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Using Design Thinking as an Educational Tool for Conceptualizing Future Smart Hotel Guest Experiences

Design thinking (DT) is the foundation of smart tourism innovation. This study extends the theoretical foundation by showcasing how DT was deployed in a tertiary classroom setting during a smart hospitality innovation project. The study involved 30 students who were asked to design tomorrow's smart hotel guest experiences for business and family travelers. The study used an explanatory case study to report the curriculum design, the DT methods used, and the way they were applied to the design practice. We made suggestions for tourism professionals and educators who want to deploy DT in their smart tourism innovation projects.

Keywords: Design Thinking, Smart Hospitality, Smart Tourism Innovation, Experience-driven Design.

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Introduction

Design has recently attracted the interest of tourism researchers (Fesenmaier & Xiang, 2017) because of its capacity to generate innovations that can transform the tourism industry. Indeed, design thinking (DT) has been considered an approach that can generate novel smart hospitality propositions with advanced technologies (Tussyadiah, 2014), and studies have found it can foster positive behavioral change (Tussyadiah, 2017). In spite of DT's potential, very few studies have investigated the deployment of the DT process in the context of smart tourism innovation. This study is based on the current knowledge by reporting how DT was deployed in a classroom setting. We report the process of implementation, which includes subject planning, the design methods used, and the activities involved. We analyzed students' works and interviewed the students on their learning experience. This study helps bridge the knowledge-practice gap of implementing DT in the context of smart tourism innovation.

Literature Review

The tourism industry has been one of the earliest adopters of information and communication technologies. A considerable amount of research has been conducted on eTourism to investigate the development and application of smart technologies in tourism settings. However, advanced technologies may fail to offer superior guest experiences at times. For instance, the robot assistant "Churi," who served in the Henn-na Hotel's rooms, was dismissed because the guests found the robot failed to answer basic questions. This phenomenon suggests that a deeper understanding of guests' needs, and expectations would help advance smart hospitality.

DT can provide a way to drive smart hospitality innovation that is desirable, viable, and feasible (IDEO, 2015). The DT process is often represented in a double diamond model (Design Council, 2005), with the diamond shapes representing two distinct mindsets

recognized as inherent to the creative process: divergent and convergent thinking (Fig. 1). In brief, divergent thinking involves ethnographic research and, hence, the exploration of plausible propositions. Convergent thinking scrutinizes and synthesizes those propositions to move toward an innovative outcome. The DT process is accompanied by DT methods. The latter is a collection of tools that enables the cognitive, strategic, and experimental design research processes by which abstract experiential dimensions can be explored, valuable propositions can be generated, and innovations can be evaluated before commercialization. Moreover, excelling in DT requires designers to act with seven "designerly" mindsets (Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013). First, the designer needs to *1. Be empathetic toward users and customers* so potential problems can be identified (and even resolved) from their perspectives. Sometimes, these problems are rooted in more complex issues, and solving them requires restructuring the context and situation that causes them. Here, *2. Creative confidence* is needed for designers to take creative leaps to achieve breakthrough innovations. The process requires designers to *3. Experiment with prototypes* of different scales and fidelities through *4. Iteration*. Going through such a process can be confusing, and thus professional designers must be able to *5. Learn from failure*, *6. Embrace ambiguity*, and *7. Act optimistically* (IDEO, 2015).

Complementary to DT, experience-centered design (Hassenzahl, 2010) provides a knowledge base that guides designers to explore and appreciate the multiplicity of human experience. Experience-centered design seeks to achieve a holistic understanding of experiential factors, such as activities, benefits, and values that lead to a positive experience. The identification of all these experiential factors is of utmost importance because the key prerequisite for experience-centered design is to have an explicit understanding of what experiences to design for (Kaasinen et al., 2015). Since the theorem of experience-centered design suggests that people act and behave in ways that are congruent with what they

consider to be important and valuable to them, Hassenzahl (2010) therefore proposes that designers should consider three levels of goals namely, be-goals, do-goals, and motor-goals. Be-goals refer to the desired end state an individual wants to attain (e.g., the need to be autonomous). The do-goals are the activities that can drive an individual to proceed towards the desired end state (e.g., travel as a backpacker). Lastly, motor-goals are the behaviors involved in performing activities (e.g., using a wayfinding app.).

