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Integration of emerging technologies in tourism and hospitality curriculum: An international perspective

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ABSTRACT

This paper investigates the status of emerging technologies, how they can be integrated into the curriculum, the skills students can acquire through these technologies, and the employment opportunities they create in the tourism and hospitality industry. In the study, a content analysis was conducted on the curriculum of 65 undergraduate tourism and hospitality management programs, followed by an analysis of data from 28 academics to explore the role of emerging technologies in the curriculum. We have observed six core topics. Technology courses had the lowest proportion. We further observe four categories of skills that emerging technologies may provide students, highlighting their potential to shape future career opportunities. Building on these findings, the current study contributes to the literature by linking these skill sets — digital and technological, theoretical, operational, and managerial — to emerging job roles such as virtual reality tour designers, competent tourism developers, and AI-driven marketing specialists. Furthermore, the study identifies the domains where emerging technologies have the most relevance and outlines which purpose they may be included in the tourism and hospitality curriculum as a course. Thus, it forwards previous studies emphasizing the importance of emerging technologies. The study also suggests the implications for the literature, practice, and public policies.

1. Introduction

Tourism and hospitality are among the most prominent global industries, contributing US$9.9 trillion to global GDP and providing 330 million jobs on average in 2023. By 2034, the industry is projected to contribute US$16 trillion to the global economy and provide employment to 449 million people. Considering the jobs provided by the tourism industry, education plays a crucial role in meeting the industry's growing employment needs (WTTC, 2024). Tourism and hospitality education has become essential in assisting the constantly expanding industry by training capable individuals to meet the industry's workforce needs (Mensah et al., 2023). As the tourism and hospitality industry expands, organizational structure and management of enterprises are also constantly evolving, requiring new and enhanced skills that can be acquired through curriculum reorganization (Tavitiyaman et al., 2023). Ensuring that the curriculum remains aligned with industry needs and up to date is essential for boosting graduates' success (McKercher et al., 2023).

Given the parallel changes in the tourism and hospitality industry and technology, it is essential to incorporate emerging technologies into the curriculum (Szende et al., 2019; Sharma & Munjal, 2023). For decades, the importance of emerging technologies has

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been discussed in tourism, mainly information and communication technologies (ICTs) (Hofstetter, 2004; Rimmington & Kozak, 1997). However, with advancements in ICTs, there has been a shift from tourism information and hotel management systems to artificial intelligence and big data. These/other advanced technologies are now considered emerging technologies (Momani et al., 2022), and their significance in tourism and hospitality education is increasingly growing (Caldevilla-Domínguez et al., 2021).

The OECD's Tourism Trends and Policies report (2024) highlights that the technological transformation will lead to a greater need for technological/digital skills; education will encourage the development of these skills. UNWTO (2019) revealed that in the next five years, tourism companies will most demand profiles with digital/I.T. skills (with 60 %). Considering the years that have passed, recent studies continue to emphasize this. According to a study conducted by Papageorgiou et al. (2024) involving professionals in the hospitality industry, the authors propose that information technology is one of the essential competencies for achieving career success. In parallel with this, Hussain et al. (2023) discovered that there are growing expectations in the tourism and hospitality industry for the future workforce to have technological knowledge. They emphasize the need to equip students with technological skills, as this plays a crucial role in managing technology usage in business processes and addressing technology-related workforce demands. Carlisle et al. (2023) studied the digital skills gap in tourism and hospitality. Their research revealed a need for more expertise in robotics, artificial intelligence, and digital skills despite the industry's widespread use of technology.

Despite the growing discussions on the increasing demand for digital and technological skills in the tourism and hospitality industry and the significance of curricula in advancing these skills, the role of emerging technologies in tourism curricula still needs to be explored. The present study addresses this issue by examining gaps across various contexts. First, the regional focus of prior studies has led to a need for a holistic understanding of the status quo of emerging technology-related courses in the tourism and hospitality curricula (Zong et al., 2022). For instance, according to Femenia-Serra (2018), there is a strong emphasis on general office software in Spanish higher education for tourism and hospitality students regarding ICT. They suggest that there is a need for courses that focus on intelligent systems. González Forero and Villegas Cortés (2023) have found that 20 % of tourism and hospitality programs in Latin America included technology in their curriculum. The authors emphasize that the insufficient presence of courses related to emerging technology is a disadvantage for students and advocate for increasing these courses to meet the demands of the tourism and hospitality industry.

In this regard, the current study aims to reveal the extent to which emerging technologies are integrated into tourism and hospitality curricula across different institutional contexts. On the other hand, scholars have contended that there has been a need for the development of technology-oriented curricula (Mandalia, 2023; Moyo & Özgit, 2022; Yan, 2019), and there need to be more courses related to emerging technologies (Menegaki, 2022; Sufi, 2022). Nevertheless, how emerging technologies can be integrated into tourism and hospitality curricula has not been adequately considered. In this context, the current study explores how emerging technologies can be integrated into tourism and hospitality curricula and for what purpose. Finally, the significance of technology in tourism education is highlighted not only in integrating tech-related courses into the curriculum but also in skill acquisition and employment opportunities (Papageorgiou et al., 2024; Hussain et al., 2023; Carlisle et al., 2023). Previous studies have examined digital skill gaps within tourism organizations, such as those in Spain (Zaragoza-Sáez et al., 2022) and the UK (Minor et al., 2024). However, these investigations fail to reveal which emerging technologies are associated with digital skills and how these skills contribute to or enhance career roles. Thus, this study also aims to explore the digital and technological skills students can attain by incorporating emerging technologies into tourism and hospitality curricula while uncovering the professional roles that can be pursued based on these skills.

For these purposes, we grounded this study on the program logic model to create a thorough course proposal for incorporating emerging technologies into tourism and hospitality education. This model provides a framework from the current state of the courses to the potential outcomes of emerging technologies as a visual representation of program theory (Cooksy et al., 2001). Thus, this study consists of two phases. The first phase involves examining the curricula related to tourism and hospitality management at institutions listed in the Q.S. World University Rankings. The second phase includes a list of open-ended questions addressed to those academics studying emerging technologies in tourism and hospitality.

