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Role of E-Learning in Promoting Sustainable Skill Development in Tourism

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Abstract

Background: *The education of tourism is experiencing a structural change because of the growing use of digital classes and distance teaching. Tourism-related institutions are likely to incorporate sustainability, competencies in the industry, and technology training in their curricula. E-learning has become a key instrument in the sustainable acquisition of skills, but its success in the tourism training needs empirical studies.* **Objective:** *The main aim of this research is to investigate how e-learning contributes to the sustainability of a skill development in tourism studies, particularly the e-learning practices, learning engagement, perceptions of the perceived effectiveness of online learning tools, and the issues linked to higher education online learning.* **Methodology:** *The study was done using a quantitative research design. The data were sampled among 300 undergraduate and postgraduate tourism and hospitality management students of the higher institutions of learning in the North India and especially in Uttar Pradesh and the Delhi-NCR region who were exposed to digital learning platforms. data collection involved the use of a structured questionnaire on a five-point Likert scale. The proposed hypotheses and relationships between variables were tested with the application of statistical methods such as descriptive statistics, reliability analysis (Cronbach's alpha), correlation analysis, and multiple regression analysis.* **Results:** *The results demonstrate that e-learning practices and engagement of the students play a significant role in sustainable development of skills. Correlation analysis revealed a positive relationship of high strength between e-learning practices and sustainable skill development ($r= 0.61$). The regression analysis also revealed that the e-learning practices were found to be the most effective predictor of sustainability skills ($\beta= 0.31$, $p< 0.05$). Nevertheless, all issues like lack of exposure in practice and technical problems adversely affect learning results.* ***Conclusion:*** *The research concludes that e-learning may be an efficient mechanism to support sustainable skill development in tourism education in case accompanied by the interactive design, technological reliability, and a chance to practice learning. To determine the most benefits of digital education in tourism programs, it is necessary to address practical training gaps and technical issues.*

Keywords: *E-learning, sustainable skill development, tourism education, student engagement, digital learning platforms*

Introduction

Due to the increased use of digital learning spaces and distance modes of teaching, tourism education has entered a period of structural change. The provision of tourism and hospitality programs in institutions is increasingly required to be in line with the sustainability objectives, industry requirements, and technological transformation (Huang et al., 2024). The conventional teaching techniques used in the classroom setting are also not always suitable to meet

the dynamism of skills requirements in terms of sustainable tourism operations, digital service delivery, and responsible destination management. E-learning platforms have come out as a substitute which facilitates continuous learning, flexible access and expanded access to learners across geographic as well as socio-economic boundaries. The observable research point is the fact that digital education is no longer considered a temporary task but a stable part of higher education systems, especially professional and applied ones like tourism and hospitality (Demirdelen, 2022; Elshaer et al., 2025).

Sustainability in skill development in tourism should be a balance between theory, awareness, and skill. Sustainability skills encompass sustainable management of resources, community relations, cultural sensitivity, environmental awareness, and long-term destination planning. These capabilities cannot be trained by using rote-learning and require practicing in the real world and reflective-learning. E-learning systems help in achieving this requirement because multimedia materials, case-based learning, and simulation driven content are incorporated in the system. Digital media enables the learners to interact with the global contexts of tourism, sustainability, and policy frameworks without being limited by physical boundaries.

The tourism industry has been experiencing a fast evolvement because of adoption of technology and sustainability led reforms. In addition to sustainability knowledge and versatile problem-solving, employers demand that graduates are now digital-capable and mindful of sustainability (Leyva et al., 2024). This change puts pressure on providers of tourism & hospitality education to re-design the curricula and methods of delivery. E-learning platforms facilitate institutions to update more regularly, combine interdisciplinary perspective and partner with industry (Wang et al., 2024). Research indicates that online-learning courses on sustainable tourism practices enable study participants to learn more about complicated problems, including climate impact, over-tourism, ethical consumption, and community-based tourism patterns (United Nation World Tourism Organization, 2022). E-learning is also flexible thus enabling lifelong learning to individuals who are already involved in the tourism industry thus its relevance to lifelong learning is also extended beyond the formal degree programs.

