

MOOCs Innovation for MICE Education: Strengthening Digital and Sustainable Competence in Tourism Learning

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ABSTRACT

The tourism industry is undergoing rapid transformation driven by digitalization, sustainability imperatives, and evolving learner expectations. Within this context, the MICE sector requires professionals who are digitally competent and sustainability-oriented. Traditional classroom approaches often fail to keep pace with these demands, while Massive Open Online Courses (MOOCs) offer scalable and flexible alternatives. This study investigates the role of MOOCs innovation in enhancing digital literacy and sustainability education in MICE learning. Drawing on Constructivist Learning Theory and Competency-Based Education, a quantitative survey was conducted with 42 undergraduate students who had completed a MICE course at Universitas Terbuka, Indonesia. Data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM). The measurement model demonstrated strong reliability and validity, and the structural model showed moderate to substantial explanatory power. Results confirmed that MOOCs innovation significantly influences both digital literacy and sustainability education, with digital literacy emerging as the strongest predictor and a key mediator between innovation and sustainability outcomes. These findings extend theoretical understanding by demonstrating how MOOCs innovation operationalizes constructivist and competency-based approaches in specialized tourism education. Practically, the results emphasize the importance for educators, curriculum designers, and policymakers to prioritize digital literacy as the most effective pathway toward sustainability-oriented learning outcomes. The study concludes that MOOCs innovation offers a strategic tool for preparing future-ready MICE professionals equipped with digital and sustainability competencies.

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1. INTRODUCTION

The global tourism industry is experiencing a profound transformation driven by digitalization, sustainability imperatives, and the changing expectations of modern learners. Within this landscape, The Meetings, Incentives, Conferences, and Exhibitions (MICE) sector plays a crucial role, demanding professionals who possess not only strong operational expertise but also digital capabilities and an understanding of sustainability. Traditional classroom-based approaches to MICE education often struggle to keep pace with rapid technological advancements and shifting industry demands[1]. The post-pandemic rise of hybrid and virtual events has further amplified the urgency for MICE professionals who are adept in digital platforms, virtual collaboration, and sustainable event planning [2]

Massive Open Online Courses (MOOCs) have emerged as a flexible, scalable, and accessible form of digital learning that addresses these limitations of conventional education. Aligned with the principles of Education 4.0, MOOCs leverage digital technologies, open data, and global connectivity to create personalized and future-oriented learning experiences [3]. Massive Open Online Courses (MOOCs) have broadened access to high-quality educational resources worldwide, enabling learners to study flexibly at their own pace through programs offered by leading institutions [4]. By offering interactive, self-paced, and often interdisciplinary content, MOOCs can bridge the gap between academic theory and industry practice. In tourism education, particularly in MICE management, MOOCs provide a platform for introducing real-world scenarios, advanced digital tools, and sustainability frameworks that are increasingly vital in post-pandemic tourism development [5]

Nevertheless, existing literature highlights that while MOOCs have been widely adopted in general technical and vocational education, their application in tourism education remains limited. Most MOOCs focus on broad tourism subjects or technical skills, with few addressing the specialized and practice-oriented needs of the MICE sector. Moreover, integrated approaches that simultaneously strengthen digital literacy and sustainability competencies remain underexplored [6] This gap presents an opportunity to investigate the potential of MOOCs innovation as a strategic educational tool for preparing future-ready MICE professionals.

Therefore, this study seeks to investigate the development, relevance, and usefulness of MOOCs in enhancing learners' digital literacy and sustainability education within the

MICE context. By doing so, it contributes to tourism education scholarship while aligning with global Sustainable Development Goals (SDGs) and responding to industry demands for competent, digitally literate, and sustainability-oriented professionals. By addressing these limitations, this study offers three distinct contributions that clearly differentiate it from prior literature. First, while existing research predominantly focuses on broad tourism subjects or generic vocational skills, this study narrows its lens specifically to the specialized, practice-oriented demands of the MICE sector in a post-pandemic landscape. Second, unlike previous studies that examine digital literacy and sustainability education in isolation, this research introduces an integrated model that positions digital competence not just as an independent skill, but as a critical mediating mechanism that operationalizes pedagogical innovation into actionable sustainability outcomes. Finally, by providing empirical validation within an open and distance learning context (Universitas Terbuka), this study offers a scalable, data-driven framework for curriculum designers and policymakers to align educational innovation with global Sustainable Development Goals (SDGs).

