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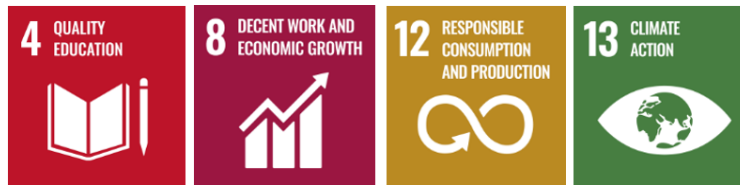
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Authentic Assessment and Embedding Sustainability Literacy and Technology Skills in Tourism Education



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Abstract

John Tribe proposed a model for ethical tourism which ‘utilises the Aristotelian idea of actions guided by practical wisdom, and that can contribute to curriculum, which participates in ‘tourism world-making’ (Tribe, 2002, p323). Considering the Sustainable Development Goals (SDGs), the integration of sustainability literacy into tourism education becomes essential for nurturing graduates capable of sustainable practices. This case study, employing a virtual fieldtrip (VFT) with authentic assessment, examines the integration of sustainability literacy and technology skills. Whilst technology enhances engagement, its role in the VFT does not surpass traditional methods. Integrated assessment and a multi-stakeholder approach make learning comprehensive. Yet, inclusion of constructs relating to values, futures and systems thinking would allow for further cross-disciplinary assessment. Whilst technology reduces the ecological footprint of field trips, it does not replace the richness of ‘live’ experiential learning.

Student feedback, via surveys based on the Unified Theory of Acceptance and Use of Technology (UTAUT) adoption model and forms, reveals the challenge of picking up new technology skills. Of 66 students, 42% responded. Students were mostly positive about technology aiding assessment (78.9%) and helping with work (75%). Yet, only half see it improving performance. Although recognising that industry desires tech-savvy graduates (89.2%), produced mixed feelings among students, not all were willing to engage with technology. This study stresses the value of real-world experiences in tourism education, emphasising industry involvement. Multi-stakeholder engagement highlights valuable learning experiences, and technology integration is seen as crucial for achieving Sustainable Development Goals, influencing sustainable destination management.

Keywords: authentic assessment; curriculum co-creation; digital skills; sustainable literacy; technology; tourism education, virtual fieldtrips.

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Introduction

The advent of the COVID-19 pandemic brought about an unprecedented disruption to the global academic landscape, necessitating a sudden shift towards online pedagogies to ensure continuity in delivery of our academic programmes. In response to this challenge, educators were compelled to rapidly upskill in the use of digital technologies and virtual learning, teaching, and assessment methodologies to ensure a seamless transition. As the shock of these changes began to dissipate, the discourse shifted towards exploring how best to navigate the new landscape. This new landscape acted as a catalyst to review pedagogies and assessment techniques, which, in this case, included running an assessment-based field study trip focusing on sustainable tourism. A key priority was to ensure that students continued to have access to, and receive equitable academic quality, despite altered the circumstances. However, guided by the module descriptors, the changed circumstances also presented an opportunity to scrutinise the academic delivery of the modules.

The module *Sustainable Tourism* has been delivered to students on an undergraduate programme in the School of Tourism and Hospitality Management, TU Dublin, Ireland since 2004 as part of educating students for sustainable development within the tourism sector. *Tourism and Technology* has been delivered on the programmes for the past decade. Addressing issues around sustainability is core to many modules in TU Dublin whose Strategic Intent revolves around People, Planet and Partnership. TU Dublin endorses the 2030 Agenda for Sustainable Development, which advocates higher education as a vehicle for achieving the SDGs and follows the learning objectives for ESD (UNESCO, 2017). The overall aim of the project was to embed sustainability literacy into the tourism curriculum by understanding and using technology skills. The stated objectives were to: using technology, highlight sustainable tourism provision by means of a co-created integrated assessment focusing on a virtual field-trip for two modules: *Sustainable Tourism*, and *Tourism and Technology*; enhance pedagogy and assessment with virtual industry engagement; and evaluate student perception of using technology to deliver field-trips and sites visits. The approach and outcomes are pertinent as they have the potential to input into university sustainable travel policy, which could further be integrated into various practices such as Erasmus students and staff exchanges.