Research methodology

This study showcases how DT was deployed as a practice-led approach for hospitality innovation. The is based on the theoretical foundation of DT for smart tourism (Tussyadiah, 2014) by implementing it in a 12-week experience design subject, which took place at the School of Design at the Hong Kong Polytechnic University. The subject was taught in collaboration with the School of Hotel and Tourism Management (SHTM), which provides support with domain-specific knowledge concerning smart hospitality.

We use an explanatory case study (Yin, 2009) because this article focuses on the transition between how students learn DT and the way in which they apply it in smart hospitality innovation. More specifically, we are interested in understanding how designer learners integrate the principles of DT (as mindset, design process, and methods) (Johansson-Sköldberg et al., 2013). In so doing, all activities, documents and discussion involved in this subject were collected and analyzed. Student learning outcomes, including design presentation and reports, were also solicited. We interviewed students to understand the issues and challenges they encountered throughout the process.

We elaborated a design brief with the goal of "designing tomorrow's guest experiences for Hotel Icon." The brief highlighted the need for integrating smart technologies to enrich guests' experiences during their sojourns. Design propositions can address hotel or

guest room services for two distinct traveler groups particular to Hotel Icon, namely business travelers and family vacationers.

The curriculum: Design for tomorrow's guest experiences

The 12-week subject comprising three stages: exploring positive guest experiences, envisioning future scenarios, and co-creating smart hospitality services. To help students achieve the objectives, each stage consists of four activities: lectures, workshop, tutorial, and presentation. The lectures provide explicit knowledge that imparts a contextual understanding of the objective; the workshop and tutorial, on the other hand, introduce relevant design tools and provide timely support to students on design research. Students need to gain tacit knowledge in mastering the design methods in order to generate valuable outcomes. Lastly, designers need to communicate their findings with visualization, such as charts, diagrams, and storytelling, through presentation and demonstration sessions. Figure 1 shows the deployment of the subject over a double diamond model.
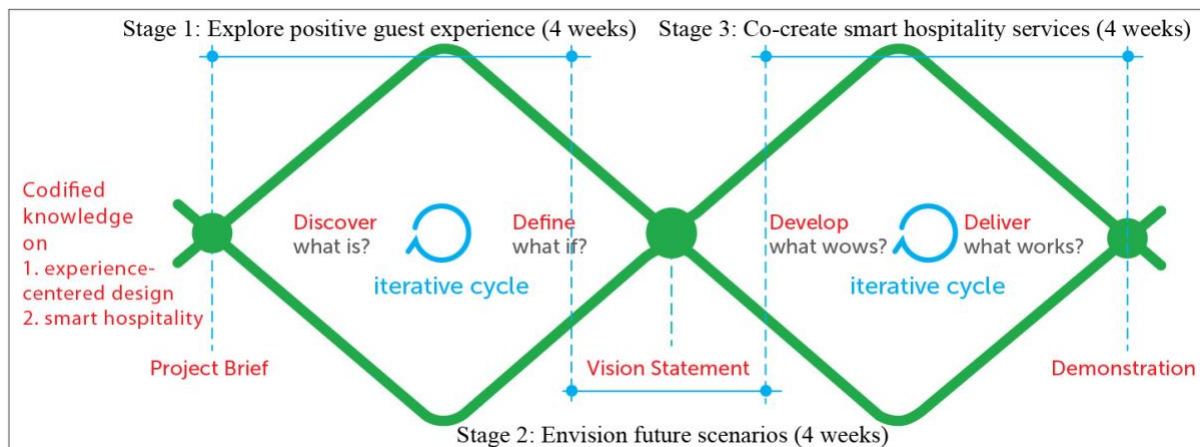
Figure 1. Three-stage process of designing future hospitality

Participants

Thirty students aged 19-23, who had enrolled in an interactive media design course in the penultimate year of studying for their degree, participated in this study. The students were

divided into six groups (i.e., five students per group). Three groups focused on business travelers, whereas another three groups focused on family vacationers. The teaching team involved an assistant professor and a PhD student, who are experts in the areas of interactive media and experience design. Two professors from the SHTM were invited to provide lectures and feedback to students.