2. RESEARCH METHOD

This research is based on Constructivist Learning Theory, which proposes that knowledge is actively constructed by learners through experience, reflection, and interaction within their learning contexts [7]. In the context of MOOCs, constructivism highlights the importance of learner-centered, interactive, and context-driven instruction. MOOCs allow tourism students and professionals to engage with authentic MICE scenarios, digital simulations, and sustainability challenges in flexible and autonomous ways. Such environments foster deep learning by encouraging reflection, collaboration, and application of knowledge, making MOOCs particularly relevant for equipping learners with digital and sustainable competencies in the tourism industry. Constructivist Learning Theory emphasizes that innovation in learning through interactive tools and creative teaching methods enhances students' ability to actively construct knowledge (Vygotsky, 1978; Piaget, 1970). Within MOOCs, innovation is reflected in the integration of digital platforms, simulations, and novel teaching strategies that encourage learner engagement. Prior research suggests that innovative educational practices can strengthen students' digital skills by exposing them to diverse technological tools and fostering adaptive learning behaviors [8] Accordingly, it is hypothesized that:

H1: Innovation significantly affects digital literacy.

Competency-Based Education (CBE) emphasizes measurable learning outcomes that align with industry needs. Within MICE education, this translates into competencies such as proficiency in digital tools, virtual event management, and sustainable event planning. MOOCs designed with CBE principles promote practical, task-oriented learning

that enhances learners' perceived relevance and usefulness of courses. While MOOCs have been widely adopted in vocational education globally, few studies focus specifically on MOOCs tailored for MICE education that integrate both digital literacy and sustainability competencies highlighting a critical research gap.

Competency-Based Education (CBE) theory posits that learning should align with industry-relevant skills and outcomes. In the tourism sector, this includes competencies in sustainable event planning and resource management. Innovative MOOCs can integrate sustainability topics into MICE curricula through project-based learning, case studies, and digital simulations, providing students with meaningful opportunities to engage in sustainability practices [9]. Innovation in educational design, therefore, plays a critical role in embedding sustainability values into tourism learning. Thus, we propose:

H2: Innovation significantly affects sustainability competence.

In the field of Sustainability Competence teachers play a vital role as facilitators who introduce sustainability concepts and embed them into curricula. Through this approach, students gain awareness of environmental preservation and resource management. In MICE education, integrating sustainability involves not only theoretical learning but also participation in projects and activities that reflect real-world practices, such as green event design and waste management strategies. Such experiences nurture responsible attitudes and equip students to contribute to sustainable tourism development.

Digital literacy enables learners to effectively navigate, analyze, and apply information from digital sources, which is essential for engaging with sustainability-related knowledge. Students proficient in digital tools are more capable of accessing resources on sustainable practices, participating in online sustainability initiatives, and applying digital solutions to real-world challenges [10]. Research in sustainability competence highlights that digital skills enhance awareness and foster critical thinking in addressing environmental and social issues [5]. Therefore, the following hypothesis is developed:

H3: Digital literacy significantly affects sustainability competence

The integration of innovation, digital literacy, and sustainability competence extends beyond skill development it cultivates a mindset that embraces change, creativity, problem-solving, and responsible use of technology. Innovation in education also serves as a driver of sustainability by fostering adaptable learning environments that prepare students for future challenges. From one perspective, ensuring the sustainability of educational innovation is crucial for long-term learning impact; from another, innovation itself can be leveraged as a catalyst to advance sustainable development through education [11]. Within MOOCs for MICE education, this dual perspective is essential to equip learners not only with technical competencies but also with sustainable values aligned with global Sustainable Development Goals (SDGs).