Revolving around the use of integrated assessment, this paper describes the pedagogical approach taken over a three-year period and feedback from students with regard to the use of technology and its role in virtual field-trips (VFTs), and embedding sustainable literacy.

Context

An integrative assessment was developed for two modules, *Tourism and Technology*, and *Sustainable Tourism*. Both modules are delivered on several undergraduate programmes including a BA in Tourism Management (Third Year), a BSc. Tourism and Digital Marketing (Second Year) and a BSc. International Tourism and Languages (Second Year). The purpose was to create an authentic assessment that would foster relationships between students and industry, student-centric, applied to context, and challenging. The project aligns to TU Dublin graduate attributes, fostering digital and sustainability literacy and SDG 4 (Quality Education). The pedagogical approach in the module *Sustainable Tourism* includes forms of experiential teaching and learning, including industry engagement, seminars, site visits and field-trips, and applied authentic assessment. A field-trip to the Burren, Co. Clare in Ireland had become part of delivery, showcasing and challenging sustainable practices. Due to COVID-19 restrictions, this could not take place. Revolving around the SDG's, particularly SDG11 (Sustainable Cities and Communities), SDG12 (Responsible Production and Consumption) and SDG 8.9 (Promote Beneficial and Sustainable Tourism), the module focuses on critical debate on sustainable tourism and climate change. The history of sustainability, indicators, and regenerative provision and consumption in the industry form the core of the module.

The module *Tourism and Technology* provides the students with knowledge and demonstration of a range of technological tools that can foster an approach towards developing both a smart economy and smart destinations. Smart destinations refer to places or cities that use innovative and sustainable technologies and practices to enhance the quality of life of residents and visitors while improving the efficiency of tourism management. In other words, they leverage technology and data-driven solutions to provide an optimal experience for tourists and locals alike. Students were encouraged to research Smart Destinations that utilise technologies such as the Internet of Things (IoT), big data analytics, artificial intelligence (AI), and machine learning (ML) to gather and analyse data on tourist behaviour, traffic flow, and visitor preferences. This information can be used to develop personalised recommendations, optimise transportation and mobility, and improve resource management. In addition to providing benefits to tourists, students learned that smart destinations aim to promote sustainability and minimise negative impacts on the environment and local communities, through renewable energy, waste reduction and recycling programs, and eco-friendly transportation options. Smart destinations strive to create a seamless, enjoyable, and sustainable experience for tourists, whilst promoting economic growth and enhancing the well-being of the local community

Literature Review

The themes that underpin this project focus on learning, teaching and assessment; the use of technology as a catalyst to foster and enhance education for sustainability (ESD) in the tourism sector and a review of this is presented here.

Teaching and Learning

There has been a paradigmatic change in approaches to teaching and learning at all levels of education (Tiwari et al., 2021). Prior to the disruptive changes associated with COVID-19, Kongtaveesawas and Prasarnpanich (2020) suggested a new paradigm for tourism education, focused on learning derived from a combination of independent learning, implementation of technology, and dynamic engagement with tourism value chain development. They argue that students, as future employees, require skills to work in the tourism industry, which has been an early adopter of virtual reality (VR) and similar technologies. Cotterall et al. (2019) found that many tourism programmes do not include a conceptualisation of sustainability which focuses on a holistic transdisciplinary and systems thinking approaches to pursuing the SDGs. According to Tasmin et al. (2022) all aspects of the tourism value chain need to be considered when addressing sustainability, including: facility, pricing, inventory, and sourcing. These aspects reflect the complex nature of the tourism experience and form the essence of required student knowledge provided for by industry, field engagement and demonstration. The approach taken by the two modules in this case-study over the past three years attends to *Planet* as one of the three pillars the TU Dublin's Strategic Intent to 2030, aligned to the 2030 Agenda for Sustainable Development.