Process: Implementing design thinking into smart hospitality innovation

The following paragraphs describe the planning, deployment, and reflection on student learning of each stage. First, we explain the structure of the course content, the DT method used, and the learning activities. Then, we discuss the students' learning process with examples of student learning outcomes. Lastly, we reflect on students' performance and highlight the challenges in each stage.

Stage 1 - Exploring positive guest experiences through laddering interviews

Stage 1 is a four-week exercise that explores positive guest experiences through in-depth interviews. Identifying positive guest experiences requires a holistic understanding of people's goals (Hassenzahl, 2010). These goals can be understood as their psychological needs, motivation, and emotion towards hotel services. The laddering interview, which has been used in marketing and design research (Reynolds & Gutman, 1988), can help designers to dig deep into the users' benefits and the psychological factors underlying a positive guest experience. The interview process involves respondents answering a sequence of "whys" in order to reveal the subconscious motives and values of their choices made on their consumption behaviors (Jiang, Scott & Ding, 2015).

Each student group was required to conduct five in-depth interviews with their target customers (i.e., business travelers and family vacationers). All interviews were to be recorded and transcribed for coding and theme identification. To ensure students could do the coding consistently, we introduced a code book comprising themes derived from the extant literature on consumer studies (Reynolds & Gutman, 1988), experience design (Desmet & Pohlmeyer, 2013), and tourism (Kim, Ritchie, & Tung, 2010).
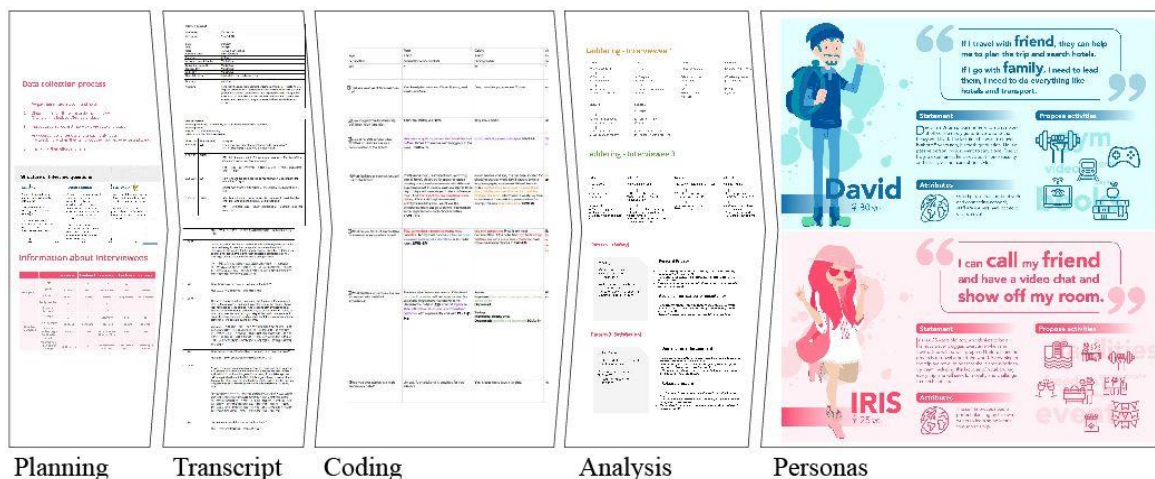
Figure 2. Explore experiential dimensions with laddering interviews

The results of the laddering interviews were summarized into a persona profile – an archetype of guests with a concrete and concise description of their goals, motivations, needs, and behaviors (Fig. 2)(Blomquist & Arvola, 2002). Complementing the interviews were research findings from different sources that personify typical guests in a coherent, meaningful, and lively manner. As such, the persona is based on ethnographic research rather than on fictive data. Within a co-design process, the persona helps designers to communicate their research findings, thereby building consensus among multidisciplinary team members. After creating the persona, student groups in this study were asked to deliver an oral presentation to peers, teaching members, and professors from SHTM.

