instructors to adapt to these cutting-edge Industry 4.0 technologies for creating MOOCs adhering to the needs of learners from varied social, economic, and, most importantly, cultural backgrounds.

The aforementioned factors served as the inspiration for this work, which examines the emerging technologies that may be used in MOOCs, and how they can present a roadmap toward MOOC 5.0. The study's contribution is as follows:

- The fundamental ideas and importance of digitization in the education industry are covered.
- The implementation of new technologies in MOOCs are examined, including IoT, Cloud Computing, Big Data, Artificial Intelligence/Machine Learning, Blockchain Technology, Digital Twin, Gamification Technologies, and the Metaverse.
- A recommendation for further research is made after reviewing past studies that integrate Industry 4.0 technologies in MOOCs.
- Additionally, MOOC 5.0 is proposed, which uses Industry 4.0 technologies and has features of improved universal access, higher learner engagement, adaptive learning, increased collaboration, security, and curiosity.

The study is divided into the following sections: Section 2 is Materials and Methods, which looks into the bibliometrics of the literature used; Section 3 provides an overview of Industry 5.0 and Education 5.0; Section 4 looks into technology intervention in MOOCs; Section 5 proposes the concept of MOOC 5.0; Section 6 contains the discussions and recommendations; finally, the study's conclusion is found in the last part.

2. Materials and Methods

This section outlines the methodology used to analyze MOOCs for future learning. To do this, articles from Scopus and the Web of Science (WoS), a few seminal works from other publications, well-known conference papers from IEEE Conferences, and significant reports/blogs from the UNESCO and World Economic Forum, etc., among others, were taken into consideration. The articles were chosen based on inclusion and exclusion criteria. The exclusion criteria were as follows:

- Non-peer-reviewed research publications were not scrutinized, as the significance of the research material is minimal.
- Additionally, postgraduate and graduation theses and dissertations were also not considered.

Figure 1 illustrates the year-by-year production of the literature used. Most of the literature explored was produced after 2014, which shows that there has been a spike in interest in the topic.

The literature review found that most of the work on MOOCs was conducted using Artificial Intelligence/Machine Learning (23%) followed by Big Data (20%) and Gamification Technologies (17%), among emerging technologies. Figure 2 shows the technology-wise analysis of the literature used in the article.

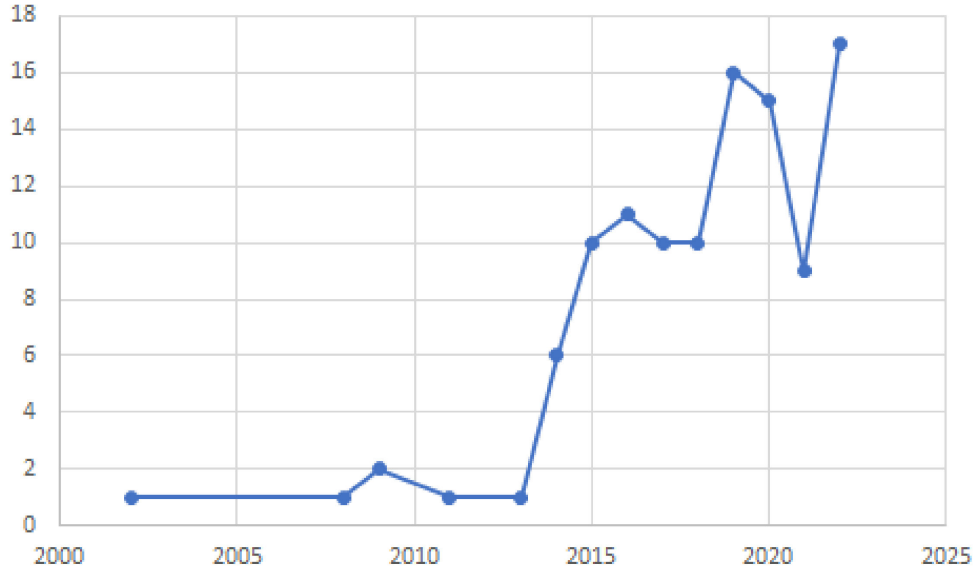

Figure 1. Year of production of literature.

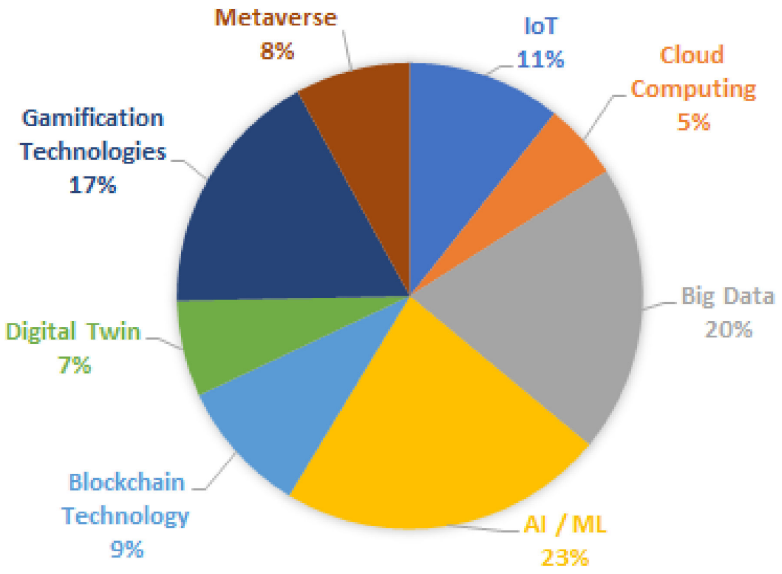

Figure 2. Technology-wise literature.