Prior to COVID-19, methods of module delivery included in-person teaching, site visits, inputs from guest speakers and field-trips, the use of a Virtual Learning Environment (VLE) to provide resources, and the occasional use of online apps to enhance engagement. Field-trips and site visits, which are components of experiential learning on the two modules, have been advocated as an authentic experience. According to Klemm and Tuthill (2003), such experience contributes to achievement of learning outcomes. Authentic assessment seeks to provide a student experience best aligned to what the graduate will experience. The benefits of using this approach can be educational and social (Ruhanen, 2005), with engagement between students deepening the learning process (Marvell et al., 2013) and peer-to-peer capacity building

(Novelli & Burns, 2010). The nature of tourism lends itself to transferring knowledge from the classroom to the field, and the learning can be used as a basis for critical inquiry. A constructivist approach enables each individual learner to construct meaning from their learning of a situation or challenge as it arises, and this is specifically the case with regards to (Bada et al., 2015). From 2020 to 2022, in-person field-trips could not take place, due to pandemic-related restrictions. Methods were adapted to suit restrictions imposed during COVID-19 and the requirements of the modules. These included online lecture delivery, HyFlex, webinars and inputs from guest speakers. Support for staff and students was provided by the learning, teaching, and assessment team. Methods of assessment were also adapted to the remote learning environment, and included requirements for students to deliver presentations, write academic and reflective reports, and undertake online assessments.

Technology and Tourism

Innovative solutions and technological implementation are required as part of the educational system to ensure that students, as future employees, have the skills to work within the tourism industry. The COVID-19 pandemic served as a catalyst for technology adoption. In the realm of education, this has led to a realisation of the critical importance of familiarity with diverse types of technology for both student learning and graduate competences. Even before COVID-19, the widespread implementation of digital learning modalities had created a pressing need for students to develop a high degree of proficiency in navigating digital tools and platforms (Deng & Yang, 2021). Such proficiency is pivotal to enable effective participation in the modern workforce and to facilitate the achievement of academic and professional goals.

The Next Tourism Generation (NTG) alliance, a collaboration between academics and industry, identified sustainability of tourism growth, the scarcity of resources, enabling technologies and digital fluency amongst the megatrends emanating from key stakeholders within the tourism sector in Europe (NTG, 2019). Gössling (2021) identified a myriad of ways in which digital technologies can play a role in advancing sustainability within the sector. Using technology to contribute to sustainable development and management can take many forms and is part of everyday living. Table 1 outlines several key technologies that are driving tourism.

Table 1: Notable digital technologies and their use in Tourism

ICT	Use in Tourism	References
Mobile devices	Smartphones and tablets have revolutionised the way people book travel. Mobile devices enable travellers to search flights, hotels, and attractions, making reservations on the go.	Conyette, 2015; Minazzi and Mauri, 2015; Fong et al., 2018; Pencarelli, 2020.
Virtual reality	Virtual reality technology is being used to provide immersive experiences for tourists. This includes virtual tours of destinations and attractions, as well as virtual reality experiences that simulate activities such as skydiving or bungee jumping.	Guttentag, 2010; Yoo & Gretzel, 2016; Beck et al., 2019; Pasanen et al., 2019; Kim et al., 2020; Lo & Cheng, 2020; Merx & Nawijn, 2021; Talwar et al., 2022
Augmented reality	Augmented reality is being used to enhance the tourist experience by overlaying digital information on the physical environment. For example, tourists can use augmented reality apps to learn more about the history and culture of a destination by pointing their smartphone camera at a landmark.	Fritz et al., 2005; Keil et al., 2011; Kounavis et al, 2012; Han, Jung & Gibson, 2013; Cranmer, 2019; Yung & Khoo-Lattimore, 2019; Cranmer et al., 2020; Law et al., 2020; Jingen Liang & Elliot, 2021.
Artificial intelligence	Artificial intelligence is being used to personalise the tourist experience by providing recommendations based on a traveller's preferences and behaviour. Chatbots are also being used to provide instant customer service to travellers.	Makridakis, 2017; Benckendorff et al., 2019; Buhalis, 2020; Pillai & Sivathanu, 2020; Samala et al., 2020; Filieri et al., 2021; Li et al., 2021; Doborjeh et al., 2022.
Internet of Things (IoT)	The Internet of Things is being used to create smart tourism destinations, where connected devices and sensors provide real-time information to tourists. IoT sensors can be used to provide information on traffic and weather conditions, or to guide visitors through a museum or theme park.	Guo et al., 2014; Cavada et al., 2018; Tripathy et al., 2018; Car et al., 2019; Verma & Shukla, 2019; Wise & Heidari, 2019; Wang et al., 2020; Grengard, 2021; Verma et al., 2021; Novera et al., 2022.