The integration between innovation, digital literacy, and sustainability reflects the role of digital competence as both an outcome and an enabler of sustainable education. While innovation introduces new learning environments, digital literacy determines how effectively learners can leverage these innovations for sustainability outcomes. Previous studies indicate that digital competence often serves as a mediating mechanism linking innovative learning environments to higher-order educational goals, including sustainability awareness and problem-solving skills [11]. Hence, it is hypothesized that:

H4: Digital literacy mediates the relationship between innovation and sustainability education

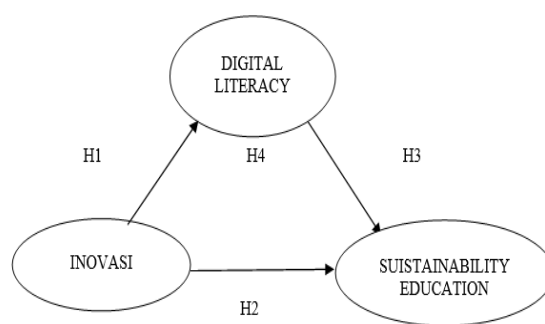


Figure 1. Research framework

This study adopted a quantitative research design, using a survey method to examine the relationship among MOOCs innovation, digital literacy, and sustainability education within the context of MICE learning. Structural Equation Modeling with Partial Least Squares (PLS-SEM) was employed as the primary analytical technique, given its suitability for exploratory research, predictive analysis, and models involving latent constructs with multiple indicators, particularly when working with relatively small sample sizes [12].

The target population consisted of undergraduate students who had completed the MICE (Meetings, Incentives, Conferences, and Exhibitions) course at Universitas Terbuka. The study was conducted in Universitas Terbuka, Indonesia, a leading provider of open and distance learning, where MOOCs are particularly relevant for enhancing digital and sustainability competencies in tourism education. A purposive sampling technique was applied, as only students with prior exposure to MICE learning were deemed relevant for this study. From this population, 42 valid responses were obtained and used for data analysis. While the sample size is relatively modest, it meets the minimum requirement for PLS-SEM analysis, which emphasizes predictive validity over sample size strictness [12]. To operationalize the research model, data were collected using a structured questionnaire that consisted of three main constructs. The measurement items for each construct were adapted from validated scales in prior literature regarding digital education, innovation, and

sustainability learning, which were then specifically refined and contextualized for the MICE education setting. All items were measured using a five-point Likert scale, spanning from 1 (strongly disagree) to 5 (strongly agree). As displayed in the measurement model, the instrument comprises a total of nine distinct indicators, with each latent variable being measured by three items: MOOCs Innovation (IN): Evaluated through three items (IN1, IN2, IN3) designed to capture the integration of novel pedagogical tools, digital simulations, and interactive teaching strategies within the course. As displayed in the measurement model, the instrument comprises a total of nine distinct indicators, with each latent variable being measured by three items: MOOCs Innovation (IN): Evaluated through three items (IN1, IN2, IN3) designed to capture the integration of novel pedagogical tools, digital simulations, and interactive teaching strategies within the course. Digital Literacy (DL): Measured using three items (DL1, DL2, DL3) focusing on the students' ability to effectively navigate, analyze, and apply information using digital platforms. Sustainability Education (SE): Assessed via three items (SE1, SE2, SE3) aimed at determining competencies in sustainable event planning, green event design, and responsible resource management. Empirical Construct Validity and Reliability were statistically established using the Partial Least Squares–Structural Equation Modeling (PLS-SEM) framework. This involved assessing individual item reliability through outer loadings, internal consistency through Composite Reliability (CR), and convergent validity via the Average Variance Extracted (AVE). The questionnaire items were adapted from relevant prior studies in digital education, innovation, and sustainability learning, and refined for the MICE context. Data were collected using a structured questionnaire with items measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The questionnaire consisted of three main constructs. The survey was distributed online via Google Forms to ensure accessibility and efficiency. Respondents were provided with informed consent forms and assured that their participation was voluntary, confidential, and used solely for academic purposes. Data collection was conducted period in September 2025.