3. Overview of Industry 5.0 and Education 5.0

The effect of technology in today's fast-changing world is not confined to modes of transportation and communication; the "Fourth Industrial Revolution" has brought us a new wave of change in all fields. The digital revolution is significantly changing how people live and work [11]. The "Fifth Industrial Revolution", branded as Industry 5.0, promises to alter the way we develop products, increasing productivity and competitive advantage. While Industry 4.0 aspired to develop future "Smart Factories" by combining physical, digital, and virtual environments using cyber-physical systems, in Industry 5.0, intelligent machines will act as collaborators rather than opponents since they will be integrated with human brains [12]. Industry 5.0 offers a vision of the business that goes beyond the narrow focus on production and efficiency and strengthens the function and value of the industry in society [13]. Figure 3 illustrates all five industrial revolutions.

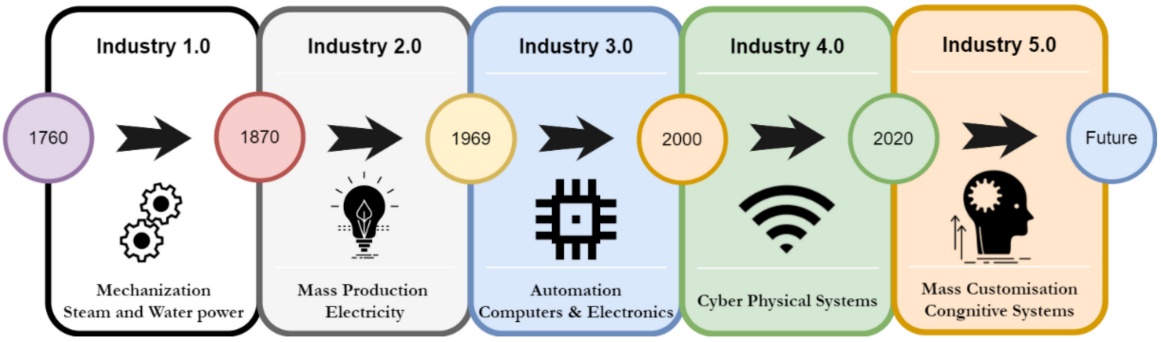

Figure 3. Industrial Revolutions.

"Industry 4.0" developments are having a wide range of organizational repercussions, not simply technological ones [14]. The first and foremost challenge of "Industry 4.0" is that there is a greater need for highly skilled employees [15,16]. Over the next five years, technology-driven job creation is likely to outnumber job loss. There is a growing sense of urgency to assist people in transitioning to more long-term employment prospects [17]. Industry 4.0 is said to be driven by technology, whereas Industry 5.0 is driven by values [18]; as a result, the current state of industry inevitably raises concerns in this period of exponential technological advancement, such as the appropriateness of the current educational system in light of Industry 5.0's requirements, design of the new educational paradigm, components in Education 5.0, etc.

Education has progressed from 'going to university' of Education 1.0 to Internet-based learning of Education 2.0, proceeding towards knowledge-based education of Education 3.0, and finally to innovation-based education in Education 4.0 [19]. Technology infiltrations into education, such as the use of smartphones, online testing, Artificial Intelligence, and Big Data, are all part of Education 4.0 [20]. Education 5.0 moves beyond the creation and use of technology and into the spheres of humanism and ethics [21]. The term "Education 4.0" and "Education 5.0" has gained popularity among educators all across the world, and emphasizes adapting to the changes, and for institutions of higher learning, this involves knowing what is expected of their incoming graduates. Figure 4 illustrates the progression of education.

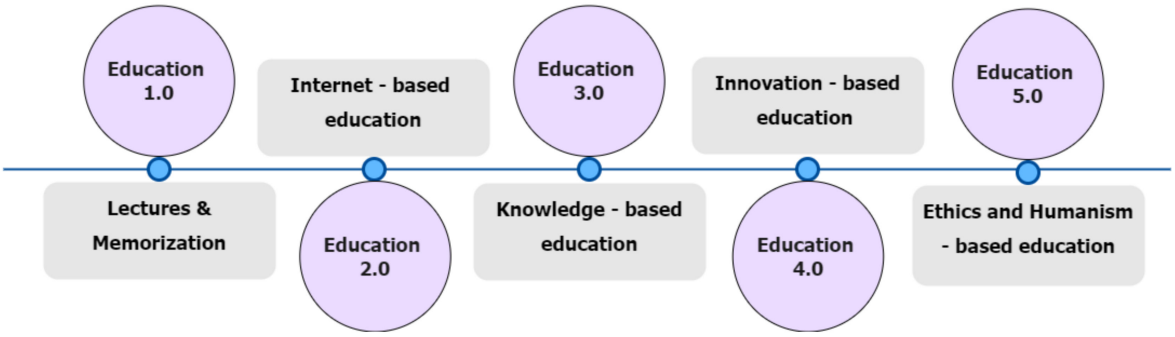

Figure 4. Progression of Education.