2. Literature review

2.1. What do we teach: curriculum review

Cultivating workforces, leaders, and managers that meet the needs of the tourism and hospitality industry is a fundamental objective of tourism education (Kim & Jeong, 2018). In a study by Lusby (2017) on American and Macau students, those with a lower skill set were less likely to engage in the tourism and hospitality industry. In this context, the curriculum plays a significant role in cultivating human resources with knowledge, skills, and abilities that can take place in the various service settings of the industry. Curriculum refers to the study program a student must complete to graduate, which includes compulsory and elective courses (Alexakis & Jiang, 2019). There is no standardized curriculum for tourism and hospitality programs, and they exhibit regional variations (Siow et al., 2021).

When examining previous studies, Leung et al. (2018) examined the curricula of hospitality programs in the U.S., UK, and Australia, identifying six different industry foci in the curriculum: hospitality, business, food service, lodging, tourism, and others. Yusuf et al. (2018) categorized the curriculum of tourism programs in Indonesian universities into tourism management, tourism industry, tourism planning and development, tourism marketing, and research. Also, Alexakis and Jiang (2019) found that the curricula of hospitality programs in the U.S. focus on teaching various professional skills such as management, human resources, finance, and marketing. Similarly, Fraser (2020) examined the curriculum courses that are prominent in enhancing the employability of hotel management

graduates in Australia, emphasizing financial acumen, leadership, customer service, and social skills. Wang and Abukhalifeh (2021) conducted a comparison of the curricula of tourism and hospitality programs in China and South Korea. The Chinese curriculum was business-oriented (e.g., accounting, economics, finance, etc.), whereas, in South Korea, independent subjects, such as hotel management and marketing, gained priority.

In their study, Crotts et al. (2022) analyzed the curricula of 47 tourism and hospitality management undergraduate programs accredited by the Association to Advance Collegiate Schools of Business. They discovered that over half of the courses included core business subjects such as management, business statistics, macroeconomics, and microeconomics. In a recent study, the authors examined tourism and hospitality programs in five Latin American countries (González Forero and Villegas Cortés, 2023). Most of the curriculum was business management and economics, followed by tourism and hospitality management courses. Additionally, because tourism is a dominant industry in Latin America, the curriculum included courses on eco-tourism, sustainability, and ecology. This may also apply to regions strongly dependent on tourism, such as Africa, Asia, Europe, and the Middle East.

2.2. Why should we teach emerging technologies: digital skill gaps

The tourism and hospitality industry is about to place greater emphasis on the integration of emerging technologies like service robots and artificial intelligence in service settings (İnanç-Demir & Kozak, 2019; Seyitoğlu & Ivanov, 2023; Vishwakarma et al., 2024). Iskender et al. (2024) propose that educators should ensure that graduates are equipped to be considered technology experts who understand how and where to apply technology in service environments. According to a study by Xu et al. (2022), students pursuing tourism and hospitality careers need expertise in virtual reality, big data, and artificial intelligence due to customer usage. Research findings on digital skills gaps in the travel and hospitality industry also support the need for integrating emerging technologies into the curriculum. Zaragoza-Sáez et al. (2022) examined the current and future digital skill gaps within Spanish tourism organizations. The authors concluded that basic digital skills such as Microsoft Office and social media, compared to computer programming, robotics, virtual reality, and augmented reality, remain essential for now and 2030.

Nevertheless, the results indicate that by 2030, the tourism and hospitality industry will require radically different digital skills — such as cybersecurity and biometrics — compared to today. Carlisle et al. (2023) examined digital skill gaps in tourism and hospitality companies across eight countries. The findings revealed that while participants were confident in their proficiency with standard software packages like Microsoft Office, they lacked knowledge of advanced technologies such as artificial intelligence and virtual reality. Similarly, Minor et al. (2024) found that UK tourism organizations had significant talent gaps in artificial intelligence, robotics, virtual reality, and augmented reality.

2.3. What should we teach: the role of emerging technologies in the tourism and hospitality curriculum

Previous studies have discussed improving graduates' digital literacy skills to equip them for the demands and possibilities of the digital economy, emphasizing the importance of various technologies such as cloud computing, the Internet of Things, and mobile technology and applications (Adeyinka-Ojo et al., 2020; Caldevilla-Domínguez et al., 2021). Interdisciplinary courses or classroom projects integrating engineering and software have even been proposed for the tourism and hospitality curriculum. This will help students gain data analysis and artificial intelligence expertise and prepare them for future job opportunities (Seo & Kim, 2021).

According to Femenia-Serra (2018), incorporating different aspects of ICTs like big data, geographical information systems, and word processors in the tourism and hospitality program can benefit students in effectively managing intelligent destinations. Based on this, emerging technologies can assist tourism and hospitality graduates in differentiating themselves in marketing by improving the online presence of destinations and products and providing insight into consumer buying habits (Renfors et al., 2020). According to Ogbeide et al. (2021), adding big data to the curriculum can aid students in acquiring skills like recognizing trends and challenges. This can ultimately assist them in becoming proficient data analysts in the tourism and hospitality industry. For instance, by taking a course on big data, students may examine the pictures posted by customers regarding their experience with staying at luxury hotels and identify the impact of the amenities provided. The data collected can be utilized to enhance the overall brand experience. Additionally, they can construct customer profiles using customer relationship management systems (Zong et al., 2022).