Breaz et al. (2022). provide a description of teachers' perceptions of e-learning based on descriptive statistics and will conduct an empirical study in future research to develop these results. The results show that the e-learning system was indispensable during the pandemic, although the classroom teacher cannot be replaced by such a system

The challenges facing the use of e-learning in the development of sustainable skills in tourism education are not yet insignificant in spite of its potential. Issues associated with student activity, practical skills evaluation, online access and instruction are all contentious. Faculty members may have to work harder because of the creation of content, supervision of online engagement, and digital instruction adherence to the quality assurance and accreditation requirements (Ahmed et al., 2023). Digital preparedness and availability of resources may result in students having unequal learning experiences. According to recent empirical studies, the contribution of e-learning to the development of skills cannot be underestimated, and it is necessary not only to consider the rates of its adoption but also to pay attention to the technological facilities (Schulz, 2023). This requires studies relating learning processes to quantifiable sustainability-related competencies. In that regard, this paper focuses on analyzing how the e-learning can facilitate sustainable skills development in the tourism education. The paper is interested in the way the digital learning environment contributes to the acquisition of sustainability related knowledge, practical understanding and professional readiness in the tourism students. Underlying the analysis with the recent research in the fields of education and tourism, the study is expected to add up to debates on the topics of digital pedagogy, sustainability education and workforce development. This study is a reaction to the demand of evidence-based contributions that can help academic institutions, policymakers, and industry stakeholders in enhancing the e-learning systems of sustainable tourism learning (World Travel & Tourism Council 2021).

According to Bramwell et al. (2017), sustainable tourism learning has over time been progressing away and instead of following traditional knowledge transmission models to competency-based learning frameworks that focus on ethical reasoning, environmental responsibility, stakeholder engagement, and responsive decision-making. They stress the point that sustainability in tourism is not a one-dimensional phenomenon, but an interdisciplinary field of study that necessitates the incorporation of the environmental science, socio-cultural awareness, economic analysis and

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the principles of governance. This transformation means that the pedagogical strategies should stop focusing on the lecture-based teaching to promote critical thinking, reflective practice, and applied skills.

According to Mandalia (2023), e-learning platforms are revolutionized systems that can underpin sustainability-oriented education through access to multimedia case studies, real-time global data, virtual simulation and interactive problem-solving tasks. With digital learning, students will be able to examine intricate world issues like the problem of overtourism, how vulnerable to climate changes they are, how to manage their carbon footprint, and the patterns of ethical consumption through immersive and scenario-based learning.

Sigala (2020) also add that the digital transformation in the tourism education process contributes to the enhancement of sustainability learning as the authors claim that technology-enhanced reflection, collaborative knowledge creation, and simulations, in turn, can be integrated into the academic program. To this end Wang et al., 2024 emphasize that curriculum integration, in this respect, is supported by e-learning, which allows curriculum modular redesign and flexibility, as well as goes hand in hand with the required reforms of the industry in terms of sustainability.

Leyva et al. (2024) argue that modern tourism graduates are being put under pressure to exhibit a high level of digital literacy and sustainability competencies at the same time. Introduction of e-learning in tourism programs is thus not only a way of enhancing the technological capacity but also creating awareness about sustainability. In line with this, Elshaer et al., 2025 affirm that such a compounding of digital and sustainability aptitude has a positive impact on graduate employability and readiness to the industry in a world that is quickly transforming in the tourism industry.

According to Ibanez et al. (2020), student engagement is one of the determinants of successful learning outcomes in online education and that engagement in digital space involves behavioural engagement, emotional engagement, and cognitive investment into academic tasks. According to their findings, meaningful engagement extends beyond the experience of attending virtual classrooms, and it involves active intellectual investment. In the framework of sustainability education, the engagement aspect is especially essential since the topic requires a reflective mindset, moral judgment, and value-oriented reasoning instead of memorization of ideas.

According to the explanation of Cantoni et al. (2009), interactive learning tools like discussion forums, peer collaboration platforms, digital storytelling, and case-based assignments are most effective in promoting the active learning processes of tourism education. These resources enable students to relate the theoretical concepts of sustainability with actual tourism realities. In line with this view Dunn and Kennedy, 2019 indicate that the degree of online student engagement is strongly correlated with the results of deeper learning and retention of knowledge in the long term. Digital engagement, in tourism education in particular, introduces students to best practices and cross-cultural sustainability views that enable them to enrich their knowledge on responsible tourism management. Cantoni et al. (2009), also emphasize the importance of digital storytelling and multimedia integration in situating the concepts of sustainability in the context of tangible tourism environment. Scenario-based tasks and narrative-based content enable students to critically assess sustainability issues encountered by destinations and assess alternative management solutions. This form of pedagogy is closely linked to the constructivist learning theory that considers knowledge as co-constructed in the process of interaction, reflection and sharing of meaning and meaning-making instead of passively imparted by teachers.