Additionally, Blockchain Technology (Erol et al., 2022; Ozdemir et al., 2020; Treiblmaier, 2020) is being used to create secure and transparent payment systems and to enhance efficiency of managing traveller data. Yet, Erol et al. (2022) identify challenges with security, privacy, expertise, and cost. Overall, these technologies change how people plan and experience travel. Smart tourism uses data-driven solutions to enhance travel experiences and improve tourism management. It uses technologies, such as the big data, artificial intelligence, and machine learning, to gather and analyse data on tourist behaviour and preferences (Shafiee et al., 2021). Smart tourism can provide benefits to tourists and other stakeholders. For tourists, it can offer personalised recommendations, seamless booking and payment processes, real-time information on local events and attractions, and access to virtual and augmented reality experiences (Femenia-Serra et al., 2019). For other

stakeholders, it can facilitate better marketing, resource management, and improve sustainability (Buhalis & Amaranggana, 2015; Gössling, 2021). Some examples of smart tourism initiatives include mobile apps that provide real-time information on local attractions (Kang et al., 2017), virtual assistants for personalised booking assistance (Buhalis & Cheng, 2020), and smart transportation systems that optimise mobility and reduce congestion (Mahrez et al., 2021).

Educating for Sustainable Tourism

SDG 4 advocates “that the concept of education for sustainable development (ESD) as a whole-institution approach” (UNESCO, 2017 p.19). Many university leaders have aligned their institutions to the Talloires Declaration (1990), seeking to embed sustainability as part of their remit. To meet its SDG 4 obligations, Ireland has enshrined its ESD priorities in its National Strategy for Education for Sustainable Development (Government of Ireland, 2022), providing guidance for schools and higher education institutions. Bringing together three institutes of technology, TU Dublin was established in 2019, over a year prior to COVID-19. Its inaugural Strategic Intent focused on three pillars: People, Planet and Partnership. Hence, sustainability underpinned many of the initiatives since its inception. A community of practice (CoP) focusing on sustainability, known as SDG Literacy, was formed by staff and students. The CoP was at the forefront of introducing the Sulitest www.sulitest.org, as part of assessment as learning, to promote sustainability literacy (Behan et al., 2022; Freeman et al., 2022). Sulitest offers a set of tools to engage students in creating awareness of sustainability issues. Whilst Kuehl, Sparks, Hodges et al. (2021) question its coherency, others, such as Mason (2019), advocates that it is a useful activation tool for more generalised discussion. Wiek et al. (2011) list ESD competencies that have been widely acknowledged. Redman and Wiek (2021) developed an integrative framework that identifies four types of thinking as the basis for planning: Systems-thinking, Futures-thinking, Values-thinking, and Strategic-thinking. Strategic thinking is developed through the exploration of the historical evolution of sustainability as an idea, concept, and approach over the past decades. Additionally, the tourism and technology module require students to reflect on the long-term impacts of tourism and to identify technologies that can be employed to promote sustainability, which reflects a form of futures thinking. However, going forward other types of thinking, such as systems-thinking and values-thinking, also deserve attention and integration into the modules.