The technologies of Industry 4.0 are already influencing our daily lives. Universities and colleges should prepare for the significant shift of incorporating technology-driven designs into the curriculum with the support of educationists and other visionaries. It is heartening to learn that the education system is integrating the usage of Cyber System technologies in learning under the mantra Education 4.0 [22,23]. At this juncture, it is vital to explore teaching methodologies in the context of the technical advancements of Industry 4.0 as the future years will test our ability to redesign learning for the learners of today's digital generation [24,25]. MOOCs also require improvements on the parts of

both learners and instructors to adapt to the new paradigms of learning. This research paper proposes MOOCs 5.0, which uses the advanced technologies of Industry 5.0 and possess features, viz., better universal access, better learner engagement, adaptive learning, greater collaboration, security, and curiosity. The features are discussed in Section 6 and are depicted in Figure 5.

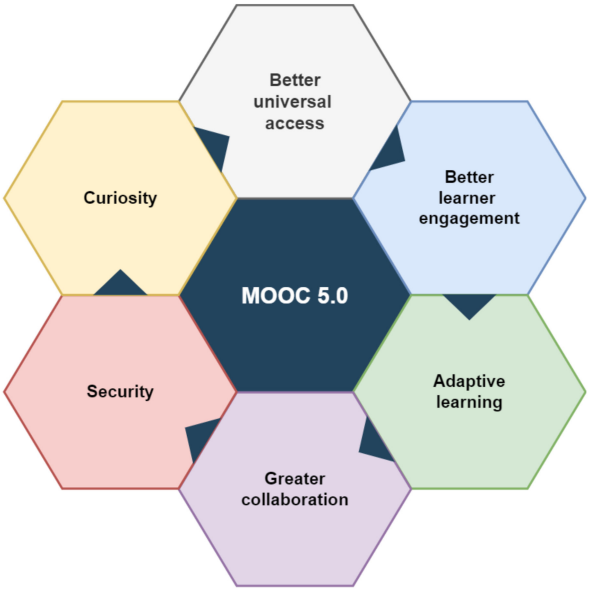

Figure 5. Features of MOOCs 5.0.

4. Technology Intervention in MOOCs

The social revolution has been sparked by Industry 5.0. technologies such as the Internet of Things (IoT), Cloud Computing, Big Data, Artificial Intelligence/Machine Learning, Block Chain, Robotics, Digital Twin, Gamification Technologies, Virtual reality (VR)/Augmented reality (AR), and the Metaverse. It is anticipated that technology will have advanced to the point of total autonomy by 2050 [16]. Future MOOCs will undergo a significant change in terms of education due to these technological improvements.

4.1. IoT in MOOCs

Kevin Ashton, a British technologist, coined the phrase "Internet of Things" (IoT) [26] to describe a way for people and items to be connected across a network. These are now widely utilized and well liked in a variety of industries, including smart homes, smart cities, wearable technology, and industrial equipment. IoT envisions a bright future for such an Internet where machine–machine communication will predominate over the present models of human–human or human–device connection [27]. Future intelligent virtual products will be created from real-world objects with the expansion of the Internet of Things [28]. IoT can be embedded in online higher education with the help of a cutting-edge AI-assisted system that considers environmental data and embedded biosensor data to estimate learners' progress, wellness, and health [29]; this will not only improve e-learning platforms but will improve learning outcomes for professions and will increase completion but also reduce expenses [30]. A literature review suggests that researchers concentrated on several topics, a few of these included IoT in mobile learning [31], blending lab projects with IoT-based learning frameworks for Science, Technology, Engineering, and Mathematics (STEM) learners [32], personalized instruction for students through IoT data collection [33], etc. All students will profit from the inclusion of IoT in MOOCs since there will be improved communication and individualized learning, not to mention the unique advantages for those with impairments. Table 1 summarizes the articles of IoT implementation for MOOCs.

Table 1. Significant studies on IoT in Online Education/MOOCs.