Castano et al. (2025) expand this idea by stating that being active online would boost the confidence of students to implement sustainability ideas to real-life situations in tourism. Engaging learners in collaborative conversations and problem-solving activities, as well as, in reflective tasks, will bring a greater likelihood of internalizing the sustainability values and converting them into professional competencies. This implies that student engagement as a concept is not just a measure of participation but a process by which sustainability-relevant skills are practically acquired within tourism education.

According to Joshi et al. (2025), the perceived effectiveness mediates the effects of digital learning settings and skills acquisition with the authors stating that technology acceptance, and the level of perceived usefulness have a significant impact on the motivation, satisfaction, and

academic performance of students. In the field of tourism education, the perceived usefulness of digital tools will be used to assess whether students will perceive sustainability material as something that can be applied into the industry setting or this is simply a theoretical material.

Ibanez et al. (2020) also emphasize that the elements of perceptions of effectiveness include the usability of the platform, the clarity of the instructions, and the feedback structure. Under the conditions of timely feedback of digital platforms, structured units, and the possibility of real-time communication, students are more committed to learning and participate more. On the other hand, platforms that are not well designed reduce the perceived value and undermine the application of learned skills in the workplace.

Mandalia (2023) underlines that the contextualized and application-focused examples are essential in sustainable tourism education, and proposes that digital simulations and virtual field visits might positively contribute to the perception of being real and having a practical exposure. These simulation tools assist in the reduction of the gap between theory and practice in the industry. Combining the literature, perception of effectiveness is not identified by technological availability alone; instead, it relies on the consistency between the pedagogical design, industry relevance, and the quality of instruction in digital learning settings.

Fernandez-Villaran et al. (2024) make a valuable contribution to the body of knowledge on tourism education by highlighting the importance of having a curriculum that allows the development of both liberal reflection and professional skills in students. They emphasize in their study the role of focusing on complexity in tourism research and developing expertise based on well-organized learning outcomes. The authors believe that the comprehensive performance-focused approach of this kind would be able to enhance the effectiveness of tourism studies in general and prepare graduates with the challenges of the highly dynamic industry. This point of view brings value to the current discussion because it provides a model that can be used to create future tourism curricula at a globalized level.

Ochilov (2025) dwells upon the changing role of digital technologies in education of tourism in the time of Industry 4.0. The research presents the combination of these tools like virtual reality, augmented reality, artificial intelligence, big data analytics, and simulation software as an effective way of improving teaching and learning experiences. It underlines the fact that these technologies do not just enhance the knowledge acquisition of the students, but also, assist in the development of the necessary technical and soft skills, needed in the sphere of tourism. The study will be of significance to the existing body of research by highlighting the issue of educational institutions implementing new forms of pedagogy and properly integrating digital technologies into tourism programs.

According to Nouraey and Al-Badi (2023), one of the biggest challenges to successful deployment of e-learning in higher education is technological barriers, digital divide problems, and gaps in the preparedness of faculty. In spite of the flexibility and access encompassed in the digital learning, these structural constraints can seriously limit its potential. Such issues are especially crucial in tourism programs since experiential learning (field visits, internships, and direct interaction with the industry) is a vital part of skill development and professional preparation.

Alqahtani et al. (2022) also note that online learning may adversely affect the student motivation and learning engagement because of the digital fatigue, low peer interaction, and low social presence. Sustainability education needs participatory discussion, awareness among stakeholders and reflective use of values, which might be limited in entirely online forms. According to Schulz (2023), it is important that in order to achieve meaningful learning, tourism education should not sacrifice the authenticity of the experience and it is hard to reproduce the dynamics of actual tourism wholesomely without using a virtual platform.

Ahmed et al. (2023) point out that the needs of creating digital content put additional strain on faculty, which further complicate the implementation of e-learning. The process of creation of interactive materials, supervision of online engagement, and alignment of digital training with sustainability metrics entails the high level of institutional assistance. Sustainability and digital transformation require effective integration, which can be achieved through proper leadership, strategies, and policy frameworks that will integrate these priorities into the institutional framework on a systematic basis.