Considering the particular relevance that technologies such as artificial intelligence and immersive technologies are acquiring, virtual reality and augmented reality are among the prominent technologies emphasized in the curriculum. Students who enroll in courses related to these technologies can enhance their skills in experience design because they will obtain knowledge in creating three-dimensional environments and applications that can be utilized in various establishments such as hotels and restaurants (Carlisle et al., 2023). Bilotta et al. (2021) researched the conceptual, methodological, technological, and practical skills that should be developed in the tourism and hospitality curriculum. They explained that students can analyze big data and social media data with machine learning; they can engage in processes related to productivity and efficiency with automation; they can develop experiences that will enhance consumer engagement in tourism areas with virtual and augmented reality; and they can manage digital systems and networks with ICT. Another example of emerging technologies for students in the tourism and hospitality industry is those that cover robotics or automation. These courses can offer valuable knowledge on improving efficiency and streamlining processes, ultimately enhancing customer satisfaction. Thus, students who take these courses may gain prominence in business and customer management (Hussain et al., 2023).

2.4. Logic model

A logic model is a visual representation of program theory that depicts the existing situation, inputs, activities, and outputs (Brousselle & Champagne, 2011). It is used to develop an understanding of the 'what' and 'how' of evaluating and improving a study or program (Smith et al., 2020). The logic model is assumed to be the first stage to efficiently promoting and extending a program. This facilitates understanding of program mechanisms, helping to develop a successful program (Oosthuizen & Louw, 2013). For instance, Ogbeide et al. (2021) used a logic model to evaluate the integration of data analytics in the tourism and hospitality curriculum. In this way, the authors provide a detailed overview of the current state of the data analytics program, the required inputs and activities for its development, and its potential impact. This model helps to assess these technologies' potential and why/how they can be integrated into the curriculum. We have used the logic model in this regard because it helps us effectively evaluate emerging technologies from their current state to their potential impacts on students through the inclusion of emerging technologies in the curriculum.

3. Methodology

This exploratory research is grounded in a qualitative research design. Qualitative research, characterized by an inductive approach, is recommended when dealing with limited information and exploratory inquiries (Miles et al., 2014). In a qualitative study, researchers use interviews, observations, text/document scrutiny, focus groups, open-ended questionnaires, scenario analysis, and case studies to access primary and secondary data (Kozak, 2018). The data for the present study, adopting an inductive approach, derive from tourism and hospitality curriculum content and insights from tourism academics. This research is divided into two phases due to some issues. Even though there has been a strong emphasis on the lack of courses related to emerging technologies in tourism and hospitality curricula, there needs to be an examination reflecting this issue. Therefore, this study includes a curriculum review to assess the presence and scope of emerging technologies in the curriculum and to validate ongoing discussions. During the initial stage of our study, we focused on undergraduate programs in tourism and hospitality management at universities that are ranked within the top 100 in the Q.S. World Ranking for Hospitality & Leisure Management (Q.S., 2023). The Q.S. is a global ranking system that evaluates universities based on factors such as academic reputation, research output, and internationalization (Estrada-Real & Cantu-Ortiz, 2022). Programs without detailed curriculum information or curricula prepared in languages other than English were eliminated. Finally, we analyzed the curricula of 65 undergraduate programs representing 47 universities (USA = 15 et al. = 3, Malaysia = 5, China = 4, the Netherlands = 3, Australia = 2, New Zealand = 2, South Africa = 2, and UAE = 1) (see appendix1).

An open-ended form was emailed to scholars studying emerging technologies in tourism and hospitality using Google Forms as part of the second phase of the research. The open-ended questionnaire is a written version of the structured interview method used to obtain primary data in inductive studies. In qualitative research, questions should address what the study aims to learn and understand (Maxwell, 2018). In this context, drawing on previous studies (Ogbeide et al., 2021; Carlisle et al., 2023; Papageorgiou et al., 2024), four open-ended questions have been developed to explicitly meet the information intended to be obtained in the research. The questions directed towards participants are shown in Appendix 2. Using a purposeful sampling strategy, relevant questions were directed towards academics who have been in academia for over a year and have published on emerging technologies (Miles et al., 2014). Due to the predominant focus on industry participants in tourism and hospitality education and technology studies, this study has approached academics to contribute to stakeholder perceptions. Moreover, a recent study by Hussain et al. (2023) on the employability of the next generation in the tourism and hospitality industry 5.0 observed differing perceptions of the importance of technological knowledge among educators. Some educators believed technological knowledge was necessary, while others did not. To contribute to the ongoing discussions in a more generalizable way, this study explicitly targets scholars who have published work on emerging technologies.

An open-ended form was distributed to 109 potential participants between October 25 and December 29, 2023. A total of 28 participants were reached. According to Czernek-Marszałek and McCabe (2024), the sample size should neither be so large as to weaken the depth of analysis nor so small as to compromise reliability. The appropriate sample size depends on research objectives and

Table 1
Interviewees' profiles.

Code	Position	Experience	Country	Code	Position	Experience	Country
P1	Associate Professor	10	USA	P15	Professor	32	Slovakia
P2	Professor	N/A	Bulgaria	P16	Assistant Professor	8	USA
P3	Professor	30+	Macau	P17	Professor	23	USA
P4	Assistant Professor	8	USA	P18	Associate Professor	8	China
P5	Associate Professor	10	Hong Kong	P19	Assistant Professor	8	China
P6	Professor	15–20	USA	P20	Professor	25	USA
P7	Associate Professor	10	Türkiye	P21	Professor	10+	UAE
P8	Professor	40+	Austria	P22	Research Assistant	35	England
P9	Professor	29	Türkiye	P23	Professor	15	Finland
P10	Professor	23	Hong Kong	P24	Professor	27	Sweden
P11	Assistant Professor	5	Taiwan	P25	Associate Professor	10	South Korea
P12	Assistant Professor	5	Croatia	P26	Professor	35	Australia
P13	Professor	20	Australia	P27	Associate Professor	15	N/A
P14	Professor	30	England	P28	Associate Professor	14	Taiwan

participant characteristics. Studies have also suggested that individuals aged 5–50 (Dworkin, 2012) or 20–30 (Marshall et al., 2013) may be sufficient. In light of this, it is possible to assert that an appropriate number of participants has been achieved, considering the purposive sampling targeting academics engaged in research on tourism and technology topics, and the participant count falls within the recommended parameters. We have completed data collection with a response rate of 25.6 %. Table 1 presents the demographic profile of the participants.

