Rise of Virtual Universities: MOOCs, Artificial Intelligence, and Structural Transformation in Higher Education

Dr. Smita Tiwary Ojha

Assistant Professor-III, Amity Institute of Psychology & Allied Sciences, Amity University Noida
Email: *stojha[at]amity.edu*
ORCID ID: 0000-0003-3644-1169

Abstract: *The rise of digital Edu-tech is one of contemporary responses to most cost-effective way to expand the reach of education. The growth of digital technology has led to effect leading to concentration of wealth within fewer firms. In addition, virtual world is fueled by rise of gig economy as well as data economy. These have given impetus to digital economy. Within, there has been tremendous rise of educational technology and Massive open online courses (henceforth MOOCS), falling within gig economy. Now, the MOOCS are added by phenomena of AI that raises many questions. One among many is whether AI within Edu-tech will replace conventional education system as scale of expansion has been so rapid. Given the fact, this question is loaded with structural complexity and evaluation of conventional education system, certain modality of education is changing rapidly. This paper attempts to explore the rise of MOOCs along with AI within Edu-tech in higher education and structural changes it brings to fore, by critically looking at available reports and established digital platforms. The expansion of digital educational technologies has significantly transformed the landscape of higher education. Virtual universities, driven by Massive Open Online Courses (MOOCs) and increasingly supported by Artificial Intelligence (AI), have emerged as scalable and cost-effective alternatives to traditional campus-based education. These developments coincide with the rise of the gig economy and data-driven digital governance, reshaping institutional structures, pedagogical practices, and assessment mechanisms. While early MOOCs primarily functioned as supplementary learning tools, recent advances in AI-enabled personalization, adaptive learning management systems, and automated assessment have intensified debates regarding the sustainability of conventional university models. This paper critically examines the rise of virtual universities by analysing the integration of MOOCs and AI in higher education and the structural changes they introduce in learning management systems, assessment practices, and lecture delivery. Using a descriptive analytical approach and drawing upon recent Scopus-indexed literature, policy frameworks, and global digital education platforms, the study highlights both the transformative potential and the emerging challenges of virtual higher education. The findings indicate that while digital education enhances access, flexibility, and learner engagement, it also raises critical concerns related to equity, governance, quality assurance, and ethical use of AI. The paper argues that balanced policy frameworks and human-centered pedagogical approaches are essential to ensure that the expansion of virtual universities contributes to inclusive and sustainable higher education systems.*

Keywords: Higher Education, Artificial Intelligence, Governance, Digital mode of learning, Digital awareness, Evaluation process

1. Introduction

Christensen and Eyring suggest that around 2011, Peter Norvig and Sebastian Thrun, two computer scientists affiliated with Stanford and Google, announced new free online course accessible on computer screens through use of artificial intelligence [1]. It was aided with multiple-choice and short programming assignment which would be subsequently submitted online and graded by computer, as argued by Blikstad-Balas, Roe, Dalland, & Klette [2]. Students from many countries got enrolled for the course, and around more than twenty-three thousand people eventually completed it. The success of this course encouraged other universities such as Stanford and MIT to also introduce online courses on the digital platform. These eventually came to be known as Massive open online Courses or MOOCs. Harvard and MIT have invested millions of dollars to create a nonprofit alternative called edX as estimated by Christensen & Eyring [1]. Further, Harvard X launched six new online courses in computer science, political philosophy, public health, ancient history, and law. Howard University suggested that "maybe half the universities would be in bankruptcy" by the rise of disruptive technology like MOOCS and Artificial Intelligence (or AI) that could create such courses covering the entire curriculum that would provide huge economies of scale making them

much cheaper than traditional offline courses [1, p. 7]. Further, MOOCs provide learners with much better pedagogical experience through the involvement and accessibility of better-quality teachers. There is growing use of AI in teaching and pedagogy, including language learning or code setting. The evolution of higher education in the digital age has been shaped by rapid technological innovation, changing learner expectations, and increasing pressures on traditional university systems. A defining moment in this transformation occurred in 2011 when Peter Norvig and Sebastian Thrun introduced a free, AI-supported online course through Stanford University, enrolling learners from across the globe (Christensen & Eyring, 2011). The unprecedented scale of participation demonstrated the disruptive potential of technology-enabled learning and laid the foundation for what later became known as Massive Open Online Courses (MOOCs).

Early MOOCs combined short video lectures, automated grading, and online discussion forums, enabling learners to engage with high-quality educational content irrespective of location (Blikstad-Balas et al., 2022). The success of these initiatives prompted elite institutions such as Harvard and MIT to invest heavily in platforms like edX, while private providers such as Coursera and Udacity expanded their offerings globally. Scholars predicted that such developments could fundamentally challenge the economic viability of traditional

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universities by offering scalable, low-cost alternatives to campus-based education (Christensen & Eyring, 2011).