Globally, prior to COVID-19, many sectors including tourism were coming under the spotlight regarding sustainable provision and consumption. Issues around sustainability in the tourism sector were often highlighted by the media prior to COVID-19 when ‘over-tourism’ became a common term for destinations in Europe (Abbasian et al, 2020; Seraphin, et al., 2018) and other hotspots. Carrying capacity was exceeded at these destinations with the experience for both the visitor and host community diminished, along with wide-ranging impacts in terms of resource depletion, pollution, and degradation. According to Lenzen et al. (2018), between 2009 and 2013, tourism’s global carbon footprint increased from 3.9 to 4.5 GtCO₂e (Gigatonnes of equivalent carbon dioxide) which is four times more than previously estimated, accounting for about 8% of global greenhouse gas (GHG) emissions. Transport is the main contributor within a complex system of interconnected modes, which are carbon consumption intensive. Encouraging short haul travel and using initiatives to encourage providers to develop a more sustainable experience in terms of provision has had limited success. Field-trips provide students with an authentic experiential mode of learning and can assist with instilling the required teamwork for developing professional competencies. Students, by experiencing first-hand real-life scenarios, can gain confidence and a deeper understanding of the issues experienced by the industry. Using the technology and working as a collaborative team on two quite different forms of assessment for two separate modules, though addressing the same question requires planning, clarity, discussion, and decision-making.

The Technology Acceptance Model (TAM) introduced by Davis in 1986 used two variables ‘*perceived ease of use*’ and ‘*perceived usefulness*’, becoming the dominant model for investigating factors that affect user’s acceptance of a technology (Marangunić Granić, 2015). Over the decades TAM has been extended to suit a variety of research. In 2020, Rauscher, Humpe, and Brehm conducted qualitative research on the acceptance of VR in tourism, using an adapted version of the UTAUT model for their enquiry. Their study focused on visitors, whilst for this project, the UTAUT model (Venkatesh, 2003) was used, adapting a version of UTAUT2 constructs, validated by Nair et al. (2015), to evaluate students’ perceptions on using technology to develop Virtual Reality Field-trips (VRF).

In summary, a paradigm that involves authentic assessment as part of a holistic approach to embed sustainability into the tourism curricula is required and engaging with smart technology is a skill that is critical to graduate competencies. An adapted UTAUT model is a tool that allows students to provide feedback on their experience of engaging with such an approach, and the learning that has ensued.

Methodology

The theoretical concepts that underpin this work focused four themes: teaching and learning which focuses on pedagogies such as HyFlex and alternative methods of assessment used; digital technologies and their use within the premise of sustainable tourism; the use of the Unified Theory of Acceptance and Use of Technology (UTAUT) adoption model (Nair et. al. 2015) and education in sustainability, with a focus on tourism education. Internal funding was provided to evaluate student perceptions using technology in delivering Virtual Field-trips (VFT). The need was prompted by restricted circumstances, which unfolded due to COVID-19 and the inability to deliver site visits/field-trips, which are part of the module descriptors for *Sustainable Tourism*, and *Tourism and Technology*. The funding was awarded under a national initiative to encourage new ways of thinking in response to COVID-19 and acted as a catalyst to this collaboration. This paper focuses on initial implementation in academic year 2020/21, summarised in Table 2. Subsequent activities are referred to in the discussion.