3.1. Data coding and analyses

We conducted content and thematic analysis of participants' responses. This involved identifying recurring patterns of meaning within the dataset and determining themes and codes to integrate the data (Guest et al., 2012). For this, we used both theoretically driven and inductively oriented approaches. The theoretically-driven approach involved predefined coding schemes, while the inductive approach aimed to uncover previously unidentified data or codes (Chan et al., 2018; Miles et al., 2014). As a result, we coded the curriculum content of 65 undergraduate programs related to tourism and hospitality management using a theoretically driven approach. The majors' curriculum was extracted into Word documents from their websites, but foundational courses like sociology and philosophy were excluded. The courses were analyzed by grouping them based on their respective fields. Previous studies were used for grouping (e.g., Leung et al., 2018). An inductive approach was employed to code the data collected from academics. An inductive approach was chosen in phase two to conceptualize, on an unrestricted basis, the identification of potential courses related to emerging technologies, the skills these courses aim to develop, and the employment roles associated with these skills. This makes it possible to go beyond specific digital skills that have been previously identified and to define new career roles in the tourism and hospitality industry on an academic basis. The MAXQDA 24.1 software package was used throughout the research to code the data and conduct frequency analysis, which was necessary to determine course frequency and proportion.

3.2. Validity and reliability

In qualitative research, the validity and reliability of findings revolve around questions such as who the research was conducted with, how many participants were involved, and how many questions were asked (Kozak, 2018). Various strategies are recommended for validity and reliability, such as ensuring appropriate and sufficient participation, diversity in participants, and the appropriateness of questions. Within these strategies, the use of purposeful sampling (involving academics engaged in studies related to emerging technologies), engagement of academics from eleven different countries, direct quotations of participants' responses, and the support of coding with previous research all indicate that the study does not pose validity and reliability concerns (Merriam, 2018).

Additionally, trustworthiness is argued to be more suitable than validity and reliability (Lincoln & Guba, 1985). Trustworthiness relates to how closely the findings align with reality and whether researchers genuinely measure what is intended. Research trustworthiness can be established through referential adequacy, triangulation, and prolonged engagement. Accordingly, both the literature and the interpretation of the findings (including coding) are supported and expressed by various references, and the method is diversified by performing curriculum analysis before collecting data from academicians. As a result, considering the interaction of the participants with the authors, the study meets the trustworthiness criteria (Lincoln & Guba, 1985, pp. 290–306). The researchers' expertise and interest in technology and tourism contributed to the study's trustworthiness, particularly by aiding the formation of code relationships during data analysis.

4. Results

4.1. Situation: what is the current status of emerging technologies in global tourism and hospitality undergraduate education?

We identified six core topic areas of the tourism curriculum: (1) management, (2) business, (3) environment, (4) academics, (5) law and ethics, and (6) technology and innovation. Management focuses on the skills needed to manage service environments within the tourism and hospitality industry. Business focuses on general business processes unrelated to tourism and hospitality. The environment focuses on current tourism and hospitality industry issues, precisely the destination and community relations. Academics focus on enhancing research and methodological skills. The law and ethics discuss the principles that govern decisions and behavior in a professional context. Finally, technology and innovation focus on developing skills related to how the industry interacts with technology. In this context, out of the total courses, 43.4 % are related to management, 35.2 % are focused on the business, 8 % are related

Table 2
Core topic areas of the tourism and hospitality undergraduate curriculums.

Core Topics	# of Courses	%
Management	455	43,4
Business	369	35,3
Environment	84	8,0
Academics	56	5,3
Law and Ethics	50	4,8
Technology and Innovation	34	3,2
Total	1048	100

to the environment, 5.3 % are related to academics, 4.8 % are related to law and ethics, and 3.2 % are related to technology and innovation. Table 2 presents the tourism and hospitality undergraduate curriculum's core topic areas.

Table 3 presents the code analysis results for the subtopics within the core topic areas. Management courses are divided into ten subtopics, while business courses cover seven subtopics. Environment-related courses are categorized into four subtopics, and academic courses are divided into two subtopics. Furthermore, the operation management sub-topic within the management core courses area is divided into five categories. Based on the frequency analysis, 24 % of the management courses are related to operation management. Out of those operation management courses, 28 % cover design-related topics. Meanwhile, 21 % of the business courses are about marketing and sales. In the environment category, 36 % of the courses concern sustainability. Lastly, the majority of courses in the category of academics (57 %) focus on research methods.

Of all the courses examined, only 3.2 % were related to technology and innovation. This indicates that technology and innovation courses are relatively small in the curriculum. Furthermore, these courses have been divided into two main categories based on their objectives: digital technology and information technology. Digital technology courses aim to teach students about technologies geared towards future trends and innovations, which significantly impact Society and the business world. In contrast, information technology courses aim to improve skills in information processing and network management, focusing on improving business processes in management. Of all technology and innovation courses, 70 % were digital technology, and 30 % were information technology. Additionally, 68 % of these courses were mandatory, while 32 % were elective. The following two quotations refer to the content examples of digital technology and information technology courses in two countries:

> *This course introduces students to contemporary information systems and demonstrates how these systems are used throughout organizations* … (Information Technology course delivered in the Department of Management Information Systems at César Ritz Colleges, Switzerland).

> *This module teaches students the importance of digital innovation and data analytics in the services sector* … (Digital Technology course delivered in the Department of Digital Innovation and Data Analytics at the University of Surrey, UK).

Table 3
Subtopic courses taught in tourism and hospitality undergraduate curriculums.