Reference	Aim of the Study	Results
[29]	AI-enabled IoT in higher education that takes into account ambient data and implanted biosensor data	A framework that supports learners' academic progress through the use of wearable technology to gather data and biofeedback techniques
[30]	Utilizing IoT within an e-learning environment	An applications framework using IoT for e-learning
[31]	Design and implement a mobile learning system for underprivileged rural learners	Development of a prototype
[32]	Incorporate an IoT-based teaching model into lab projects for STEM core courses	Lab development kit using IoT
[33]	Using IoT data in higher education.	personalized instruction for students through IoT data collection

4.2. Cloud Computing in MOOCs

In recent years, the shift to Cloud Computing has picked up pace [34]. Business owners are turning over control of their assets, including critical systems, to platforms that cloud service providers offer and operate [35]. Cloud Computing is quickly replacing traditional computer paradigms in all facets of life including education; some of the successful examples of this paradigm in the education field are Learning management systems (LMS), MOOCs, and Podcasts [36]. They all use the Internet to make education perpetually accessible to a limitless number of learners. In this paradigm, two main cloud service models are employed, which are infrastructure as a service (IaaS) and software as a service (SaaS). All the major MOOC providers employ cloud services and resources to promote quality teaching and learning internationally [37]. As the Cloud Computing trends make it abundantly evident that it will be crucial to IT in the upcoming years [38], MOOCs will witness better and more affordable services in the near future. Table 2 summarizes the articles of Cloud Computing in Online Education/MOOCs.

Table 2. Significant studies on Cloud Computing in Online Education/MOOCs.

Reference	Aim of the Study	Results
[34]	Analyze Cloud Computing	Discusses the idea, background, benefits, and drawbacks of Cloud Computing
[35]	Analyze Cloud Computing for critical services	Important data can be processed and stored on the cloud
[36]	Education-related uses of Cloud Computing	Discusses successful examples of this paradigm in the education field
[37]	Exploring MOOC as the success of Cloud Computing in education	MOOC providers employ cloud services and resources to promote quality teaching and learning internationally
[38]	Analyze Cloud Computing trends	Cloud Computing will be crucial to IT in the upcoming years

4.3. Big Data in MOOCs

MOOCs produce a significant amount of heterogeneous educational data [39] and provide several chances to study a variety of issues connected to teaching design and learner outcomes [40]. Finding a way to extract knowledge from the extraordinarily rich datasets being produced and turn it into information that can be used by students, instructors, and the general public is the key problem in Big-Data-intensive research and learning analytics [41]. According to a literature study, researchers investigated a variety of MOOC categories using Big Data, among which included diverse Big Data of MOOC [42], identification of MOOC dropout learners [43,44], forecasting MOOC learners' potential grades [45], MOOC data analytics [46], learning analytics [47], demand for MOOC [48],

Educational Privacy in the Online Classroom [49], Automated text detection [50], Privacy in MOOC [51], MOOC video watching behavior [52], Topic-oriented learning assistance [53], etc. Table 3 summarizes the articles of Big Data in Online Education/MOOCs.

Table 3. Significant studies on Big Data in Online Education/MOOCs.

Reference	Aim of the Study	Results
[42]	To investigate a variety of MOOC categories using Big Data	Educational data mining and learning analytics will allow more egalitarian and flexible learning
[44]	Dropout forecasting in MOOCs	Gradient Boosting Decision Tree model achieves 88% accuracy in dropout prediction
[45]	Anticipate students' future grades using flipped classrooms based on MOOCs.	The projection resulted in a considerable improvement in student test scores
[47]	Trends in Learning Analytics	A larger variety of learning-related characteristics
[50]	Automatic text recognition in MOOC videos	Assessment of ICDAR Benchmark datasets for video text results in high recall

4.4. Artificial Intelligence/Machine Learning in MOOCs

Artificial Intelligence (AI) and Machine Learning (ML) have made considerable strides in recent years, and they now represent an emergent technology that will transform how people live. The use of AI/ML in education is expanding quickly to enhance the caliber of teaching and learning. According to the Horizon Report's Higher Education Edition from 2017, Artificial Intelligence will be applied in higher education by 2022 [54]. MOOCs have a strong probability of using AI/ML by an analysis of the extensive MOOC dataset [55]. AI/ML may employ data analytics to enhance teaching and learning methods. Large datasets of MOOCs may be used to train Machine Learning algorithms so they can learn from them and provide predictions or suggestions on how to learn something new or improve teaching. The MOOC dropout prediction studies using AI/ML have been discussed by several authors [56–59]. While notable researchers focused on many different subjects, some of these included learner clickstream analyses [60,61], satisfaction among the learners [62,63], time-based metrics of learner interactions and evaluations [64], the usage of MOOC datasets for the K-means method [65], using Machine Learning techniques to sort and categorize MOOC learners [66], learners' emotional tendencies [67], MOOC learning behaviors [68], an intelligent investigation [69], Convolutional neural networks (CNN) for measuring the levels of learner engagement through webcam [70], etc. Table 4 summarizes the articles of Artificial Intelligence/Machine Learning in MOOCs.

Table 4. Significant studies on Artificial Intelligence/Machine Learning in MOOCs.