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Naik (2024) looks at the increased role of digitization in education, noting how e-learning has increased accessibility and changed the conventional teaching approach in institutions of higher learning (HEIs). According to the research, there are several obstacles to successfully implementing e-learning, with financial factors being of paramount importance that creates poor infrastructure, insufficient access of equipment, and lack of internet connectivity. The study identifies these barriers, using an ISM-MICMAC method, into a hierarchic focus, which provides information about the relationship of the barriers. The results are relevant to the literature because they present an organized framework that can guide policy makers and institutions in prioritizing on strategies of overcoming these difficulties and ensuring sustainable adoption of e-learning.

According to Tuazon et al., 2024, sustainability education usually requires field-based evaluation and live observation of tourism activities, which a completely digital environment might not be sufficient to offer. The depth of competence development can therefore be influenced by the lack of practical exposure. As a way of addressing such concerns, blended learning frameworks are becoming one of the optimal recommendations to support a balanced format of digital flexibility and experiential depth to promote even more holistic sustainability skills acquisition in tourism education.

More recent studies also reveal the increasing role of digital technologies in enhancing sustainability competencies in tourism education. New teaching resources, including virtual simulations, virtual learning environments, and virtual collaboration tools, will enable students to learn about the reality of tourism with simulated situations and get to examine the sustainability issues within the destination management. These technologies facilitate experiential education and assist students in acquiring practical skills concerning environmental management, responsible tourism procedures, and communicative interaction with the community (Huang et al., 2024; Wang et al., 2024).

The available studies on e-learning in tourism education have mainly concentrated on the adoption of technology, satisfaction of learners as well as generic academic performance with little emphasizing on sustainability as skill-based learning outcome. The majority of research approaches sustainability as a theoretical or policy-based subject as opposed to studying how digital learning can help in developing viable skills like responsible decision making, environmental consciousness and ethical approach to tourism. There is limited empirical evidence that culminates into a linkage between e-learning practices and sustainable skill development among tourism students especially on the learner perspective. Moreover, the developing and emerging economies have scarcer research that is not as relevant in the world tourism development and challenges in sustainability. What is also lacking is the analysis of the issues that can reduce the efficiency of e-learning in enhancing sustainability-related skills.

This gap identifies the necessity of narrowed empirical studies that take into consideration the ability of e-learning in the facilitation of sustainable skills acquisition in tourism education.

The study will add to the body of knowledge in the area of tourism education, as it empirically connects the practice of e-learning with the development of skills with an orientation towards sustainability. Whereas the adoption of technology and the level of satisfaction were put in the focus of the previous studies, minimal studies have quantified sustainability as a skill-based learning outcome. The research can especially be applicable to the developing economies in which the issue of tourism growth and sustainability is a pertinent issue. The results provide implications into curriculum change, development of digital pedagogy and policy.

Hypotheses:

H1: E-learning has a significant relationship with sustainable skill development in tourism education.

H2: E-learning positively influences student engagement in sustainability-oriented tourism education.

H3: Student perception of e-learning effectiveness is positively related to sustainable skill development in tourism.

H4: Challenges associated with e-learning negatively affect sustainable skill development in tourism education.

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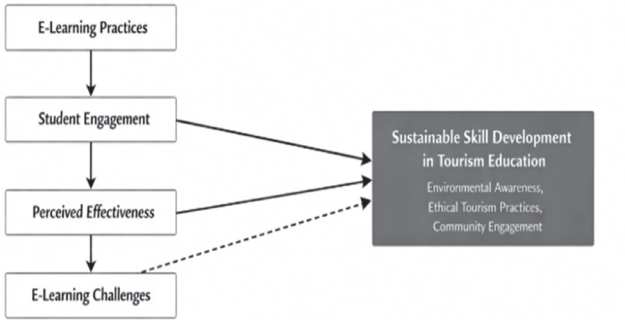
performance with little emphasizing on sustainability as skill-based learning outcome. The majority of research approaches sustainability as a theoretical or policy-based subject as opposed to studying how digital learning can help in developing viable skills like responsible decision making, environmental consciousness and ethical approach to tourism. There is limited empirical evidence that culminates into a linkage between e-learning practices and sustainable skill development among tourism students especially on the learner perspective. Moreover, the developing and emerging economies have scarcer research that is not as relevant in the world tourism development and challenges in sustainability. What is also lacking is the analysis of the issues that can reduce the efficiency of e-learning in enhancing sustainability-related skills.