Core Topics	No.			
Management	*1.*	Subtopics	# of Courses	%
	1.1.	Operation Management	111	24
	1.1.1.	Design	*31*	*28*
	1.1.2.	Leadership and behavior	*29*	*26*
	1.1.3.	Revenue	*27*	*24*
	1.1.4.	Cost and purchase	*14*	*13*
	1.1.5.	Safety and Sanitation	*10*	*9*
	1.2.	F&B Management	84	18
	1.3.	Lodging Management	59	13
	1.4.	Customer Management	48	11
	1.5.	Talent Management	45	10
	1.6.	Recreation and Leisure Management	35	8
	1.7.	Destination Management	31	7
	1.8.	MICE Management	18	4
	1.9.	Travel Management	12	3
	1.10.	Transportation Management	12	3
Business	*2.*	Subtopics	# of Courses	%
	2.1.	Marketing and Sales	79	21
	2.2.	Accounting and Finance	68	18
	2.3.	Management	58	16
	2.4.	Analytics and System	54	15
	2.5.	Investment	40	11
	2.6.	H.R. and Employment	37	10
	2.7.	Economics	33	9
Environment	*3.*	Subtopics	# of Courses	%
	3.1.	Sustainability	30	36
	3.2.	Current Issue	25	30
	3.3.	Culture and Heritage	19	23
	3.4.	Risk and Resilience	10	11
Academics	*4.*	Subtopics	# of Courses	%
	4.1.	Research Methods	32	57
	4.2.	Research and Scholarly Activities	24	43
Technology and Innovation	*5.*	Subtopics	# of Courses	%
	5.1.	Digital technology	24	70
		Information technology	10	30

4.2. Inputs-contents: which emerging technologies can be included in the curriculum, and for what purpose?

The results revealed that the participants emphasized ten different emerging technologies 71 times. According to the results, the emerging technologies are distributed as follows: Augmented & Virtual Reality (A.R. & V.R.) account for 32 % (n = 24), Generative Artificial Intelligence (GAI) is 14 % (n = 10), Cloud Computing (CC) is 10 % (n = 7), Blockchain (B.C.) is 9 % (n = 6), Artificial Intelligence (AI) is 9 % (n = 6), Internet of Things (IoT) is 7 % (n = 5), Extended Reality (X.R.) is 6 % (n = 4), Robotics (RBT) is 6 % (n = 4), Information and Communications Technology (ICT) is 4 % (n = 3), and Metaverse (MV) is 3 % (n = 2). Further, results revealed that emerging technologies could be integrated into eight domains. These domains include tourism and hospitality management (19 %, n = 10), marketing and sales (19 %, n = 10), operation management (17 %, n = 9), destination management (17 %, n = 9), customer management (17 %, n = 9), recreation and leisure management (5 %, n = 3), F&B management (3 %, n = 2), and travel management (3 %, n = 2).

Fig. 1 displays the most common intersections of emerging technologies and domains. Moreover, it highlights the technologies and fields that participants have emphasized. Fig. 2 depicts the course proposal based on these findings. According to the results, A.R. and V.R. are the most notable technologies, while tourism and hospitality management, marketing, and sales are the most prominent domains. Additionally, the area with the highest intersectionality is operation management, implying that GAI, CC, AI, and ICT technologies need to be integrated into the curriculum based on operation management. Also, A.R. & V.R. intersected most frequently with the marketing and sales domain:

> *The primary purpose of this course would be to equip students with cutting-edge skills in V.R. and A.R., tailored specifically for enhancing tourism marketing strategies. It aims to prepare future professionals who can leverage these technologies to create compelling, immersive experiences that attract tourists, differentiate destinations, and contribute to sustainable and inclusive tourism growth.* [P12]

In tourism and hospitality service settings, service robots are a significant technology (Seyitoğlu & Ivanov, 2023; Vishwakarma et al., 2024). However, results show that robots are not often emphasized. One participant suggested including robotic technologies in the curriculum for this purpose:

> *A new generation of customers may like robotics, but they may replace some labor force in the tourism and hospitality industry. This course aims to help students understand how to apply the technology and manage customer experience with the technology.* [P18]

In addition to responses that emphasized specific emerging technologies, some views suggested integrating multiple technologies into the curriculum simultaneously:

> *I would like to include data mining, programming, etc, in the curriculum and make all the students aware of metaverse technology, how these universes are created, and how the basis of IoT works for the tourism industry. Moreover, I could facilitate the AI technology and gaming facilities to enjoyably teach about sustainable tourism via tourism-related metaverses focusing on environmental issues, contests between student groups on green energy usage, etc.* [P16]

Students are expected to gain skills in digital and technological (29 %), management (26 %), operational (24 %), and theoretical (21 %) areas when emerging technologies are included in the curriculum. The research suggests that the tourism and hospitality curriculum can contribute to theoretical and practical skills (Ferdian et al., 2023) and enhance digital skills (Mandalia, 2023; Renfors

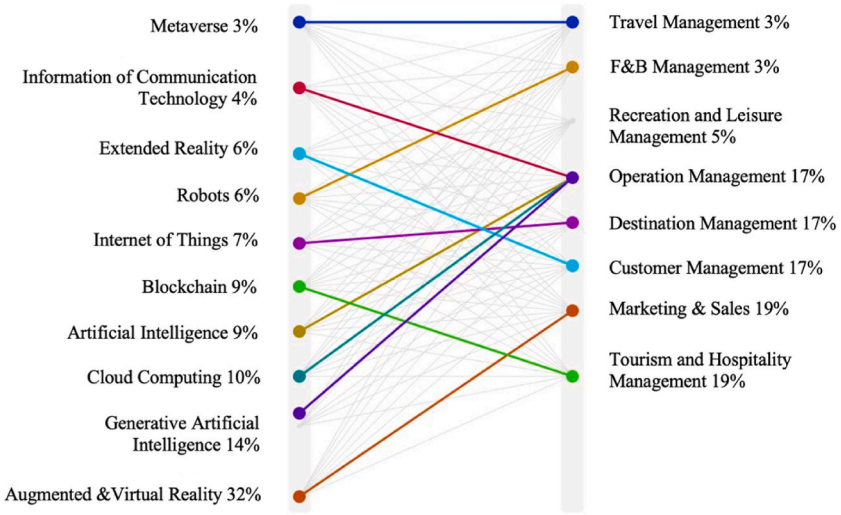

Fig. 1. Intersectionality of emerging technology and domains

Outputs: What skills can students obtain from learning emerging technologies in their curriculum? What career roles can students stand out in by developing emerging technology skills.?.