3. RESULTS AND DISCUSSION

Total of 42 valid responses were collected for this study. In terms of gender, 23 participants (55%) were male and 19 (45%) were female, indicating a relatively balanced distribution. Regarding age, the majority of respondents (64%) were between 21 and 30 years old, followed by 14% aged 31–40 years, 12% under 20 years old, and 10% between 41 and 50 years old, reflecting a predominantly young adult sample. With respect to the use of digital technology in learning, 40% reported using it very frequently, 36% frequently, 12% occasionally, and 12% rarely. This suggests that most respondents were accustomed to integrating digital technologies into their academic activities. The respondents were distributed across various regional branches of Universitas Terbuka (UT). The largest groups came from UT Batam and UT Mataram (14% each), followed by UT Jakarta (10%),

UT Ambon (7%), UT Bogor, Gorontalo, Kediri, Purwokerto, and Lombok (each 5%). Other regions such as Denpasar, Lombok Tengah, Palu, Serang, Jember, Kendari, Padang, and Yogyakarta each contributed 2–3% of the sample. This distribution highlights the diverse geographical representation of UT students across Indonesia. Overall, these demographic characteristics indicate that the sample is not only balanced in terms of gender and age but also broadly representative of different regions, thereby strengthening the relevance of the study's findings.

The measurement model was initially evaluated based on indicators of reliability, internal consistency, and convergent validity. As presented in the table, all outer loadings exceed the recommended threshold of 0.70, with values ranging from 0.901 to 0.952, thereby confirming adequate indicator reliability [12]. The Composite Reliability (CR) values were 0.944 for Digital Literacy, 0.958 for Innovation, and 0.958 for Sustainability Education, all of which are well above the minimum criterion of 0.70, indicating strong internal consistency reliability. Furthermore, the Average Variance Extracted (AVE) values were 0.848 (Digital Literacy), 0.883 (Innovation), and 0.884 (Sustainability Education). These values exceeded the cut-off point of 0.50 (Fornell & Larcker, 1981), providing evidence of convergent validity. Collectively, these results demonstrate that the constructs in this study are measured reliably and validly, thus establishing a solid foundation for evaluating the structural model.

Table 1. Measurement Model

Indicator	Outer Loading	Composite Reliability	AVE
DL1	0.919	0.944	0.848
DL2	0.942		
DL3	0.901		
IN 1	0.952	0.958	0.883
IN2	0.944		
IN3	0.922		
SE1	0.945	0.958	0.884
SE2	0.952		
SE3	0.923		

The evaluation of the coefficient of determination (R^2), predictive relevance (Q^2), and effect size (f^2) demonstrates that the model meets the recommended thresholds [12]; [13]. The model explained 51.3% ($R^2 = 0.513$) of the variance in Digital Literacy and 66.3% ($R^2 = 0.663$) of the variance in Sustainability Education, indicating moderate to substantial explanatory power. Regarding predictive relevance, the Q^2 values of 0.569 for Digital Literacy and 0.408 for Sustainability Education are both greater than zero, thus confirming the model's strong predictive accuracy.

In terms of effect size (f^2), Innovation exerted a large effect on Digital Literacy ($f^2 = 1.055$), while Digital Literacy strongly influenced Sustainability Education ($f^2 = 1.187$). However, the direct effect of Innovation on Sustainability Education was relatively small ($f^2 = 0.027$). These findings suggest that Innovation plays a pivotal role in enhancing Digital Literacy, which subsequently becomes the main driver of Sustainability Education.