Reflection on stage 1. During this stage, students learned how to apply the laddering interview as an inductive DT method (Dunne & Martin, 2006). Students learned the process of systematically conducting an in-depth interview. We observed three main challenges the students encountered: building empathy, understanding the complexity of human experience, and communicating findings with visualization. For example, we found that at times the students were challenged by conducting in-depth interviews and attributing relevant themes to the interview transcript. For example, a student group interpreted the pleasure of receiving a basket of fresh local fruit after checking in to the hotel room as an experience of personal growth but failed to establish how the "joy and pleasure" leads to "personal growth" in the report. In the follow-up interviews with students, they admitted that conducting laddering interviews was challenging. This is probably due to the lack of experience in conducting interviews. The students found many participants failed to articulate and associate their behaviors to higher-order psychological needs, as required in the laddering interview.

Furthermore, students also experienced difficulty comprehending abstract psychological concepts and terms, which hindered their ability to analyze the collected data. Nevertheless, students tried to uncover values and benefits based on the conversations with target customers. Overall, the student groups identified four common themes from the interviews: safety and security, relaxation and comfort, novelty and local experience, care and helpfulness. To communicate the findings, each student group generated one or two visual personas based on the themes, representative quotes, and aggregated data from the interviewees.

Stage 2 - Envisioning future scenarios with a vision statement, trend identification, and video sketching

Stage 2 is another four-week exercise that focuses on envisioning future hospitality experiences. The goal of this stage is to propose design directions that highlight a plausible and desirable end state based on the personas. This stage, which refers to generative design research, concerns proposing plausible future scenarios and their associated experiential factors derived from the personas. Brown (2009) delineated three essential criteria for successful innovation: desirability, feasibility, and viability.

At the beginning of Stage 2, we provided a lecture and a site visit for students to increase their awareness on the use of smart technologies and the operation of hospitality. One of the challenges was to adopt abductive reasoning (Desmet & Pohlmeyer, 2013), an approach to synthesize and generate a hypothesis based on an incomplete set of information in order to come up with a potential solution for further development. We introduced two types of design method, namely forecasting and storytelling, in order to facilitate the generation of a vision statement.

Each group needed to envision trends, then generate three hypotheses and create visual narratives that could effectively communicate the propositions to target audiences for collecting feedback that could further be incorporated into the next iteration (Figure 3). The result produced learning and reflection that helped the design team to make informed decisions. Lastly, each group needed to conclude and summarize its findings into a compelling vision statement with the support of visual narratives such as diagrams and video sketching. Figure 3 shows an example of the vision statement and the scenarios generated by the student groups.
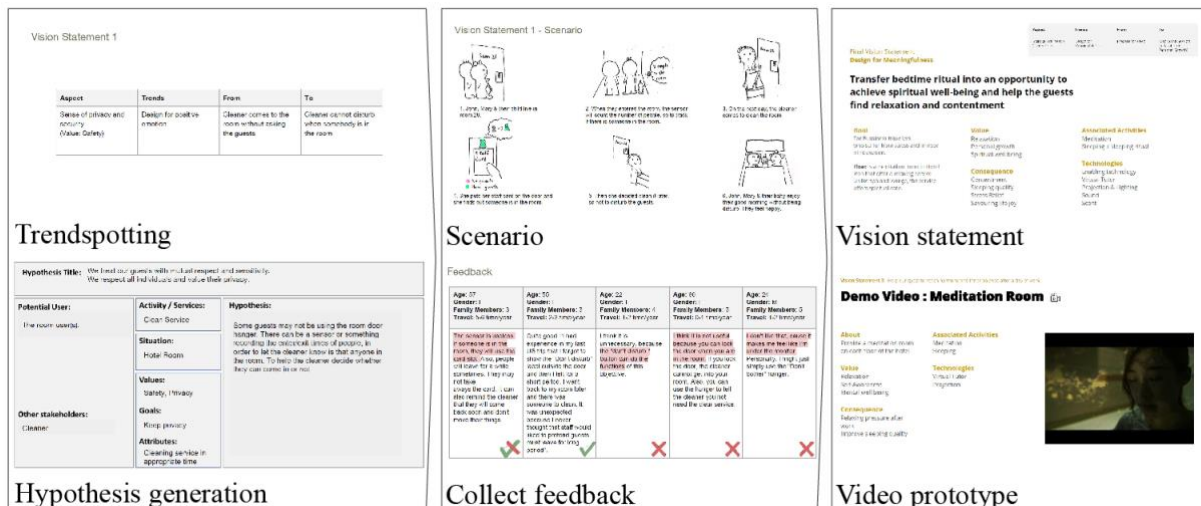
Figure 3. Envisioning future scenarios