Figure 1

Conceptual Framework



Source: *Developed by the authors based on Mandalia (2023) and Wang et al. (2024).*

Objectives:

- To examine the extent to which e-learning supports sustainable skill development in tourism education
- To analyse the relationship between e-learning practices and sustainability-oriented competencies among tourism students.
- To assess student perceptions regarding the effectiveness of digital learning platforms in learning sustainable tourism practices.
- To identify key challenges associated with using e-learning for sustainability focused skill development in tourism programs
- To explore the role of digital learning in aligning tourism education with industry and sustainability expectations.

Methodology

Research Design: The study adopted a quantitative, explanatory research design to examine relationships among e-learning practices, engagement, perception, challenges, and sustainable skill development.

Locale: The study was conducted among tourism and hospitality management students enrolled in higher education institutions located in Uttar Pradesh and the Delhi-NCR region of India, where tourism and hospitality programs increasingly incorporate blended and online learning modes.

Sampling Design: Undergraduate and postgraduate Tourism & Hospitality Management students exposed to at least one e-learning course. Convenience sampling was used due to accessibility considerations. A total of 300 valid responses were collected.

Tools and Technique: Data were collected using a structured questionnaire based on a five-point Likert scale. The questionnaire was administered through an online survey platform (Google Forms) and distributed to students through academic communication channels and student groups. Participation was voluntary and informed consent was obtained from all respondents.

Data Analysis and Statistical Analysis: Descriptive statistics (Mean, SD, Frequency, Percentage), Reliability analysis (Cronbach's Alpha), Pearson Correlation, Multiple Linear Regression, Significance level: $p < .05$

Results and Discussion

Demographic Analysis: Table 1 shows the demographic profile of the respondents. The study has collected 300 valid responses. The sample was mostly male (56%), and female (44%), which means that there was a rather equal gender representation. Education qualification wise most of the respondents were undergraduate students (60.7%), with 39.3% experiencing a post-graduation study. On the issue of mode of learning, majority of the participants (68) were under blended learning, with 32% pursuing online learning programs that were fully online courses. These attributes indicate that the sample is heterogeneous and sufficiently identifies students who undergo various degrees of education and learning conditions.

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Table 1

Demographic Characteristics of Respondents

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	168	56
	Female	132	44
Education Level	Undergraduate	182	60
	Postgraduate	118	39
Mode of Learning	Blended Learning	204	68
	Fully Online	96	32

Note. *N = 300. Percentages are rounded to one decimal place.*

Table 2

Reliability Statistics for Study Constructs

Construct	Items	Cronbach's α
E-learning Practices	6	0.84
Student Engagement	5	0.81
Perceived Effectiveness	4	0.79
Sustainable Skill Development	6	0.86
E-learning Challenges	5	0.82

Note. *All values exceed 0.70, indicating satisfactory internal consistency.*

Table 3

Pearson Correlation Matrix

Variable	1	2	3	4	5
E-learning Practices	1				
Student Engagement	0.54				
Perceived Effectiveness	0.49	0.57			
E-learning Challenges	-0.32	-0.28	-0.35		
Sustainable Skill Development	0.61	0.58	0.55	-0.41	1

E-learning practices show strong positive correlation with sustainable skill development (r = 0.61). Challenges show negative correlation (r = −0.41).

Table 4

Multiple Regression Analysis Predicting Sustainable Skill Development

Predictor	β	p
E-learning Practices	0.31	< 0.05
Student Engagement	0.27	< 0.05
Perceived Effectiveness	0.22	< 0.05
E-learning Challenges	-0.19	< 0.05

Note. *R^2 indicates substantial variance explained.*

Relationship between E-learning Practices and Sustainable Skill Development: The initial hypothesis stated that e-learning practices correlate a lot with the sustainable development of skills in tourism education. The correlation analysis results have shown that the e-learning practices and sustainable skill development show a strong positive correlation (r= 0.61). More so, the regression analysis results show that e-learning practices are a strong predictor of sustainable skill development ($\beta = 0.31$, $p < 0.05$), and it is the strongest of the variables used in the model.