In recent years, the integration of Artificial Intelligence has further accelerated this transformation. AI-driven analytics, adaptive learning pathways, automated assessments, and personalized feedback systems have shifted MOOCs from static content repositories to dynamic learning environments (Bond et al., 2024). These developments have coincided with broader structural changes in the global economy, particularly the rise of platform capitalism, the gig economy, and data-centric governance models. Consequently, virtual universities are no longer peripheral innovations but central actors in the reconfiguration of higher education systems worldwide.

This article seeks to explore the rise of virtual universities by critically examining how MOOCs and AI are reshaping teaching, learning, and institutional structures in higher education. By focusing on learning management systems, assessment practices, and lecture delivery mechanisms, the study situates digital education within broader debates on governance, equity, and educational quality.

2. Methodology

The present article has a descriptive research design aimed at exploring the rise of MOOCs with AI in higher education and the structural changes it brings to fore in teaching and learning, by critically looking at available reports and established digital platforms. The analysis focusses on the use of learning management system, assessment procedures and lecture delivery methods prevalent in the virtual environment. The present study adopts a descriptive and analytical research design to examine the structural transformation of higher education through MOOCs and AI-enabled digital platforms. The analysis is based on a critical review of Scopus-indexed journal articles (2021–2025), policy documents, and reports from established global and national digital education platforms. Attention is given to learning management systems, assessment frameworks, and lecture delivery methods prevalent in virtual universities. The study synthesizes empirical findings and conceptual insights to identify emerging trends, challenges, and implications for higher education governance.

3. Results and Discussion

3.1 Learning Management System

One area where it is seen that technology of MOOCs developed is through the learning management system (LMS). Online learning is an example of continuous adaptability. Initially, when internet speeds were low and many online courses were nothing more than an online adaptation of the traditional lecture delivery, online courses did not offer much compared to the traditional courses. As a result, only those who couldn't attend courses offered at a certain time or place, such as working adults, opted to use this medium of learning. For them, the definition of quality had more to do with ease of access than effective learning. With passage of time and the adoption of new technology such as video conferencing, tutorials and student discussion forums, all organised online, have provided multiple benefits to the learners in the virtual

landscape. In 2020, regulatory norms via UGC were relaxed to run online education, and private universities from Lovely Professional University, G D Goenka to Manipal saw opportunity to extend their reach and generate new revenue streams in professional courses ranging from Management, Commerce to Law [3]. Competitive concerns were also in play in these early years of growth in online credential offerings, the assumption being that online students represented an entirely new market of students who otherwise wouldn't enroll, due to distance and lack of access. These private universities already had on-campus and distance-education prior to opening online education. The pattern repeated itself with the recent arrival of MOOCs and will likely continue with introduction of various micro credentials and new types of certificates. Private universities have now invested heavily in marketing their online education programs, especially via emerging Internet marketing channels. The entry of most profiting universities into the online degree market has made the idea of earning a degree online more credible. The online degree market development also illustrates the interplay between university strategies, consumer (student) and employer receptivity to new forms of credentials, private companies and investors, and the regulatory environment. To properly determine the benefits of online/digital education, NEP 2020 proposes pilot studies while simultaneously optimizing and expanding current capacities to provide quality education to all [4, p. 58]. Learning Management Systems (LMS) constitute the backbone of virtual universities. Early online education platforms largely replicated traditional classroom models, offering digitized lectures with limited interactivity. Consequently, online learning initially appealed primarily to working professionals and learners constrained by time and location, where accessibility outweighed pedagogical sophistication.

Advancements in digital infrastructure, cloud computing, and AI-based analytics have significantly transformed LMS functionality. Contemporary platforms integrate synchronous and asynchronous learning, real-time discussion forums, adaptive content sequencing, and learner analytics to enhance engagement and retention. Recent Scopus-indexed studies indicate that AI-enabled LMS can identify learning patterns, predict dropout risks, and personalize instructional pathways, thereby improving learner outcomes (Haryanto et al., 2025).

In the Indian context, regulatory reforms following the University Grants Commission's 2020 notification enabled universities to offer full-fledged online degree programs. Private institutions such as Lovely Professional University, GD Goenka University, and Manipal University capitalized on these reforms to expand their digital footprints. These developments align with the National Education Policy (NEP) 2020, which advocates for technology-enabled access, flexibility, and lifelong learning while emphasizing the need for quality assurance and pilot-based expansion (Ministry of Education, 2020).

However, the rapid expansion of virtual universities also raises concerns regarding commercialization, unequal access to digital resources, and the concentration of educational capital within a few dominant platforms. Recent literature highlights the need for regulatory oversight to ensure that digital expansion does not exacerbate existing socio-economic inequalities (Bond et al., 2024).