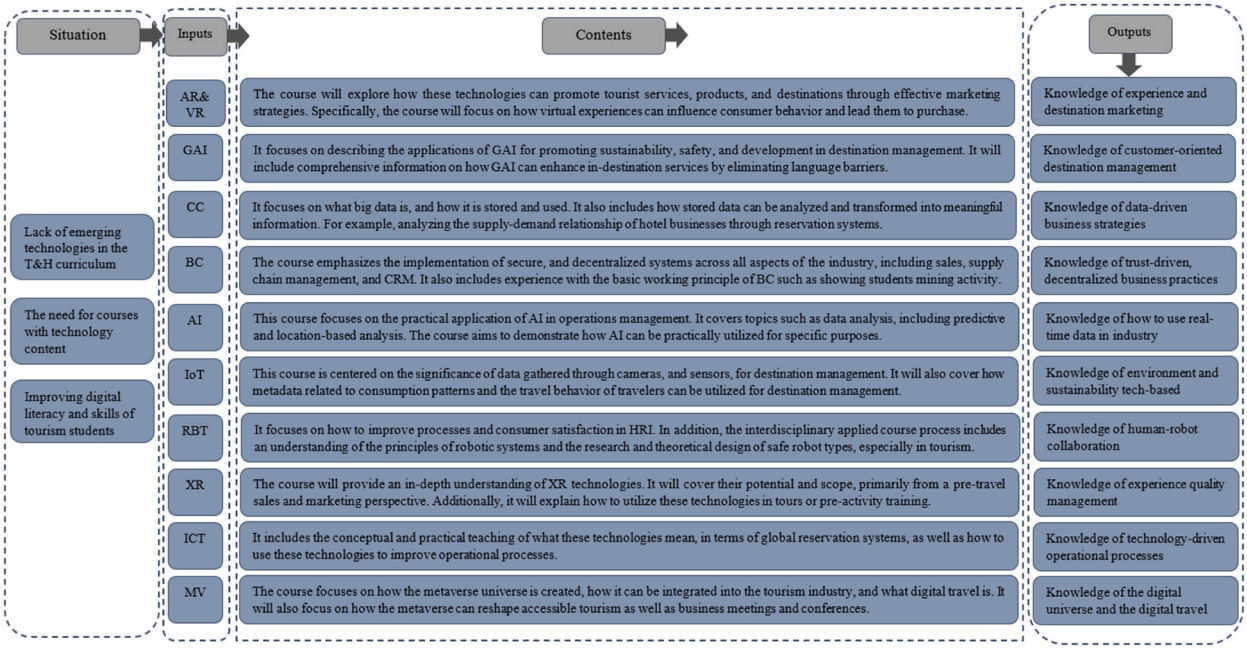

Fig. 2. Emerging technologies-based course proposes
Notes: AR &VR: Augmented & Virtual reality; GAI: Generative Artificial Intelligence; CC: Cloud Computing; BC: Blockchain; AI: Artificial Intelligence; IoT: Internet of Things; XR: Extended Reality; ICT: Information Communication Technology; MV: Metaverse; RBT: Robotics.

et al., 2020). As the tourism and hospitality industry increasingly integrates emerging technologies, students must adapt to this trend and acquire multidisciplinary skills like data analysis (Nannelli et al., 2023). The findings reveal that emerging technologies have the potential to provide students with digital and technological skills that make them stand out in different roles. Digital and technological skills are the ability to use technology in various areas of the tourism and hospitality industry, such as marketing and product

Fig. 3. Skill sub-codes and career model.

development in tour operators, travel agencies, destination management organizations, and accommodation establishments (Carlisle et al., 2023). Our study observed that these skills are related to high-tech skills such as cybersecurity and data analysis:

> *With a focus on big data, roles in data analysis can emerge, wherein students leverage data insights to enhance tourism operations and customer satisfaction." Also "with tech knowledge, roles in managing digital risks and enhancing cybersecurity in tourism operations can emerge.* [P12]

Management skills are associated with effectively managing operations and the team. Management skills refer to capabilities based on the effective management and sustainability of the tourism and hospitality industry through emerging technologies:

> *Students with expertise in A.I. and emerging technologies in tourism can contribute significantly to sustainable and smart tourism development. Their skills would be precious in various roles, from strategic planning to crisis management.* [P27]

Operational skills are based on practical skills associated with effectively applying knowledge and task execution (Ferdian et al., 2023). The research refers to the skills provided by emerging technologies to improve processes and enhance service delivery:

> *Knowledge of such technologies can be advantageous for students because, in the future, the tasks requiring low skills may be eliminated in the industry … In the tourism industry, for example, a tourist guide will have to make a difference in the future instead of only providing information about a heritage site or a monument. The usage of V.R. or A.R. by tourist guides can be advantageous in terms of promotion or the virtual pre-visit of destinations.* [P7]

Finally, theoretical skills include understanding the concepts and principles (Ferdian et al., 2023). Based on the research findings, the skills mentioned are linked to specialized knowledge acquired through comprehension of concepts related to emerging technologies. These skills are not limited to technology but are also relevant to technology-driven domains such as marketing and sales. One respondent has expressed the value of theoretical skills in the following manner:

> *The development of emerging technologies is speedy, and how to develop and apply the technologies in tourism may require knowledge of computer science, which is difficult for tourism students. Including courses on such emerging technologies in the curriculum may only help students acquire marketing or managing tourist experience for the business world.* [P18]

Fig. 3 shows each skill category's sub-codes and associated career roles. According to the participants' responses, students with digital and technological skills may excel in high-tech roles such as I.T. security specialists and prominent data analysts. Those with management-related skills may succeed in competent destination developer and sustainable tourism consultant roles. Students with operational skills are expected to contribute to service-oriented roles such as virtual reality tour designer and product and service co-designer. Theoretical skills facilitate employment in roles like travel technology specialist. The findings related to potential career roles are supported by previous research on the digital literacy and technology-related skills required by the tourism and hospitality industry, e.g., data science and cloud computing (Adeyinka-Ojo et al., 2020).