Table 2. Structural Model Evaluation

Path	R ²	Q ²	f ²
Digital Literacy	0.513	0.569	
Sustainability Education	0.663	0.408	
Innovation → Digital Literacy			1.055
Innovation → Sustainability Education			0.027
Digital Literacy → Sustainability Education			1.187

The results of the bootstrapping analysis further confirmed the significance of all hypothesized relationships. Innovation significantly influenced Digital Literacy ($\beta = 0.717$, $t = 7.587$, $p < 0.001$) and Sustainability Education ($\beta = 0.136$, $t = 2.802$, $p < 0.001$). Furthermore, Digital Literacy strongly predicted Sustainability Education ($\beta = 0.906$, $t = 7.291$, $p < 0.001$). In addition, the mediation analysis demonstrated that Digital Literacy significantly mediated the relationship between Innovation and Sustainability Education ($t = 4.526$, $p < 0.001$), highlighting its critical role as a transmission mechanism for Innovation’s impact.

These results align with the argument that technological and pedagogical innovation enhances learners’ digital competencies, which in turn facilitates sustainable educational practices in tourism and hospitality contexts. Similar to previous findings by [14], the current study confirms that skill-oriented constructs (in this case, Digital Literacy) exert substantial influence on sustainability-related learning outcomes. Moreover, the dominance of the indirect effect compared to the direct path underscores the mediating power of Digital Literacy, echoing prior research emphasizing the transformative role of digital competencies in sustainability education [15]. To conclude, all hypotheses (H1–H4) were supported. The findings suggest that MOOCs innovation contributes most effectively to sustainability education by first enhancing digital literacy, thereby positioning digital competence as the key driver of sustainable learning outcomes in MICE education.

Table 4. Hypothesis Testing Results

Hypothesis	Path	Path Coefficient (β)	t- value	p-value	Decision
H1	Innovation → Digital Literacy	0.717	7.587	0.000	Supported
H2	Innovation → Sustainability Education	0.136	2.802	0.000	Supported
H3	Digital Literacy → Sustainability Education	0.906	7.291	0.000	Supported
H4	Innovation → Digital Literacy → Sustainability Education		4.526	0.000	Supported

Overall, the statistical results demonstrate that the structural model achieved acceptable explanatory power, with R^2 values of 0.513 for Digital Literacy and 0.663 for Sustainability Education, alongside strong predictive relevance ($Q^2 = 0.569$ and 0.408 , respectively). The effect size analysis confirmed that Innovation had a large effect on Digital Literacy ($f^2 = 1.055$), while Digital Literacy strongly influenced Sustainability Education ($f^2 = 1.187$). By contrast, the direct effect of Innovation on Sustainability Education was small ($f^2 = 0.027$). Bootstrapping results further verified that all hypothesized paths were statistically significant ($p < 0.001$), including the mediation effect of Digital Literacy ($t = 4.526$, $p < 0.001$). Collectively, these findings confirm that all four hypotheses (H1–H4) were supported, with Digital Literacy emerging as the strongest predictor in the model.

The finding that Innovation strongly influences Digital Literacy ($\beta = 0.717$, $t = 7.587$, $p < 0.001$) aligns with literature showing that educational innovation and technological integration bolster digital competence. For instance, research argues that innovation in education through new teaching tools and digital platforms can improve quality of teaching and learners' skills. Moreover, studies on teacher innovativeness emphasize that innovative teachers often adopt new technologies and pedagogical practices, thereby enhancing their students' technological competence [16]. This research shows that innovation positively affects digital literacy. In the context of MOOCs, innovative learning features allow students to more actively interact with digital learning resources, thereby improving their ability to access, evaluate, and utilize information effectively. This finding aligns with study which suggests that innovations in educational technology and instructional methods serve as important mechanisms for improving digital literacy [1].

Although the direct path from Innovation to Sustainability Education is statistically significant ($\beta = 0.136$, $t = 2.802$, $p < 0.001$), the small effect size ($f^2 = 0.027$) suggests that innovation alone does not strongly drive sustainability outcomes. This supports the idea from Competency-Based Education that merely introducing innovative tools is not enough the tools must be coupled with competency development strategies in sustainability. Prior studies on innovation in education warn that unless innovation is meaningfully integrated with curricular content, its impact may remain superficial [17]. The findings indicate that learning innovations support Sustainability Education and create more interactive and meaningful learning experiences. Although innovation creates greater learning opportunities, the successful achievement of Sustainability Education still requires competence. This finding is also in line with learning innovation can produce sustainable long-term impact when supported by adequate competency development [18].