3.2 Assessments

Online education platform now appears as the ideal environment to meet the demands of modern society and the university community. The MOOCs (Massive Open Online Courses) are open online courses with free registration to which a massive number of students can register [5]. Also, they are open in terms of information sources, curriculum and evaluation procedures. Assessment or evaluation procedures are the necessary part of the online education system. After COVID-19 pandemic, distance learning and online learning have impacted students' involvement in digital education with online assessment and feedback becoming integral part of learning [2]. Generally, assessment is divided into two categories, namely formative assessment and summative assessment [6]. Formative assessment is a continuous evaluation process of students' progress during their course and also give feedback to the student about their performance regarding their course so that they can change and modify their responses. Whereas summative assessment evaluates the students' performance at the end of the course focusing on final grades of the students' performance. Gilandi et al. have argued that online formative assessments are highly effective as they can provide immediate feedback, foster engagement and promote equitable education [7]. George Siemens has identified three different formats of MOOCs [8]. In Connectivism (c-MOOCs) learners are voluntary in nature. The course design has linear, content-based and objective-oriented learning paths with active learner participation. It may have accredited participation (evaluated by course instructor by assignments, artefacts etc.), which is basically a credit earning course or may have unaccredited participation, which is not based on credit earning, so it is an assessment free course. In an Extended (x-MOOCs) course, teachers create and upload the videos and learners are required to watch and listen to all the lectures passively. Evaluation is done individually by automatic machine grading with no direct interaction between individual learner and instructor or by peer assessment [9]. Popular x-MOOCs-based platforms are edX, Coursera and Udacity [10]. The Quasi MOOCs provide structured online learning content without having any assignment. So, the basic difference between c-MOOCs & x-MOOCs and Quasi MOOCs are their pedagogical foundations. Experts propose assessment of student learning to be the pivot of any MOOC [11]. For the MOOC courses, there are some assessment techniques that are required to check the efficiency and credit score of the students. Assessment procedure can be categorized into Intermediate quizzes, Self-assessment, Peer assessment, and Final Exam using automated scoring systems or automated rubrics. Studies on effectiveness of automated essay scoring (AES), have found that while AES-holistic grades and AES-rubric grades were highly correlated, both tended to give lower scores than the instructor mainly in written assignments [12].Peer review and self-assessment are other types of assessment used in MOOC platforms [13]. Different techniques to guarantee the correct grades have been proposed but many studies show that peer assessment activities are not a good predictor of the final grades [14] [15] [16]. Different social activities might also be used for assessment under MOOC evaluation process [17]. Traditional assessment techniques along with Artificial Intelligence are popularly used in MOOCs [18]. Different MOOC platforms, for example edX, Coursera, Miriada X, and Khan Academy, have varied mix of assessment techniques. Khan Academy provides automatic evaluation process and gamification, including the facility to improve the quality of knowledge through several attempts of test. Meanwhile the edX platform supports the creation and editing of complex assessment exercises through an authoring tool called Studio which is used to segregate the different assessment activities in the different sections and sub sections. The various platforms have their own objectives and learning outcomes as such different assessment techniques become concomitant to the varying objectives and learning outcomes. Assessment remains a critical component of educational quality and credibility in virtual universities. MOOCs typically employ a combination of formative and summative assessments, including quizzes, automated assignments, peer assessments, and final examinations. The COVID-19 pandemic further accelerated the adoption of online assessments, embedding digital evaluation mechanisms into mainstream higher education.

AI-driven assessment tools now play a central role in MOOCs, enabling automated grading, plagiarism detection, and personalized feedback. Studies suggest that AI-supported formative assessments enhance learner engagement by providing immediate feedback and adaptive remediation (Gikandi et al., 2011; Bond et al., 2024). Nevertheless, concerns persist regarding the reliability and fairness of automated evaluation systems, particularly in subjective assessments such as essay grading.

Peer assessment and self-assessment remain widely used in MOOCs, especially in large-scale courses where instructor-led evaluation is impractical. While these methods promote learner autonomy and reflective learning, empirical evidence indicates that peer-graded scores often exhibit limited reliability when compared to instructor assessments (Piech et al., 2013; Admiraal & van der Veen, 2014).

Recent research emphasizes the growing role of AI-assisted hybrid assessment models that combine automated scoring with human moderation to balance efficiency and fairness. Ethical considerations, including data privacy, algorithmic bias, and transparency, have emerged as central concerns in the governance of AI-based assessment systems (Bond et al., 2024).