5. Conclusion and implications

This study has been designed to address the current status of emerging technologies in the global tourism and hospitality undergraduate education; the skills students can obtain from learning emerging technologies, and the type of emerging technologies that can be included in the curriculum and its rationale. The study findings have indicated that the tourism and hospitality curriculum mainly emphasizes technology-related undergraduate courses. This result is supported by the findings of the previous regional research (González Forero & Villegas Cortés, 2023; Zong et al., 2022), and it highlights the lack of technology-focused courses on an international level. The research contributes to the current state of tourism and hospitality curricula in various countries, considering its dynamic and regionally diverse nature. The study identifies the domains where emerging technologies have the most relevance and outlines which purpose they may be included in the tourism and hospitality curriculum as a course. Thus, it forwards the previous studies that emphasize the importance of emerging technologies (Iskender et al., 2024; Sharma & Munjal, 2023).

Previous research focusing on digital skills gaps in tourism and hospitality has associated digital skills mostly with knowledge of office, computer, data analytics, and social media (Minor et al., 2024) and observed that they are divided into two factors: advanced and basic digital skills (Carlisle et al., 2023). The study findings indicated that incorporating emerging technologies in the tourism and hospitality curriculum helps students develop skills in four areas: management, operational, theoretical, and digital-technological. This aligns with previous studies that have identified the specific skills imparted by the curriculum (Ferdian et al., 2023; Mandalia, 2023). The results also show that the digital and technological skills often mentioned in the literature are about knowledge of using or understanding technology and extensions of operational and management-related skills. It has been highlighted that five areas of expertise and knowledge can help with the development and competitiveness of international tourism. These areas include product and experience development, multi-channel sales and marketing communication, multi-industry collaboration, managing business operations, cultural awareness, and internationalization (Renfors et al., 2020). The study showed that emerging technologies have the potential to impact these skills directly. For instance, virtual tours may enhance product and experience development, and extensive data analysis may improve multi-channel sales and marketing communication. The study indicated that emerging technologies such as A.R. and V.R. are promising technologies that could be extensions of these skills. This refers to the operational skill, such as a virtual simulation of products and services, rather than how students will use A.R./V.R technologies (digital/technological skill).

Furthermore, the study suggests that the emphasis on digital and technological skills (29 %) is higher than previous studies. For instance, Minor et al. (2024) concluded that managers believe that the least needed skills, both now and in the future, are AI, robotics,

and digital hardware skills such as A.R. and V.R. This study focused on academics. In contrast, previous studies focused on tourism stakeholders, which may explain the contradictory findings. Furthermore, this difference may arise from the diversity of academic perspectives and industry needs. Despite the lack of a widespread technological revolution in the industry, academia prioritizes technology research. Therefore, academics are likely to have a wealth of technological knowledge. However, on the industry side, stakeholders prioritize current operational needs and profitability. This may lead industry professionals to consider advanced digital skills less necessary. In this context, technological transformation in the tourism and hospitality industry is primarily happening in academia as a theoretical rather than practical implementation.

Existing studies indicate that knowledge and skills related to emerging technologies will prepare students for future job opportunities (Seo & Kim, 2021) and that there may be a demand for high-tech skills such as big data analytics, cybersecurity, and IoT by 2030 (Zaragoza-Sáez et al., 2022). However, the specific job roles in which students could be employed based on these technological skills have not been clearly defined. The current study contributes to the literature by identifying potential career roles associated with four distinct skill sets: digital and technological, theoretical, operational, and managerial. For example, the findings suggest that emerging technologies, such as virtual reality tour designers, competent tourism developers, and AI-driven marketing specialists, could give rise to new job roles. Furthermore, it is widely acknowledged that digitalization impacts job roles within the tourism and hospitality industry. Examples of these roles include experience creators, sustainable destination tourism managers, guides, and MICE specialists (Carlisle et al., 2023). The findings also reveal that emerging technologies can potentially transform existing roles. For instance, tourism specialist positions like MICE specialists may increasingly incorporate technology-focused expertise, such as AI-driven marketing specialist and travel technology specialist roles.

Moreover, Ogbeide et al. (2021) pointed out that extensive tourism and hospitality curriculum data courses can contribute to students' development as competent data analysts. The findings suggest that data analyst positions like tourism forecasting analysts could encompass specific roles. In a recent study titled "The Future of Tourism Work: Is Technology a Substitute for Labour Supply" by Yeoman and McMahon-Beattie (2024), the authors discussed four scenarios of substitution: replacement, experiences, argumentation, and redesign. They highlight that technology is not solely replacing human labor but is also actively involved in creating immersive experiences and reorganizing operations. Within this context, our findings shed light on the skills that technology can enhance in collaboration with human labor, as well as the evolving roles within operational processes.

In conclusion, technology has gained increasing importance in tourism education, especially in the transformations that began after the COVID-19 pandemic, as it facilitates remote learning and enhances course interactivity (Kırlar-Can et al., 2024). On the other hand, as the current study reveals, technology will also gain prominence in the curriculum and career development paths. In the next decade, technology will become one of the fundamental pillars of tourism and hospitality education and a key criterion for the workforce in the industry.

Practical implications

This study has several practical implications for tourism and hospitality academics, directors, and public authorities. First, the findings demonstrate that each emerging technology is more closely associated with a specific tourism domain. Based on this, academics and institutional directors may incorporate the content related to these technologies into course modules without abandoning core tourism subjects. Ensuring the content is theoretical, practical, and applied is essential. In particular, making the course more hands-on will likely increase students' motivation. Integrating GAI into a destination management course module is an example. In this course, students can be taught how to create content such as images, audio, and video that will be useful in the promotion of the destination and for what purpose through GAI. However, the effectiveness of content creation through GAI depends on the scope and clarity of the prompt. Therefore, it may be advisable for academics and institution directors to collaborate with prompt engineers or specialists to assist in designing the course module.