Reflection on stage 2. At this stage, the student groups generated a wide range of innovative ideas. For example, the team that focused on relaxation and comfort suggested that guests be provided with an in-room meditation space that increased their mental wellness, and a smart pillow that keeps track of guest's sleeping quality. Another team that focused on novelty and local experience suggested offering an interactive carpet which would allow guests to discover local attractions. The team that focused on caring and helpfulness advised the hotel to provide a portable real-time translator and cultural etiquette tips for foreign guests. Certainly, not all the ideas were feasible and desirable. Nevertheless, the abductive design process requires designers to be optimistic and embrace ambiguity (IDEO, 2015).

The follow-up interviews showed that students felt frustrated because of the participants' diverse opinions, and thus the feedback cast doubt on the validity of their propositions. Furthermore, the students confessed that they were not familiar with smart technologies, and thereby were not confident about developing their ideas. The lack of creative confidence may explain why students relied very much on the feedback of tutors and experts, although learning from failure is considered to be another designer mindset. Designers need to learn how to embrace ambiguity because they will not be able to fully understand design problems and solutions until solutions emerge (Dorst & Cross, 2001).

Learning how to embrace ambiguity requires designers to be flexible and open to change (Kelley & Kelley, 2013).

Stage 3 – Enriching smart hospitality propositions

The last stage was a four-week exercise consisting of co-designing tomorrow's guest experience based on the finalized vision statement compiled by the participants. The goal of this stage was to engage participants in the co-design development processes so the design propositions could satisfy the needs and wants of target guests. Since smart hospitality often involves services, stakeholders, and a complex ecosystem (Leonidis et al., 2013), design teams need to facilitate different co-design workshops in order to address design issues at different levels of granularity. Therefore, a lecture on co-design methods was provided to students to introduce different co-design methods, such as narration, creation, prioritization, and contextualization, relevant to design development. The design team needed to identify appropriate co-design workshops for the development of their projects. From a macro-level perspective, co-design workshops involve prototyping solutions, so the final proposition is desirable (human values), viable (business values), and feasible (technology values). In contrast, designing at the micro-level involves experience prototyping and interface design (i.e., experience and usability testing) on specific touchpoints. Therefore, the design team needs to have a throughout understanding of the design propositions so that key moments and benefits can be identified, and design criteria can be addressed with appropriate prototyping methods.

Final demo day presentation. The subject ended with a demo session in which students presented their final propositions through visual and textual means. The presentation was conducted in a demonstration booth format. Since smart hospitality solutions involve both

information systems and touchpoints, the presentation involved different narratives illustrating the complexity of the services. Here, the designers became communicators advocating and demonstrating the values of their design propositions to the audience. Design artifacts, such as persona, journey mapping, service blueprint, stakeholder mapping, system diagrams, scenarios, videos, and interactive prototypes, were used to communicate the final propositions. Here, we provide two representative projects that demonstrate how smart hospitality can enhance the guest experience. The first project, "Me time & We time," enables personal time and creates a close relationship between senior and young family members (Figure 4). With the "me time" mode, guests can enjoy hotel services and facilities without disturbing others; for instance, the solution suggested a smart pillow to create a personal space for a better night's sleep (e.g., the pillow would track sleep and serve as a personalized alarm clock). The "we time" mode, on the other hand, proposes activities that encourage family and social interaction. For instance, the project suggests that family members can retouch, create, and print out photos taken from the journey with a smart TV entertainment unit. Ultimately, the project addresses three important experience design criteria, namely, a sense of autonomy, privacy, and relatedness. Figure 4 provided an overview of the artifacts and processes involved in the development of the solution.
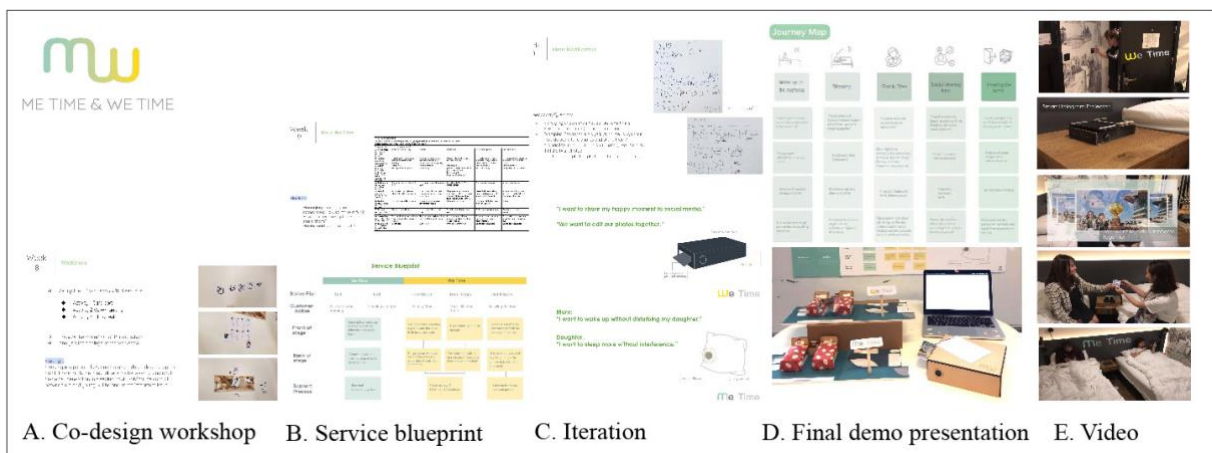
Figure 4. We time and Me time