Table 2: Project Activities (2020/2021)

Year	Related Seminar	Field Studies Trip	In- class Tech Demonstration	Use of Technology	Use of Sulitest	Student Output
Sem 2 2020/21	Yes	On-line and industry/student-led. Focus on the Burren, Co. Clare (Assessment based).	On-line delivery. Tech demos included Google Earth, Screencast-O-Matic, Loom, Vimeo, Matterport 3D, Google Streetview, Canva, PowerPoint, Prezi.	Screencast-O-Matic Vimeo iMovie - Movie maker Google Earth	Yes - as learning activity	Reflective Summative Assessment; Virtual Tour focused on sustainability; Presentation; Group report

Delivery of both modules in Year 1 was on-line. Co-creation (both student and industry) and peer review were used as part of the assessment to encourage engagement. The modules in question, *Tourism and Technology* and *Sustainable Tourism* also used the VLE to provide resources, video, and online demonstration. To provide context for their assessment, a student-led webinar was undertaken with invited industry speakers, focusing on technology from a tourism destination perspective and how it could contribute to a sustainable provision. Student questions posed questions in advance. Guest speakers and case studies provided insight and expanded the student breadth of knowledge beyond the classroom. Students created videos using Google Earth and Screencast-O-Matic, the content of which communicated sustainable provision in a chosen part of Ireland. Industry and student co-created criteria were developed, and industry and student peer evaluation of the assessment was undertaken. A five-point Likert scale evaluative tool comprising twenty statements based on the adapted UTAUT constructs was developed, considering performance expectancy, effort expectancy, social influence, facilitating conditions, the use of VR and technology for educational purposes, the use of

VR/technology for field-trips, and students' familiarity with, and use of technology. The survey was administered anonymously online after module delivery and evaluated using statistical analysis. In addition, students completed Quality Assurance (QA) feedback forms which use a mix of Likert scaling and open questions and these provided further insights .

Findings and Discussion

Upon completion of the two modules, student feedback was evaluated using two distinct methods: a closed survey employing an adapted version of the UTAUT/TAM Model, and the Quality Assurance end-of-module feedback forms. Although the number of responses received was relatively low, the data collected provided a foundation for reflection and analysis by all involved in delivery of the modules. The assessment process also presented students with a unique set of challenges, including the continuous development of new technology-related skills. The students needed to strike a balance between their use of technology when creating their videos and the critical message component relating to its role in promoting more sustainable tourism management and development. Of the 66 students attending the modules, 28 students (42%) responded, with 82% being female, congruent with response rates of a similar study conducted by Rauscher (2020). Table 3 summarises the responses.

Table 3: Percentage (%) response rate to statements n=28 (neutral responses not included)

	Question theme	Positive %	Negative %
Performance expectancy	Technology enhanced	78.9	0
	A Better Job	50	14
	Helped	75	3.6
Effort expectancy	Took longer than expected	53.5	21.4
	Worth it	71.4	7.2
	Try my best	92.9	0
Social influence	Expectation from industry	89.2	3.6
	Friends enjoy using	67.9	10.7
	Need to embrace	67.9	14.3
Facilitating conditions	Ease of use	57	10.7
	Support received	37.3	10.7
	Prefer self- directed	32.1	25
Using VR/technology for educational purposes	Learnt a great deal	57.1	7.2
	Focused more on tech than content	25	42.9
	As a positive inclusion in educational delivery	60.7	17.8
Using VR/tech for sites visits/field-trips	Can play a role	57.1	21.4
	Better way of learning	39.3	25
	Act as a substitute	46.7	42.9

The majority perceived that technology enhanced the assessment (78.9%) and that it helped them undertake the work (75%). However, only 50% of the respondents felt that a better job was performed. Despite this, a significant proportion of the students (71.4%) felt that efforts to use technology was worthwhile. The majority of students indicated that there was an expectation from industry that they should use technology (89.2%), more than two-thirds of the respondents (67.9%) felt they needed to embrace it. In terms of facilitating conditions, a high number of neutral responses were observed, indicating a possible indifference, although 39.3% of the respondents indicated they received sufficient support and 57% found the technology easy to use. Regarding educational purposes, 60% of the respondents indicated that the technology was a positive inclusion, and 57% indicated they learned a great deal. However, it is worth noting that 25% of the students reported that they focused more on technology use than on the content (sustainability provision).