The results of the study indicate that well-organized e-learning programs are significant in development of sustainability-related skills in tourism students. Digital learning environments offer interactive case studies, multimedia, activities that are based on simulation and collaborative learning which enable students to comprehend advanced issues of sustainability concern in the tourism sector. The availability and convenience that digital learning provides to students also make students be able to access sustainability content that is not confined to a classroom setting.

The findings are reliable in line with Mandalia (2023) and Sigala (2020), who support that the e-learning systems may assist in the experiential learning and sustainability education through combining the digital simulations, global case studies, and problem-solving tasks. On the same note, Leyva et al., (2024) assert that technological competence and sustainability awareness among tourism graduates increases with the incorporation of digital learning technologies. Thus, the results confirm H1 that the effective practices in e-learning play an important role in enhancing sustainable skills in tourism education.

Relationship between E-learning Practices and Student Engagement: The second hypothesis was that e-learning has a positive effect with regard to student engagement in sustainability-oriented tourism education. According to the findings, there is an average positive relationship between e-learning practices and student engagement (r= 0.54). Also, regression analysis shows that the involvement of students plays a significant role in the process of developing skills sustainably ($\beta = 0.27$, $p < 0.05$).

The results obtained show that engagement is the key to the digital learning experience that can be transformed into

a valuable educational experience. When students engage in online discussion and collaborative projects and problem-solving activities, they get a better insight on the principles of sustainability and how these can be applied in the tourism industry. The involvement in digital space stimulates the reflective thinking and exchange of knowledge which are necessary in the context of sustainability-focused education.

This finding conforms to the results of Ibanez et al. (2020), who emphasize that engagement among students is one of the primary factors that affect positive learning outcomes in online learning settings. On the same note, Dunn and Kennedy (2019) discovered that increased online engagement is a significant contributor to knowledge retention and academic performance. In the framework of the education in the field of tourism, interactive learning activities like case studies and storytelling using digital platforms can enable the student to analyse the sustainability issue in the real world and consider possible solutions. Thus, H2 is accepted as the results have proven that e-learning practices do contribute greatly in increasing student engagement in sustainability-driven tourism education.

Relationship between Perceived Effectiveness of Digital Learning Platforms and Sustainable Skill Development: The third hypothesis was the perception of the effectiveness of digital learning platforms by the student was associated with sustainable skill development in tourism education. The regression analysis shows that the perceived effectiveness of digital learning platforms causes a significant impact on sustainable skill development ($\beta = 0.22$, $p < 0.05$).

The result of this finding implies that the perceptions held by students about usefulness and relevance of digital learning technologies have a strong influence on the learning performance of students. As soon as students view the digital platforms as useful resources to gain some practice and a set of skills, which are relevant to the industry, they will be more willing to actively use course materials and transfer the idea of sustainability into solving problems. Perceived effectiveness is thus a significant psychological aspect that determines motivation, commitment to learning and application of knowledge.

The finding confirms the claims made by the Fulop et al. (2023), who observed that the perception of usefulness and usability of e-learning systems has a strong effect on student satisfaction and academic achievement. On the same note, Huang et al. (2024) state that digital learning platforms need to include aspects of experiential and applied learning so that they can reinforce their perceived relevance to industry practice. Virtual field visit, interactive case studies, and simulation-based learning platforms can be used in tourism education to make the sustainability concepts seem more realistic and applicable. Therefore, the results confirm H3, which proves that perceived effectiveness of digital learning platforms is a positive contributor towards sustainable development of skills.

Impact of E-learning Challenges on Sustainable Skill Development: The fourth hypothesis stated that the difficulties related to e-learning have a negative impact on sustainable development of skills within tourism education. The outcomes of the correlation analysis demonstrate that there is a negative correlation between challenges of e-learning and sustainable skill development ($r = -0.41$). The regression analysis also supports the fact that the e-learning difficulties do not contribute to the development of sustainability skills in any significant way ($\beta = -0.19$, $p < 0.05$).

These results show that despite the flexibility and accessibility that e-learning offers, there are some challenges that inhibit the ability of e-learning in tourism education. The barriers that are usually perceived by the students are problems with technology, the lack of internet connection, digital fatigue, and a lack of field experience. In many cases, tourism education entails practical learning by means of visits to fields, internships, and personal communication with the representatives of the industry. Without these experiential elements, the students will not be able to acquire practical sustainability competencies completely.

