Integrating technology and tourism education with design thinking: Developing and evaluating a design-based learning environment[1][2]

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ABSTRACT

Design-based learning is a pedagogical approach that aims to design creative and innovative learning outcomes through collaboration on topics within the learning process. This study aims to develop a design-based learning environment utilizing information and communication technologies (ICT) and to evaluate the learning experiences of students resulting from the training. The participants in the study, which employed a qualitative research approach, consisted of students enrolled in the 'Destination Management' course within the Tourism Management Undergraduate Program. Data were collected through a needs analysis form and student diaries. As a result of the analysis, it was seen that technology-supported, creativity-encouraging, interactive, student-centered educational activities and techniques were preferred more by the students. It was also found that integrating ICT into the course content not only facilitated the course process but also increased students' motivation, collaborative work, and ability to use technology. It is believed that the research results will make significant contributions to creating learning environments that equip students with 21st-century skills.

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INTRODUCTION

In today's rapidly evolving technological landscape, educational systems are profoundly influenced, necessitating the adoption of new approaches to education. Tourism education is one of the fields where technology integration is particularly prominent (Emir & Doğantan, 2020). "Design Thinking," the central theme of this study, plays a significant role in facilitating technology integration and equipping students with advanced skills (Assen et al., 2023). Design thinking offers a process centered on students, aiming to understand their needs and experiences. While fostering a student-centered learning process, it also seeks to enhance creative problem-solving skills. This approach encourages students to develop innovative solutions to problems encountered in the tourism sector. Moreover, by engaging with real-world problems, students can enhance their problem-solving abilities, thereby strengthening their career preparedness (Tovmasyan, 2018).

One of the core principles of design thinking is empathy. Students' ability to understand their target audience and develop sensitivity to their needs is a key factor in the success of sectoral practices. When educators guide students, they can unveil their creative thinking skills and support the development of innovative approaches. This perspective promotes a learning environment where students not only advance academically but also express their emotions and ideas (Brown, 2009). Consequently, contemporary educational settings are transforming to foster students' learning processes and provide them with hands-on experiences. Student-centered learning, collaborative processes, and the use of innovative educational technologies are of considerable importance in tourism education. Integrating design thinking into tourism education can create opportunities for enhancing teaching methods and learning experiences.

In this context, the study emphasizes the importance of adopting and disseminating a design-based learning approach in tourism education. It aims to develop a learning environment grounded in information and communication technologies and to evaluate students' learning experiences. The study may offer valuable insights into understanding students' perspectives on learning processes and how this integration and transformation should be implemented. The objectives of the research can be summarized as follows:

- To develop a design-based learning environment for tourism management students using information and communication technologies.
- To investigate and document students' experiences with design-based learning.
- To contribute to the existing literature on design-based learning as a pedagogical approach.

CONCEPTUAL FRAMEWORK

Education and Technology Integration in Tourism

Education 4.0, which emphasizes the importance of technology in education, forms the foundation of digital transformation, specifically referring to the integration of smart technologies into educational systems (Hwang, 2014). Educational technologies encompass a range of tools and techniques, including virtual reality, augmented reality, online learning platforms, and software applications. These tools provide learners with enriched learning experiences and strengthen their connection to real-world applications (Baker & O'Flynn, 2021).

Tourism education is not only a dynamic field but also one that continuously evolves under the influence of information and communication technologies (ICT). The integration of technology into tourism education involves the transmission of theoretical knowledge alongside the incorporation of practical applications, making the learning process more interactive and effective. It enables students to acquire practical knowledge and facilitates their ability to keep up with industry changes (Baker & O'Flynn, 2021). By offering students the opportunity to learn theoretical concepts in a hands-on and interactive manner, this integration enhances the quality of education. Consequently, students gain not only theoretical insights but also practical skills for industry application, preparing them more effectively for their future professions through the active use of technology.