The aim of this exercise was to assess students' perceptions of using technology as part of developing VFTs and this yielded some interesting findings. Over half (57%) indicated that technology had a role to play in developing VFTs. Yet, although 46% indicated that it could act as a substitute for face-to-face field-trips, only 39% said that the VFT was a better way of learning. As expected, 82% of the students felt at ease using technology, although 17% indicated that if they had their way, they would rarely use technology. So, whilst the majority of students felt at ease using technology, there is still a portion who would prefer to avoid it. Additionally, the finding that VFTs are not necessarily viewed as a better way of learning is noteworthy, as it suggests that they may have limitations. It will be important to continue to explore students' experiences with technology to better understand how it can be effectively integrated for learning. The post-module Quality Assurance survey, comprising open-ended questions, yielded comparable responses (n = 27). The feedback received did not make explicit mention of the Sustainable Tourism module's integrated assessment, suggesting a potential lack of clarity amongst students regarding its integrative nature. Notably, some students expressed discomfort in using technology for the assignment, highlighting a sense of challenge. Whilst many students reported ease in using technology, some encountered difficulties. In general, the feedback received on the modules and the implemented approach was affirmative, with several students finding the video-making exercise advantageous and applicable to industry.

Field-trips and site visits have been recognised as a legitimate mode of genuine engagement in the educational arena. In the context of the present modules, they were employed as a means

of assessment. The evaluative content of the modules was centred around the conceptualisation of a sustainable message and the use of technology to realise this objective. The students were presented with a pedagogical challenge, compounded by the COVID-19 pandemic and the resultant limitations that precluded physical field-trips and site visits. Despite these constraints, the project was adapted in response to nationwide restrictions. The outcomes of this adaptation were significant, providing a wealth of insights into learning, teaching, and assessment practices that underpin this particular educational programme. Key findings relate to the integration of technology, integrated and authentic assessment, enhanced pedagogy in relation to embedding sustainability and technology skills in tourism curricula, and feedback on student perception in using technology as a medium in developing and engaging with field-trip studies. These findings are valuable because they highlight the importance and value of field-trips and site visits as an authentic mode of engagement. As well as providing insights into learning, teaching, and assessment practices, they underscore the importance of experiential learning, technology, and sustainability in the field of tourism education.

The integration of technology facilitated a shift in the approach to teaching and learning away from a lecturer-centred model towards one that prioritises the student and industry. This was achieved through a student-led seminar that contextualised the assessment and was driven by student-generated questions. Furthermore, the co-creation of assessment criteria by students imbued them with a heightened level of responsibility. The use of technology augmented the accessibility of learning content and contexts for students, particularly given their inability to physically travel. Through the deployment technology, students were able to virtually visit and research the Burren sites of their choice, thereby enriching the scope of their work. This mode of engagement was environmentally conscious as it negated the need for transportation, thereby reducing the carbon footprint of the project and minimising physical or visual impacts at the site. It is important to note, however, that technology is not without its own ecological footprint. The absence of physical visits to the local businesses also meant that there was no associated income generated from accommodation and food/beverage consumption.

The development of an integrated and authentic assessment in the areas of Sustainable Tourism, and Tourism and Technology demanded that students adopt a holistic perspective and exercise careful consideration of assessment requirements. This necessitated the acquisition of a comprehensive understanding of both subject areas and associated theories, and the ability to apply them to a specific site. The assessment was field-based, closely aligned with the

discipline, and consistent with the recommendations of the National Teaching and Learning Forum (2017), which emphasises the importance of providing students with an assessment that aligns with their identified needs and anticipated professional contexts – i.e. *‘which the student cohort identify and/or the context in which they anticipate that they will be working or studying’*. The development of the integrated assessment is important and significant for teaching and learning because the approach enables students to acquire a comprehensive understanding of both subject areas and associated theories and apply them to a specific site, thereby enhancing their knowledge and skills in the field and reflecting practise within the industry.