3.3 Lecture Delivery

The increasing globalization of education has led to the adoption of large-scale digital technologies in the teaching pedagogy [19]. Teachers include technology within their teaching style to make lectures more enticing [20, 20]. The popularization of computers, internet and supportive websites has sprouted widespread use of short lecture videos, review questions, self-paced online lessons, optional extension videos, readings from textbooks and primary literature, live online workshops etc. in higher education [20]. Many teachers have found the creation and dissemination of short online videos to be beneficial aid to the regular teaching. Topical videos are created and uploaded on platforms like YouTube for the learners to view at their convenience. Most MOOCs platforms divide the course material into smaller modules. Each module deals with some related topics which are provided to the learner in the form of short videos, generally 15-20

minutes, keeping in mind that the average attention span of human beings is of around this length. In self-paced online lessons style, the learners progress through the study material at their own pace. The study material is provided in the form of video lectures along with suggested reading materials. At times online lectures pertaining to a core topic may be supported by optional extension videos which provide more in-depth analysis of a related subject for those interested in pursuing it. Being optional, these videos can be skipped by learners not requiring a very in-depth knowledge of the subject. However, they aptly cater to the needs of the higher performing learners. Readings from textbooks and primary literature continue to be utilized as means of knowledge creation in virtual teaching. The foundation created by prior reading leads to more involved interactions among the students and faculty online. Many online courses provide list of readings to be completed by the students as foundation for the various lecture modules. Review questions help improve the understanding of learners. By adding review questions to online lectures, instructors can gauge the understanding of students and ascertain focus areas where lecture delivery needs to be altered for increasing clarity and understanding. Increasing digitalization in higher education has encouraged live online workshops as part of virtual learning. The live online workshops differ in the teaching – learning method through increased interactions between the learners and teachers and among learners in real time. Of the various methods of online lecture delivery discussed above, the most popular one is the short video lecture method. However, quality of video lecture delivery format can have a strong effect on the eventual learning by students. Studies on the various formats highlight a strong link between the video lecture delivery format and the engagement felt with the content discussed [21]. Good quality videos are found to be more effective due to their memorability along with ease of reading and listening. Further, the presence of a lecturer in person and as part of a video presentation tends to leave a more lasting impression as compared to only voice over slides [22]. Therefore, lecture delivery styles have evolved to include teachers as part of the presentation. Many platforms like MIT's edX have transported their offline lectures to the digital sphere which gives online learners a feel of the classroom even across devices. Others like Swayam, NPTEL, Coursera have video lectures of experts followed by short quizzes to ensure learning. The knowledge sharing platform of One UN Climate Change Learning Partnership, UNCC: Learn has short videos interspersed with one-minute questions that must be answered before proceeding further. This maintains attentiveness of the learner and gives a chance for reflection on key concepts. Lecture delivery in virtual universities has evolved substantially with the integration of multimedia technologies and AI-supported instructional design. Short video lectures, typically ranging from 10 to 20 minutes, have become the dominant mode of content delivery in MOOCs, reflecting cognitive research on attention span and information retention.

Empirical studies demonstrate that high-quality video production, instructor presence, and interactive elements significantly enhance learner engagement and comprehension (Gilardi et al., 2015). Platforms such as edX, Coursera, SWAYAM, and NPTEL incorporate quizzes, reflection prompts, and live webinars to promote active learning.

AI technologies further enhance lecture delivery through personalized content recommendations, real-time captions, multilingual translation, and adaptive pacing. Recent bibliometric analyses indicate a growing shift from passive content consumption to data-driven, learner-centred pedagogical models in virtual higher education (Vargas-Hernández et al., 2024).

Despite these advances, challenges remain in fostering meaningful social interaction, sustaining learner motivation, and replicating the informal learning dynamics of physical campuses. Scholars argue that hybrid models combining online and offline pedagogies may offer a more sustainable pathway for the future of higher education.

4. Conclusion

The Government initiative for digital education with integration of Artificial Intelligence (AI) is a one way of technological advancement as well as it also reshapes the higher education system. Digital education offers cost-effective and flexible mode of learning. This flexibility and reduced costs help improve access to learning while also highlighting issues of equity and governance in context of conventional education system. As the number of platforms providing online education rises, newer enterprises based on the gig economy model will emerge with strong implications for teaching methodology, learning outcome and the framework of institutions providing education. If not complemented with accompanying policy changes, improved and inclusive governance and objective research and assessment, this can mitigate the benefits that education provides to individual and society. The rise of virtual universities represents a profound structural transformation in higher education, driven by the convergence of MOOCs, Artificial Intelligence, and digital governance frameworks. AI-enabled platforms have expanded access, enhanced flexibility, and introduced innovative pedagogical and assessment practices. At the same time, these developments raise critical questions regarding equity, quality assurance, institutional governance, and the future role of conventional universities.

While virtual universities offer significant potential to democratize education, their long-term impact depends on inclusive policy frameworks, ethical AI governance, and rigorous academic standards. As higher education systems continue to evolve within digital and gig-economy paradigms, balanced integration of technology with human-centred pedagogy will be essential to ensure that educational transformation serves both individual learners and society at large.

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