The results can be compared with those of Nouraey and Al-Badi (2023), who mention technological barriers and digital divide as the leading issues in the adoption of e-learning in universities. In the same manner, Schulz (2023) in his argument asserts that tourism education should be authentic in experience in an attempt to achieve meaningful learning outcomes. Online environments alone might not be able to mimic the dynamics of real-world tourism in which case the extent of sustainability skills development might be restricted. As such, findings substantiate H4, and as such, it concluded that e-learning issues have an adverse effect on sustainable skill acquisition in tourism education.

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Conclusion

The present study explored the applications of e-learning to ensure sustainable acquisition of skills in tourism education and suggested empirical evidence to support the advantageous role of digital learning settings to sustainability-focused competencies. The results substantiate the idea that formal practices of e-learning, student involvement and the view toward the usefulness of digital platforms have a great impact on the process of development of sustainability-related knowledge, awareness, and practical skills in tourism students.

The findings show that the properly designed digital learning platforms help to access case studies, simulations, multimedia materials, and collaborative learning tools to enhance the knowledge of responsible tourism activities, environmental stewardship, and ethical decision-making and community-oriented development in learners. E-learning practices proved to have the best foretelling of sustainable skill advancement, proposing that instructional plan and pedagogical framework have a more central purpose than the sole presence of technology.

Engagement of students was identified as one of the core processes in which sustainability learning is internalized. Interactive, discussion-based learning and team-based problem-solving seem to promote reflective thought and situational implementation of sustainability principles. Moreover, the perceived usefulness of e-learning systems affected the acquisition of skills in a positive manner, which is why it is vital to make digital resources relevant to the industry requirements and the requirements of the tourism sector.

Nevertheless, the results also prove that such issues of e-learning like a lack of real-life experience, technological obstacles, and digital fatigue adversely influence sustainable skill acquisition. The nature of sustainability education in the tourism field is that it involves the aspects of experience and field learning which cannot be entirely provided via virtual platforms only. As such, although e-learning is a strong pedagogical resource, it must be planned to be used in blended learning models where online learning is used in conjunction with field-based, experiential, and industry-connected learning.

The research, in general, supports the notion that the digital transformation of tourism education cannot be interpreted as technological modernization but rather can be regarded as an appeal to reconsider sustainability pedagogy. To effectively train tourism graduates in terms of the industry challenges of sustainability, institutions need to implement learner-centred digital strategies which facilitate interaction, contextual application, and critical reflection.

In spite of its contributions, there are a number of limitations of the study which need to be mentioned. To begin with, the study is based on self-reported information based on structured questionnaires. Even though self-perception measures are popular in educational research, they can have bias in the response, social desirability, or personal understanding of sustainability competencies. The results are therefore based on perceived skill development and not a measure of performance outcome.

Second, the research design is cross-sectional, as the study involved student responses at a single time. Sustainable competency building is a progressive and changing process; hence, longitudinal research designs would be more insightful to the role of digital learning in competency building in the long-term.

Thirdly, the sampling method is both geographically and institutionally restricted. Although the sample of 300 respondents is statistically sufficient, the sample is restricted to tourism students of a limited number of institutions, and thus, their generalizability to other educational systems and other cultural settings and technological infrastructure levels can be limited. The sampling frame might be extended in future research to expand the study to multi-regional or international comparisons to increase the external validity.

Forth, the study mostly represents the learner side. There are various stakeholders that affect sustainable tourism education; they include faculty members, curriculum designers, industry partners, and policymakers. The multi-stakeholder research methods should be embraced in the future to investigate how multi-stakeholder policies and faculty preparedness and industry partnership determine the effectiveness of e-learning in the development of the sustainability skills.

Fifth, the study is directed at quantitative assessment of connections between variables. Although statistical analysis can be used to determine important correlations, qualitative

research (interviews, focus groups, or case studies) may offer more in-depth information about how students find digital sustainability learning and how teaching methods may be streamlined.

Further studies can also consider: Comparison between blended learning and fully online learning models. Measurement of experimental design of actual sustainability competence performance. The mediating value of technological preparedness and digital skills. Adoption of emerging technologies like virtual reality and simulation-based learning of tourism. Graduate monitoring to determine industry-level sustainability. These areas would help to have a more comprehensive picture about how digital education structures can positively impact sustainable workforce development in tourism.

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