Second, as technological integration becomes more pervasive in the tourism and hospitality industry, the demand for digital and technological skills will steadily increase. For this reason, the active role of business managers and policymakers is critical in the development of the digital and technological skills of employees. One of the reasons why tourism and hospitality businesses do not offer digital training, as discovered by Minor et al. (2024), is the absence of training opportunities. Therefore, policymakers should launch training programs. An example is the "Digital Skills Partnership program launched by the United Kingdom." The program was developed in response to the increasing demand for workers with digital skills. The goal is to offer skills in various areas, including digital marketing, cybersecurity, and coding, at all levels, from beginner to advanced (Department for Digital, Culture, Media and Sport, 2021).

Third, in the aftermath of the COVID-19 pandemic, tourism and hospitality businesses have increasingly embraced digitalization to overcome labor shortages and ease the workload on their employees. The owners with data analytics and IT backgrounds explored alternative strategies to decrease labor needs. For instance, they have adopted Q.R. code-based food and beverage ordering systems (OECD, 2024). Consequently, business owners and managers also need digital and technological skills. Policymakers may offer training and financial assistance to aid in digital integration, especially for SMEs facing difficulties keeping their operations running smoothly. Such initiatives would help business owners and managers acquire digital skills and integrate digital technologies into their business processes. This, in turn, would enhance business resilience in the face of crises and pandemics. Additionally, research by Khoo et al. (2024) reveals that digital technologies can empower women in the tourism industry, but a lack of digital skills presents a significant obstacle. Consequently, if policymakers provide training and funding to encourage the development of digital skills and integration, it would also positively affect female entrepreneurship.

The study also has several limitations as an avenue for future research. First, the representation of the findings is limited only to

several countries with a broader picture of the tourism and hospitality programs worldwide. The study only examined the curricula of undergraduate tourism and hospitality programs. Future research could include postgraduate programs to observe whether there are changes in the technology-related content of the curriculum as the hierarchical level of education increases. In addition, the current research focused only on tourism and hospitality management programs. Therefore, specialized tourism technology programs could also be considered. Second, the current study evaluated only technology-related courses that can be an extension of technology and innovation in curriculum analysis. Therefore, a particular course may include, for example, marketing, AI, or big data. However, it could not be included in the technology and innovation group because its name is only marketing instead of AI/extensive data marketing. Therefore, future research can conduct case studies involving a few universities and analyze course modules instead of curriculum analysis. Third, this study is based on only the perceptions of tourism academics. Future research may consider comparing responses involving industry stakeholders, students, and academics to provide a more comprehensive understanding of emerging technologies and further the discussions on this. Fourth, program theory was used to conceptualize how emerging technologies can be incorporated into the curriculum as courses in this study. Other curriculum-based theories, such as BEKA, could be used in future studies to evaluate students' opinions on proposed courses. Finally, the current research addressed the inclusion of emerging technologies in the curriculum only in terms of objectives/aims. For future research, the authors may design studies that provide more detailed guidelines on external resources and classroom arrangements for incorporating emerging technologies into the curriculum.

CRediT authorship contribution statement

Miraç Yücel Başer: Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Metin Kozak:** Writing – review & editing, Writing – original draft, Validation, Supervision, Conceptualization. **Tuba Büyükbeşe:** Writing – original draft, Resources, Investigation.

Appendix1

Country	Institution
USA	University Of Nevada
University = 14	University of Central Florida
Program = 15	The Washington State University
	University of Houston
	Florida International University
	University of Florida
	University of South Carolina
	Purdue University
	University of South Florida
	Arizona State University
	New York University
	Temple University
	University of Massachusetts Amherst
	Cornell University
UK	Bournemouth University
University = 9	University of Surrey
Program = 20	Oxford Brookes University
	University of Derby
	Leeds Beckett University
	Middlesex University
	Sheffield Hallam University
	Ulster University
	University of Strathclyde
Switzerland	EHL Hospitality Business School
University = 8	Swiss Hotel Management School
Program = 8	Glion Institute of Higher Education
	Les Roches Global Hospitality Management Education
	Cesar Ritz Colleges
	Hotel Institute Montreux
	HTMi-Hotel and Tourism Management Institute
	Business and Hotel Management School
Spain	Escuela Universitaria de Hotelería y Turismo de Sant Pol de Mar
University = 3	Universitat Ramon Llull
Program = 3	Universitat de Barcelona
China	Macao Institute for Tourism Studies (IFTM)
University = 3	The Chinese University of Hong Kong
Program = 4	The Hong Kong Polytechnic University
Malaysia	Taylor's University
University = 3	UCSI University
Program = 5	MSU Management Science University

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Country	Institution
Australia	The University of Queensland
University = 2	Griffith University
Program = 2	
Netherlands	Hotelschool The Hague
University = 2	Breda University of Applied Sciences
Program = 3	
New Zealand	Auckland University of Technology
University = 1	
Program = 2	
South Africa	International Hotel School
University = 1	
Program = 2	
UAE	The Emirates Academy of Hospitality Management (EAHM)
University = 1	
Program = 1	

Appendix2

Dear participant,

This study aims to explore the integration of emerging technologies into the tourism curriculum and define specific objectives. Additionally, it aims to develop a technology-focused curriculum that enhances the employability of graduates.

1. What abilities could the inclusion of courses on artificial intelligence and emerging technologies (e.g. Blockchain, Internet of Things, Robotics, Virtual Reality, Augmented Reality) in the curriculum help students acquire or enhance for the business world?
2. How do you think that, with the integration of artificial intelligence and emerging technologies into the tourism curriculum, students could distinguish themselves in which areas with the potential skills they would gain, and in which roles could they be employed?
3. If you were to introduce a course related to emerging technologies into the curriculum, which technology would it encompass, and in which domain of the tourism industry would it focus? What would be the purpose of this course?
4. The university/institution you are currently affiliated with?
5. How many years have you been in academia?
6. Your current academic title?

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