Technologies employed in tourism education include 360-degree VR videos for virtual tour guide training (Huang et al., 2016), AR applications for promoting historical and cultural heritage (Yung & Khoo, 2017), and platforms such as Moodle and Blackboard for managing and organizing content (Martín-Blas & Serrano-Fernández, 2009). For instance, virtual reality applications allow students to take virtual tours of diverse tourist destinations, thereby adding visual and experiential dimensions to their learning (Albayrak et al., 2018). Online simulation tools enable students to practice in areas such as hotel management, travel agency operations, destination management organizations, or event planning. By combining technological learning with experiences beyond the classroom, students enhance their sector-specific knowledge and skills (Keller, 2018).

The advantages of technology in tourism education include overcoming geographical limitations and fostering global collaboration. Students gain opportunities to explore diverse cultures and destinations worldwide, broadening their perspectives and cultivating an international vision. For example, virtual shopping experiences and online tourism fairs enable students to acquire international-level experiences (Beirman, 2018). Guttentag (2019) examined the use of digital simulations in tourism education, highlighting significant contributions through scenarios such as hotel management and travel agency operations. By applying such scenarios via digital simulations, these tools make meaningful contributions to tourism education.

Students' perceptions of technology integration offer valuable insights into its effectiveness in learning processes. Research indicates that students generally evaluate technology-supported education methods positively, noting that these methods enhance their learning motivation (Johnson et al., 2016). Interactive and experiential learning environments, especially in tourism, increase student engagement and make knowledge retention more durable (Doğantan, 2023).

Digital Applications in Tourism Education
Emir and Doğantan (2020) classify digital applications used in the tourism sector into four main categories to guide educational curricula: end-user applications, sector-specific applications, strategy-based applications, and disruptive innovations. For instance, design tools (e.g., *Adobe Photoshop, Illustrator, InDesign*), social media platforms (e.g., *Facebook, Instagram, Snapchat*), and publishing applications (e.g., *Adobe Reader, Microsoft Publisher*) have become foundational at all levels of education. Tourism graduates are increasingly expected to possess proficiency in utilizing these tools (Hardy et al., 2006).

Applications such as *Cloudbeds, Preno, Hostaway*, and *Lodgify* are becoming standard in many hotels, enabling the efficient management of hotel functions. Modern property management systems (PMS) leverage cloud-based web technologies, enabling the automated and integrated management of multiple facilities worldwide. Training in the use of such systems within tourism education typically focuses on room management and hotel operations (Nadkarni, 2003). Students trained in these industry-specific software systems acquire the practical and operational skills required to work effectively in the sector.

As industries worldwide shift toward a data-centric approach, understanding how to access and analyze large datasets from relevant sources (e.g., *Google Analytics, Facebook Analytics*) is crucial for acquiring marketing intelligence tailored to specific domains (Chen et al., 2012). Analytical software tools such as *Microsoft Azure, SPSS*, and *AMOS* assist managers in interpreting industry-related data through visualization, modeling, and forecasting, thereby optimizing company performance. By incorporating these strategy-oriented applications into curricula, higher education institutions enhance students' ability to leverage technology for strategic decision-making.

This research combines technology (software) with design thinking in education. Design thinking facilitates the development of creative solutions to address various challenges and aims to create learning environments that promote active participation aligned with students' needs (Kelley & Kelley, 2013). The integration of technology and design thinking in tourism education underscores the significance of students' perspectives.

Students often emphasize the advantages of technology use in the teaching process, particularly noting that virtual learning environments and interactive educational tools improve their concentration and make learning experiences more engaging. Additionally, group projects and collaborative activities conducted through a design-thinking approach contribute to the development of students' social skills and strengthen cooperation among peers (Dumont et al., 2016; Doğantan, 2023).

Design-Based Learning

Design is a multifaceted process that involves various skills, including observation, synthesis, critical thinking, feedback, visual representation, creativity, problem-solving, and value creation (Neck et al., 2011). Design-Based Learning (DBL) is a pedagogical approach that aims to facilitate the creation and production of innovative and creative learning outcomes through collaborative processes associated with the subject matter of the learning experience (Gomez Puente et al., 2013). In other words, DBL is a pedagogical approach where learners collaboratively engage in iterative cycles of problem identification, prototyping, and reflection to create innovative solutions to real-world challenges. Rooted in constructivist principles, DBL emphasizes active, student-centered learning and integrates theoretical knowledge with practical application (Gomez Puente et al., 2013; Doppelt, 2009). This approach enhances learners' capacity to produce content and develop collaborative abilities. Within these learning processes, learners are expected to confront real-world problems and devise solutions that address them. The process of creating an authentic product enables learners to experience both theoretical and practical aspects simultaneously (Doppelt, 2009).