Reference	Aim of the Study	Results
[58]	MOOC dropout prediction	The prediction accuracy of the deep learning model is significantly higher than the model's accuracy using conventional Machine Learning
[60]	MOOC learning pattern visualizations based on clickstream data	Course instructors can benefit from the results
[63]	Examines the factors that might influence MOOC learner satisfaction	Factor analysis using sentiment analysis and supervised Machine Learning
[66]	To sort and categorize MOOC learners	Model based on filters methods
[70]	Measure learner engagement through webcam	On learner engagement, CNN models were 95% accurate.

4.5. Blockchain Technology in MOOC

Blockchain technology has demonstrated remarkable application opportunities since its beginnings and has been used in numerous sectors; because of its strengthening security

feature, it may be used to construct many Blockchain systems [71,72]. Blockchain technology may be implemented at higher education institutions to enhance teaching strategies, provide better learning platforms, improve recordkeeping, and enhance student involvement and motivation [73]. The literature suggests that the rapid advancement of Blockchain technology will have a positive impact on the creation of MOOC communication platforms resulting in the advancement of higher education [74]. MOOCs' completion records are kept in Electronic Learning Records (ELRs), which are often maintained in a cloud data center, which are crucial for learners since they provide solid proof of the learning process. However, the security and Privacy of ELRs cannot be ensured with third-party storage. As a result, a Blockchain-based solution for the safe storing and distribution of ELRs in MOOC learning systems can be implemented [75]. A Blockchain system that keeps track of every detail of every transaction will allow the academic institution that awards credentials to confirm that learning actually happened and that knowledge, competencies, and skills were accurately assessed [76]. Melanie Swan suggested using Blockchain to encode open badges for MOOCs [77]. Table 5 summarizes the articles of Blockchain Technology in Online Education/MOOCs.

Table 5. Significant studies on Blockchain Technology in Online Education/MOOCs.

Reference	Aim of the Study	Results
[73]	Improve perception of Blockchain applications	The level of student collaboration increases with increased motivation, which is mostly driven by new technology and instructional techniques
[74]	Integrated Blockchain ecosystem for the development of sustainable MOOC education	Evaluation of the development scenarios
[75]	Blockchain-based solution for the safe storing and distribution of Electronic Learning Records in MOOC learning systems	The suggested system outperforms existing similar efforts and provides a genuine level of security guarantee
[76]	Analyze Blockchain system for learning	Explores tools and trends
[77]	Blockchain to encode open badges for MOOCs	Blockchain has the potential to be the fifth revolutionary computing paradigm

4.6. Digital Twin in MOOCs

Though highly creative and needing a broad framework of several technologies, the Digital Twin notion is still not at the cutting edge [78]. The qualities of a Digital Twin include a virtual and actual symbiosis, high levels of simulation, real-time contact, and deep understanding, among others. The trend of its use is moving from the industrial to the educational sectors [79]. Interesting scientific material has begun to stream on topics such as smart factory Digital Twin technology in education [80], Digital Twin Campus [81], Ontology [82], etc. For many IT applications in Industry 5.0, the concept of the "digital twin for everything" seems to be a relevant one [83]. However, the use of Digital Twin (DT) in education is still in its infancy when compared to that of DT in the industrial sector. Table 6 summarizes the articles of Digital Twin in Online Education/MOOCs.

Table 6. Significant studies on Digital Twin in Online Education/MOOCs.

Reference	Aim of the Study	Results
[78]	Analysis of concerns in a Digital Twin	Challenging to combine Artificial Intelligence (AI) techniques
[79]	Analysis of features of Digital Twin technology	The potential use of holographic classrooms is presented
[80]	Online open courses are created using Digital Twin technology	The usefulness of Digital Twin technology in education
[81]	The idea of a Digital Twin Campus (DTC) for education	Significant integration of the teaching methods between the physical campus and the virtual campus to some extent
[82]	Use of Ontology	Utilizing the created ontology enhanced the MOOC platform

4.7. Gamification Technologies in MOOCs

Gamification is the application of components often prevalent in games, such as plot, feedback, rewards systems, conflict, collaboration, competition, defined objectives and rules, levels, trial-and-error, enjoyment, engagement, and interactivity [84], and it is often used to fix problems and enhance learning [85]. The primary goal of Gamification, for non-gaming objectives in real-world environments, is to increase human motivation and performance concerning a particular task [86]. In the beginning, Gamification techniques were used in marketing campaigns and web applications to encourage, involve, and retain customers [87].

With the shifting paradigm in education, Gamification has also found use in the teaching–learning process. Concept acquisition and awareness were considerably enhanced when using information and communication technologies (ICT) along with Gamification [88]. It applies the foundational principle of learning by doing, which encourages students to acquire knowledge and make discoveries about many topics via independent experimentation. There is limited acceptance of serious games in higher education; for example, higher education institutions in Portugal use only around 20% of the Gamification techniques [89]. Massive Online Open Courses (MOOCs) are a growing trend, but their extremely low completion rates provide difficulty. Finding innovative strategies to inspire learners and persuade them to finish the course is vital because a significant number of learners drop out of the MOOC [90]. Gamification-based methodology for motivating MOOC learners to complete the course can be a better strategy [91–94]. Gamification design for MOOCs should incorporate both social and individual components, based on the implementation goal, social presence, social impact, and flow theory [95]. Studies have revealed that MOOC Gamification has been implemented in a few cases and even if the outcomes on motivation and learning are positive, there are still prospects for scholarly publishing [96]. Table 7 summarizes the articles of Gamification Technologies in Online Education/MOOCs.