The utilisation of a multi-stakeholder approach in the pedagogical process proved to be highly effective. Industry played a pivotal role in furnishing the students with relevant context for the assessment. Their contributions served to bring to the forefront the challenges and realities associated with being a provider. Industry involvement was not limited to co-creation, but extended to evaluation and feedback, thereby providing students with a more comprehensive understanding of industry perspectives. Additionally, the recognition of the student groups that performed most exceptionally, as judged both by industry and peers, was an integral aspect of the pedagogical approach, with a small prize awarded to the group deemed most deserving. The divergence between the winners selected by the industry and those chosen by the student groups proved to be an essential aspect of the learning process. This discrepancy, highlighted to the students, was that the industry had a distinct perspective concerning what was valuable in terms of technology and sustainability contexts. This realisation was instrumental in providing students with a more nuanced understanding of priorities of industry professionals, and thus better prepared them for future roles and responsibilities within the field.

Technology integration has opened new avenues for achieving the SDGs. It is crucial for students to comprehend the impact of technology and its potential in managing a destination sustainably. For instance, technology can aid in managing tourism-generated content (TGC) to influence, promote, and market a destination sustainably (Bourliataux-Lajoinie et al., 2019). Additionally, technology can facilitate sustainability integration into students' social and professional lives. In response to the issue of over-tourism in Dubrovnik, digital systems employing Tourism Carrying Capacity (TCC) have been implemented to mitigate congestion and noise. Digital technologies enable the establishment of meaningful carrying capacity monitoring systems for the city.

Conclusions and Recommendations

This case-study focused on integrating sustainability and technology skills into module delivery. The approach involved adapting content, engaging with a range of learning activities, industry input, and a group assessment that focused on co-creating virtual field-trips. COVID-19 prompted the pivot to online and to HyFlex delivery but over the course of the following two years the pedagogy included face-to-face, demonstration, site visits, guest lectures, and industry engagement. The on-going approach goes some way to embedding sustainability in the modules. To promote a more comprehensive learning experience, an integrated assessment approach is prioritised. Future research could include qualitative or mixed methods approach to assess the learning value and other contributory factors, such as the hedonic value. This approach to delivery is being refined, with an emphasis on gathering feedback from industry providers. Whilst there is already strong industry engagement through guest lectures, site visits, and field-trips, efforts will be made to identify additional opportunities for co-creation to enhance learning experience authenticity. To date, industry feedback has been positive. To further incorporate technology in field-trips for sustainable tourism, a co-created module on Field-trips is offered as an option in Year 4 of the BSc in Tourism and Digital Marketing, which encourages students to engage with technology in the learning process, from preparation to post-trip reflection. In Year 4, students have the option to participate in a more in-depth exploration of sustainability. A 5 ECTS module, *Educating for Sustainability*, integrates multiple disciplines, bringing together students and staff to explore engaging sustainability topics. The module features reflective assessment and workshops, which a focus on design thinking and module descriptor evaluation, providing a deeper understanding of the SDGs. The module content in *Sustainable Tourism* can be further strengthened by assimilating thinking constructs such as values, futures, and systems thinking, which would enable the module to be linked with other disciplines. Authentic assessment will continue to be used, including site visits, guest seminars, and field study trips. Reflective practice will be extended to involve industry feedback. There is interest from industry to involve staff and students in the role of technology to promote sustainable tourism. This presents an opportunity to explore sustainable tourism provision using technology, which can be used as a substitute for travelling to sensitive areas, thus minimising impact while displaying the wonders of the place.

Overall, the alignment between the different modules enables students to develop a deeper understanding of the complex challenges facing the tourism industry and to foster a more sustainable approach to both tourism provision and consumption.

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