Research suggests that the sustainability of tourism education requires the adoption of approaches that enable experimentation with new ideas and prototyping (Hsu, 2018). In this context, design-based learning (DBL) is seen as one of the most popular pedagogies related to innovation processes and innovation education (Ruano-Borbalan, 2019). However, it can be said that research on the application of this approach in hospitality and tourism education is very limited. In a study in the field of tourism, DBL was considered as an experiential learning approach and how course content could be designed. Students identified customers' desire to discover and create their own coffee as a design issue and developed innovative solutions through collaborative activities, including brainstorming, empathy, and storyboarding. It was determined that the activities encouraged tourism students to think creatively and actively, and were effective in developing students' communication, teamwork, decision-making, and empathy skills (Doğantan, 2023). In another study on design thinking in hospitality education in the Netherlands, it was found that design thinking played a crucial role in developing students' higher-order thinking skills (Assen et al., 2023).

The DBL approach situates learners at the core of the learning experience (Gomez Puente et al., 2013) while integrating problem-based and project-based learning steps into its methodology. This enables learners to explore and comprehend numerous previously unknown elements through active engagement. Learning processes under DBL are typically collaborative and interdisciplinary (Gomez Puente et al., 2013). In this framework, learners utilize prior experiences and interact with their peers to design, develop, and construct their own solutions and content (Chandrasekaran et al., 2013).

The design process itself is inherently practical, fostering active learning through experiential methods. This characteristic aligns the DBL approach with constructivist principles, emphasizing learner autonomy and participation. During the DBL process, learners devote significant time to the design phase (Doppelt, 2009), which offers them the opportunity to gain diverse perspectives (Neck et al., 2011). In this phase, learners employ visualization tools to translate their ideas into tangible products (Seitamaa-Hakkarainen, 2011). In other words, learners can tailor their content development to their preferences (Doppelt & Schunn, 2008).

Moreover, the DBL process provides critical benefits by enabling learners to achieve enriched learning outcomes and acquire advanced technological skills (Doppelt et al., 2008). Figure 1 presents the outcomes derived from the DBL process.

Figure 1. Benefits of the DBL Process (Source: Chandrasekaran et al., 2013)

As shown in Figure 1, DBL environments enable learners to work in collaborative settings through interaction-based processes, allowing them to develop solutions to the problems they encounter. From this perspective, it can be argued that adopting the DBL approach in learning processes is a critical element for achieving experience-based, enriched learning outcomes. In addition to enhancing learning outcomes, the DBL approach is also considered significant in fostering learners' ability to establish social environments and become confident participants in the learning process.

Resnick and Rusk (1996) identified the following advantages of the DBL method:
- Design activities allow learners to take a central role in the learning process.
- Design activities support the problem-solving process, culminating in the creation of a product.
- Design activities demonstrate that learners can achieve learning objectives through multiple pathways.
- Design activities are structured as interaction-based processes with an interdisciplinary approach.
- Design activities enable learners to reach consensus among themselves, fostering collaborative solutions.
- Design activities provide learners with opportunities for practical application, enabling them to experience more enduring learning experiences.

Components of the Design-Based Learning Process

The Design-Based Learning (DBL) process is designed to equip learners with various skills, including fostering creativity, enriching their imagination, acquiring advanced thinking abilities, and developing problem-solving skills (Joordens et al., 2012). The DBL process comprises the following stages: identifying the problem and determining needs, gathering information, generating alternative solutions to the problem, selecting the most appropriate solution, designing and developing a prototype, and evaluating and refining the process.