Table 7. Significant studies on Gamification Technologies in Online Education/MOOCs.

Reference	Aim of the Study	Results
[88]	Gamification in education	Concept acquisition and awareness were considerably enhanced
[90]	Access the impact of Gamification in MOOCs	Gamification in MOOCs leads to the overall rise in MOOC engagement and retention rates
[92]	Examines how the use of Gamification techniques in MOOCs impacts the level of engagement among participants	The gamified platform provides a considerably greater percentage of activity completion
[94]	Provides a cooperative MOOC Gamification model	Boosts the interest of learners in MOOCs
[95]	The intention of raising participants' engagement and goal-accomplishment through Gamification	Determine the best game components and demonstrate Gamification design in MOOCs

4.8. Metaverse in MOOCs

The Metaverse is a perpetual multi-user habitat that unifies the actual world with digital virtual elements [97]. Virtual reality (VR), Augmented reality (AR), as well as mixed reality (MR), are some of the most important elements of the Metaverse since they successfully give users a 3D immersive virtual experience [98], although Virtual reality (VR)/Augmented reality (AR) is now employed extensively across many industries. As MOOCs need personalization and communication for traditionalist means of material introduction (fixed visual, sound, and contents) to provide the learners with a more engaging learning experience [99], the Metaverse and its components provide excellent chances to raise educational standards by developing fresh approaches and strategies. Few Metaverse MOOCs have been implemented where learners confirmed their applicability and functioning both within and outside of the classroom [100] and some have been proposed [101]; however, it will take time, and studies presently show that there is a research gap in

the educational Metaverse [102]. Table 8 summarizes the articles of Metaverse in Online Education/MOOCs.

Table 8. Significant studies on Metaverse in Online Education/MOOCs.

Reference	Aim of the Study	Results
[98]	MR, VR, and AR roles in the Metaverse	VR, AR, and MR technologies will be crucial to the development of the Metaverse
[99]	Personalization of MOOCs	Creation of an internal avatar model utilizing interfaces for VR and AR
[100]	Creation, implementation, and usage of a Metaverse as a teaching aid for learners	Learners confirmed its applicability and efficacy both within and outside of the classroom.
[101]	Propose Gemiverse a learning environment based on Blockchain and Metaverse	Gemiverse is recommended to go through three stages of the development process
[102]	To highlight the limitations, focuses, and trends in Metaverse research	Research gap in the educational Metaverse

5. MOOC 5.0

For a substantial portion of the world's population, MOOCs provide not only learning opportunities but access to world-class educators and researchers from top-tier educational institutions [103]. Some literature categorizes MOOCs in various ways; however, there does not appear to be agreement on the best way to do so. It has been classified as MOOC 2.0. on the concepts of collaboration among other online learners [104,105], credit credentials [106], and personal learning goals [107], as MOOC 3.0 is based on MOOC incorporation into traditional academic programs and credit recognition [108]. Otto Scharmer [109] suggests that MOOCs have evolved from instructor-centric one-to-many to learner-centric many-to-one personalized education. Figure 6 explains all four levels of evolution of MOOCs. The theory was based on a pilot MOOC, where for evolution from MOOC 1.0 to MOOC 4.0, there has effectively been a change in the conversational level at which the learning takes place, which evolves from downloading MOOC 1.0 to a two-way interaction in MOOC 2.0, to a multi-lateral dialogue in MOOC 3.0 before finally being anchored in level 4 as collective creativity in MOOC 4.0 because conversation is experienced as a co-creative.

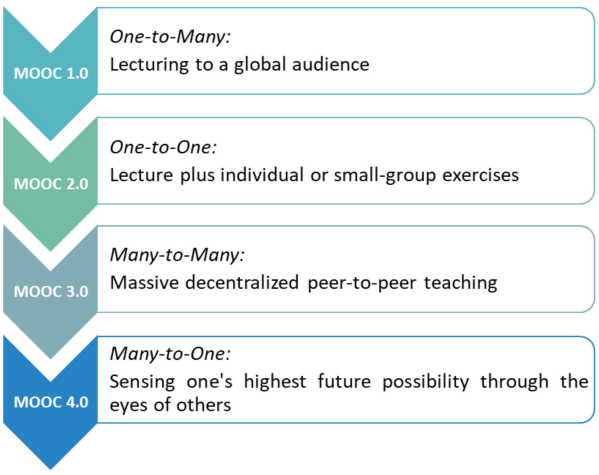

Figure 6. Evolution of MOOCs based on Otto Scharmer's classification [109].