The second project, titled "serene slumber," proposed helping business travelers have a relaxing night and prevent jet lag by indulging themselves with a Chinese herbal treatment (e.g., herbal tea for relaxation). Guests suffering from stress, jet lag, or insomnia could select a favorable way to release stress with various programmed smart home appliances such as lighting, room temperature, shower, curtains, and personalized music. Guests would receive personalized recommendations for better sleep quality. Similar to other projects, the students used several design visualization tools to communicate their propositions (Figure 5).
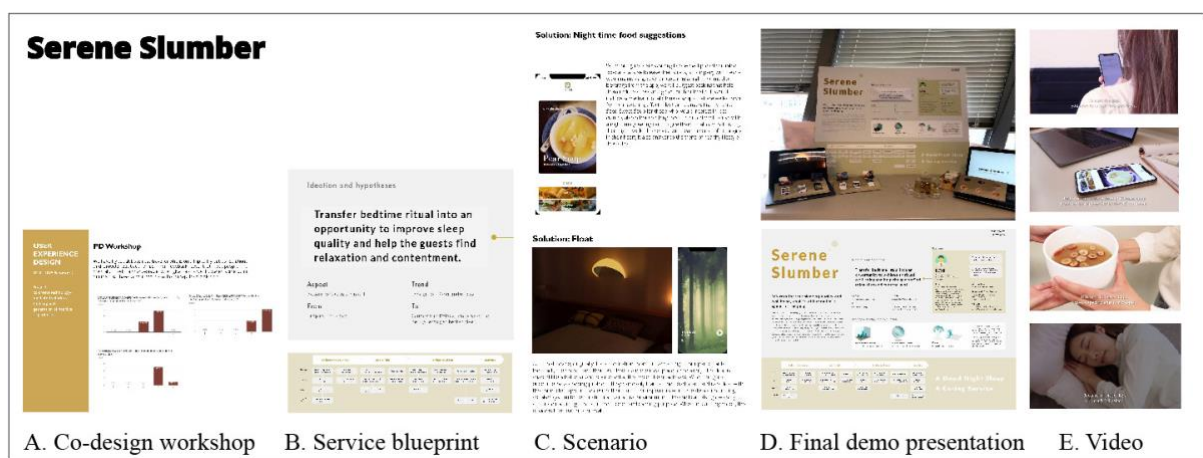
Figure 5. Serene Slumber

Reflection on stage 3 and demo day presentation. During this stage, students used different co-design workshops as a means of gathering feedback from participants, and the results were later incorporated into the final propositions. Small-scale workshops and low-fidelity prototyping were recommended because they allow for an agile learning process, and thus facilitate iteration. Designers exercise abductive and deductive reasoning so the design team can move to a more elaborate workshop and employ high-fidelity prototyping. On the abductive reasoning, student groups concretized their vision statements into design propositions via service blueprints and prototypes. With deductive reasoning, they evaluated the viability and effective of their propositions moving towards to preferable outcomes. The final design proposition was summarized into explanatory videos, short videos that focus on

communicating the key moments, benefits, and values in a direct, engaging, and compelling way.