Digital Literacy emerged as the strongest determinant of Sustainability Education ($\beta = 0.906$, $t = 7.291$, $p < 0.001$; $f^2 = 1.187$), underscoring its central role in shaping sustainability-related learning outcomes. This finding highlights that students who possess higher levels of digital competence are better able to access, interpret, and apply sustainability knowledge in meaningful ways. Prior studies affirm that digital literacy is not merely a technical skill but a foundational competence that enables learners to critically evaluate information,

participate in digital environments, and translate knowledge into sustainable practices[19];[20]. In higher education, digital competence has been linked to improved engagement with sustainability content and to the development of critical thinking and problem-solving skills required for addressing environmental and social challenges[21]. Within the MICE context, where event planning increasingly integrates green practices and digital tools, digital literacy equips students to design, implement, and evaluate sustainable solutions effectively. The strong effect observed in this study confirms that digital literacy functions as the key pathway through which educational innovation translates into sustainability-oriented outcomes. The findings reveal that Digital Literacy serves as the strongest predictor of Sustainability Education. This suggests that students with a higher level of digital literacy are better able to comprehend, critically evaluate, and apply sustainability concepts in the learning process. Digital literacy extends beyond technical proficiency and includes the ability to analyze information, make ethical judgments, and recognize the broader social consequences of technology use. Consequently, digitally literate students are more capable of accessing and evaluating sustainability related information, and connecting sustainability concepts with real practices in the MICE industry [22].

The mediation analysis confirms that Digital Literacy significantly mediates the relationship between Innovation and Sustainability Education ($t = 4.526$, $p < 0.001$). This indicates that the effect of innovation on sustainability is largely channeled through improved digital competence. The finding is consistent with models of educational innovation that emphasize digital competencies as intermediary mechanisms for translating innovation into higher-order educational outcomes [23].

4. CONCLUSION

This study set out to examine the role of MOOCs innovation in strengthening digital literacy and sustainability education within the MICE learning context. Building on Constructivist Learning Theory, the findings affirm that innovative, learner-centered environments enable students to actively construct knowledge and develop digital competencies. In parallel, the results reinforce the principles of Competency-Based Education, as MOOCs innovation directly and indirectly contributes to the development of industry-relevant competencies, particularly in sustainability. The empirical evidence confirms that while innovation is essential, its strongest impact on sustainability education is realized through digital literacy, which emerges as the key mediator. This suggests that innovation in educational design alone is not sufficient; rather, it must be integrated with strategies that enhance digital literacy in order to fully translate innovation into sustainability-oriented outcomes. From a theoretical perspective, this study contributes to the literature by extending constructivist and competency-based approaches into tourism and MICE education, showing that digital literacy functions as a mediating mechanism

linking innovation to sustainability. From a practical and policy standpoint, the results emphasize the importance for educators, curriculum designers, and decision-makers to prioritize digital literacy when designing MOOCs or other digital learning strategies, as it represents the most effective pathway to achieve sustainability-oriented outcomes. For managers in the tourism and hospitality industry, these findings suggest investing in innovative, digitally driven training programs that embed sustainability frameworks to prepare MICE professionals who are both digitally competent and sustainability-minded. Finally, future research may extend this study by involving a larger sample, applying the model to other tourism education contexts beyond MICE, or including additional constructs such as student motivation, and may provide further insights into how MOOCs innovation influences learning outcomes.

Taken together, these findings suggest that MOOCs innovation must be purposefully designed to build digital literacy if the goal is to impact sustainability learning. Innovation without robust support for digital skills may lead to limited gains in sustainability education. The results reinforce a dual role of digital literacy as an outcome of innovative instructional design and as a gateway to sustainable learning outcomes.

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