As learners will have access to more technology in the future, humanized online courses that cater to each learner's unique requirements will be more and more essential [110]. This is where MOOC, which is being developed using Industry 5.0 technology and also examines the areas of ethics and humanism, may be extendedly classified, giving it the name MOOC 5.0. The focus of MOOC 5.0 teaching may be on each learner's interpretation and way of thinking, as well as providing them with personalized learning recommendations that have humanism and ethics. The concept is shown in Figure 7.

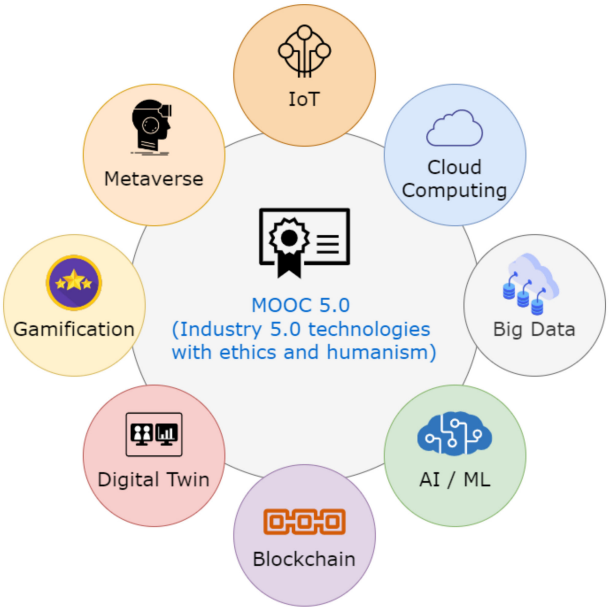

Figure 7. MOOCs 5.0.

6. Discussions and Recommendations

New economic development will be sparked by Industry 5.0 technologies. How effectively these technologies are implemented into education will determine how far humanity develops in the future. The fusion of cutting-edge technology and learning systems can more accurately simulate the dynamics of high-level learning. Industry 5.0 technologies, including the Internet of Things (IoT), Cloud Computing, Big Data, Artificial Intelligence (AI) and Machine Learning, Blockchain technology, Digital Twins, Gamification Technologies, and the Metaverse, will significantly change MOOCs. Within a few years, the developing technologies of Industry 5.0 are projected to be a typical feature in MOOCs 5.0. Figure 8 depicts and highlights the major recommendations.

The highlights of the major recommendations for moving forward with SDG4 of Quality Education and SDG9 of Industry, Innovation, and Infrastructure to achieve the SDGs are:

- **MOOC with better universal access:** Learners, especially those in rural areas or who would typically have limited access to formal education, will soon have a better experience with MOOCs 5.0 as a result of the widespread availability of mobile devices, next-generation networks such as 5G, better Cloud Computing services [36–38], and IoT devices [33]. A boost for MOOCs 5.0 will come from the development of a mobile learning platform that prioritizes providing a reliable, inexpensive, WiFi-detection device and user-friendly mobile applications, which work even in rural areas [31].
- **MOOC with better learner engagement**: The creation of affordable intelligent edge computing-enabled IoT devices will use the learner system's camera, clicks, and biosensor data to estimate the learning levels and evaluate their academic progress [29]. The tool would save the data on the learners' computer, cutting down on bandwidth usage and accelerating response time. A better Cloud Computing service [36–38] with an IoT device with an intelligent edge computing capability continuously monitors the student's metrics, can enter alert mode or alarm mode based on conditions, and would provide feedback on the learners' engagement to both the learner and the instructor.
- **MOOC with adaptive learning:** The most prominent problem of MOOCs all over the world is the dropout problem. As discussed in this paper, AI/ML and Big-Data-based systems for assessing learner development and its impact on learning progress are already in place [44,56–59]. The research on design and development has to be expanded by the scholars by using in-built learning analytics capabilities with AI/ML and Big Data [47] on a MOOCs 5.0 platform, which would process data about the

learning activities of learners, measure the effectiveness of teaching methods and students' engagement to identify at-risk students. The system can predict and alert the learners and course coordinators about potential dropouts. As a consequence, the option of adaptive learning will be made available, which modifies the pace and substance of learning to suit the needs of each learner.

- **MOOC with greater collaboration**: with a combination of Cloud Computing [36–38], Big Data, AI/ML [56–59], Gamification [88–95], and the Metaverse [99] in the background with MOOCs 5.0, there would be room for novel innovations in collaborative learning.
- **MOOC with security:** MOOCs 5.0 will offer credentials of the learners through Electronic Learning Records (ELRs) through Blockchain technology [75], which might then be shared in a secure format with potential employers too. Other research areas of Blockchain could be better MOOC communication platforms, and encode open badges for MOOCs to motivate learners [77].
- **MOOC with curiosity**: Cloud Computing [36–38], Big Data [42–53], AI/ML [56–59], the Metaverse [99], and integrated Gamification [88–95], with features such as points, badges, rewards, and leader boards to encourage learners to be more engaged, would provide a platform that will create interest in the subject matter for the learners in MOOCs 5.0. In the future, researchers will need to expand their research into 3D interface design and educational video games.