Interviews with students showed that they easily got lost while conducting the co-design workshop because there were no strict rules governing the workshop (Robertson & Simonsen, 2012). Thus, the teaching team played an important role in advising them on how to go about their projects. Another challenge was synthesizing and communicating learning from different workshops into coherent, experience-driven service propositions. Students needed to reflect on their research process, and then communicate their findings with compelling and informative storytelling. Lastly, the students found the presentation in front of the professors of SHTM to be very valuable because of their expertise and experience in hospitality.

General discussion and conclusion

Currently, scant literature exists on how DT methods are deployed in the tourism industry, even though they are fundamental to tourism innovation. We demonstrated three stages of innovation within a 12-week curriculum. Students learned and used 13 different design methods (Table 1), each of which helped the design team move towards a desirable and valuable proposition. A design process involves understanding and exploring the current situation, generating a hypothesis, and developing innovative propositions. Beyond using different DT methods, a capable designer needs to be aware of the complexity of a design process that is composed of convergent and divergent thinking. Moreover, advancing a design process often involves different actors (i.e., experts and participants) and knowledge (i.e., codified knowledge and tacit knowledge). Through learning these skills, students can make informed decisions, and discuss and communicate their design propositions.

Table 1. Design thinking method used in the study.

Stage	Design method used	Application in the course
Exploring positive guest experience		

1	Laddering Interview	To capture implicit values and motivations behind guests' choices.
	Persona	To communicate key findings of the laddering interviews.

Envisioning future scenarios

2	Trendspotting	To identify trends in smart hospitality and experience design.
	Hypothesis generation	To propose hypotheses which connect persona profiles and trends in smart hospitality
	Vision statement	To communicate a probable vision that is valuable, viable, and desirable.
	Video sketching	To communicate and exemplify the vision using video storyboard.

Enriching smart hospitality propositions

3	Co-design workshops	To concretize vision statement into services and touchpoints with participants.
	User journey mapping	To develop holistic guest experience from the guest's perspective.
	Service blueprint	To develop front-end services and back-end support concerning user journey map.
	Scenario	To summarize findings from co-design workshops, user journey mapping, and service blueprint into effective storytelling.
	Explainer video	To communicate values, benefits, and service attributes of the final propositions with compelling videos.
	Interactive prototype	To demonstrate the walk-through of the core services and features.
	Demo presentation	To present the project to all stakeholders

In this study, students found that the domain knowledge in the tourism and hospitality industry and experience design were highly valuable in their design decision making. We found little attention has been paid to the importance of codified knowledge about hospitality, technology-mediation and experience design in the current literature (Bhushan, 2019). The codified knowledge help students build a shared knowledge base and thereby facilitate debate and discussion for constructive development. Establishing a common ground for design research is particularly crucial for co-design practice because of the diverse backgrounds of the participants who communicated with different codes and notions (Muller, 2003). Moreover, design often concerns wicked problem solving (Buchanan, 1992) in which the

designer needs to restructure the current situation for a desirable future. Thus, designers need to reflect on their practice and be ready to embrace failures and uncertainty. The ambiguity caused discomfort among students, as reflected by their heavy reliance on the tutor's comments and approval throughout the design process. Simply providing guidelines and instructions on DT methods were not sufficient; students wanted examples that demonstrated how these design methods could be implemented. Overall, nurturing a "designerly" mindset and achieving competence in DT seem to be more than just applying DT methods. The role of the designer within a co-design practice is another issue because the practice involves participants who receive little or no design training. Designers need to play different roles at different stages of a design research process so that the strengths of each member can contribute to the development and communication of design propositions. More importantly, this study provides experience-centered approach, rather than from management perspective (Buhalis & Leung, 2018), by generating smart hospitality solutions that address different levels of human needs (Hassenzahl, 2010; Tussyadiah, 2017) such as the need for autonomy, relatedness and mental and psychological well-being. This study provides hospitality educators and industries references on using DT in their projects.

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