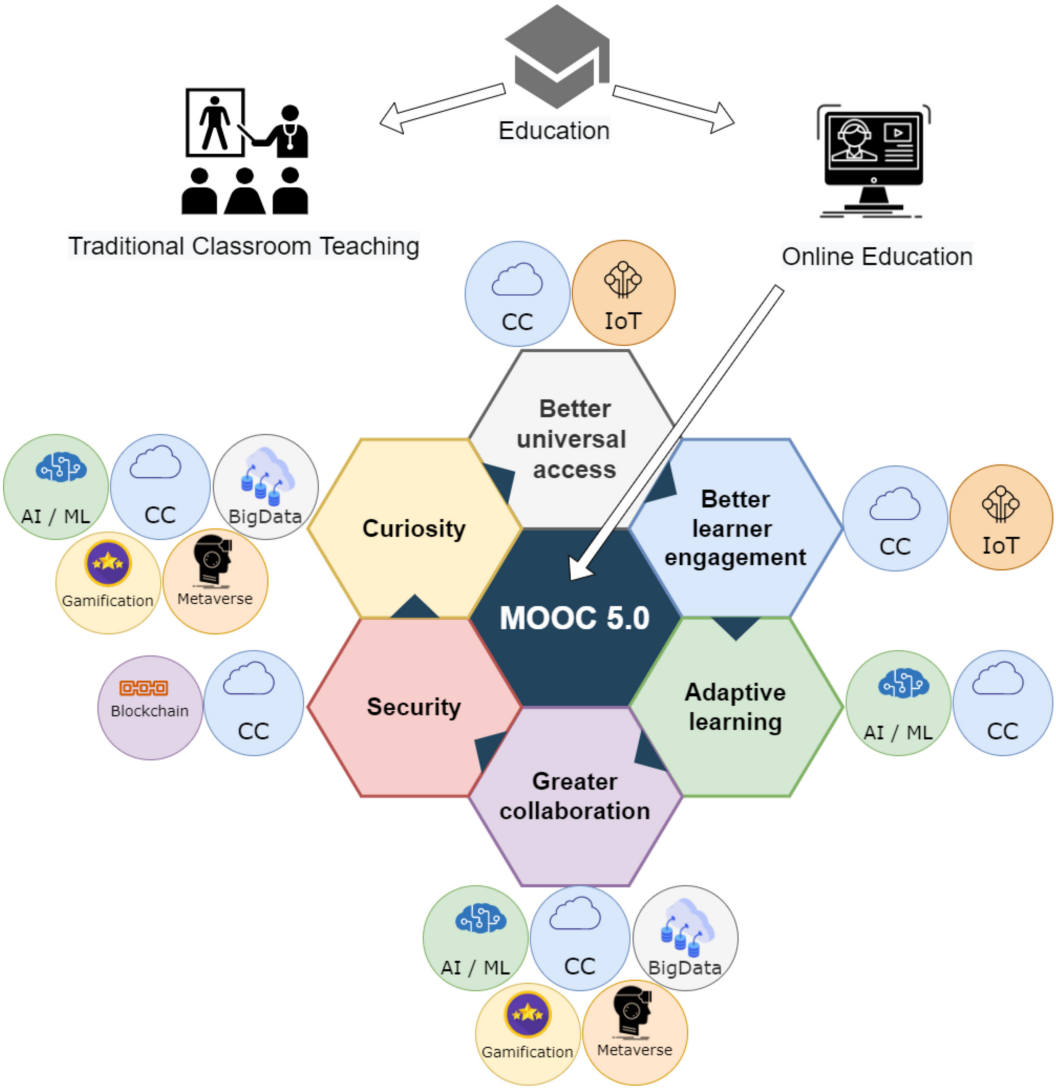

Figure 8. Recommendations for MOOCs 5.0.

7. Conclusions

The Sustainable Development Goals, SDG4 of Quality Education, and SDG9 of Industry, Innovation, and Infrastructure can be achieved with the use of new educational technologies in a sustainable manner. Based upon this motivation, this study discussed the implementation of Industry 5.0. technologies, viz., IoT, Cloud Computing, Big Data, Artificial Intelligence/Machine Learning, Blockchain Technology, Digital Twin, Gamification Technologies, and the Metaverse in MOOCs. From the above analysis, this study concludes that the adaptation of these technologies in education will support innovative pedagogies, guaranteeing comprehensive and equitable Quality Education and encouraging possibilities for lifelong learning for everyone. There is a lot of future scopes in integrating emerging technologies in MOOCs. Further research should be conducted to make MOOC 5.0 a reality. Every MOOC 5.0 feature—improved universal access, higher learner engagement, adaptive learning, increased collaboration, security, and curiosity—offers the chance for in-depth research. The future of learning will be all about the integration of digital and physical worlds. MOOCs were a revolution in the way we learn, but Industry 5.0 and Education 5.0 has already created a new world for us to explore. The MOOCs 5.0 evolution will provide learners with a richer and more personal experience than ever before.

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