Although these stages closely resemble the steps of problem-based learning, the DBL process distinguishes itself through its emphasis on prototyping, development, refinement, and evaluation phases. Furthermore, like problem-based learning, the DBL process supports learners in conducting scientific research and engaging in scholarly activities (Doppelt et al., 2008). This process enables learners to gain experience in problem-solving, formulating hypotheses, and applying research methodologies.

As illustrated in Figure 2, DBL environments consist of five components:
- Project characteristics
- Design components
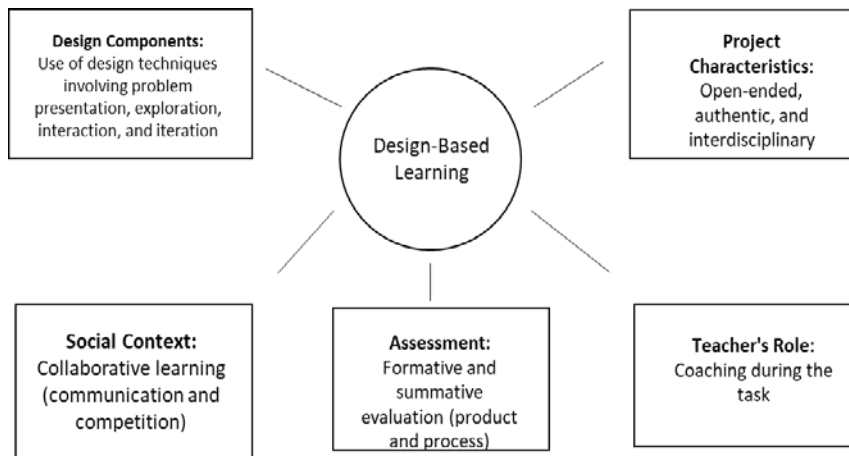- Social context

- Role of the teacher
- Evaluation

Figure 2. Components of DBL Environments (Source: Gomez Puente et al., 2013)

When considering Figure 2, it can be inferred that the Design-Based Learning (DBL) process should be structured based on a problem situation, incorporating an interdisciplinary perspective and promoting collaborative learning. Additionally, instructors are expected to assume a guiding role, acting as facilitators to support learners throughout the process. In the evaluation stage, it is suggested that process-based assessment approaches be adopted.

When reflecting on the potential fields where the DBL process could be applied, the tourism sector stands out as a significant area for implementation. Learners in tourism can engage in collaborative group activities within their courses, identifying the strengths and weaknesses of tourism regions. They can also discuss potential strategies for further improving these regions.

In such learning environments where the DBL process is employed, learners can experience a learner-centered educational experience, embedded within communication and interaction processes.

METHOD

This research aimed to develop a design-based learning environment grounded in information and communication technologies and to evaluate students' learning experiences. A qualitative research approach, the case study design, was utilized for this purpose. In a case study, detailed and in-depth information about a situation is gathered through multiple sources of data within a specific period (Creswell, 2013). In this study, data were collected through a questionnaire (needs analysis) and student diaries.

Participants

The study participants consisted of a total of 26 students, including 10 males and 16 females, who enrolled in the "Destination Management" elective course during the 2023-2024 academic year at Anadolu University, within the Tourism Management Bachelor's Program. The students' ages ranged from 20 to 24 years old.

Data Collection Tools and Process

In the research, data were collected through an online questionnaire and participant diary forms.
1. Participant Diary Form: It is noted that diary studies are a technique used to collect qualitative data regarding specific experiences, behaviors, and activities over time (Salazar, 2016). In this context, participant diaries were used to capture students' experiences during the course process. The diary was developed by Lee (2023) to assess

the effects of design-based entrepreneurship education. No changes were made to the form, but foreign language experts were consulted for translation validity. Students filled out their diaries at the end of each class and shared them through the learning management system (Mergen). The participant diary consisted of the following questions (Table 1):

Table 1.
Questions of the Participant Diary (Source: Own research)

1	What do you think were the objectives of today's lesson?
2	How did you feel after the lesson?
3	Was there any topic in the lesson that challenged you? If so, what were they?
4	If there was any topic in the lesson that challenged you, what did you do to overcome these challenges?
5	Do you think you developed any skills during the lesson? If so, please explain.
6	Which skill would you have liked to develop further in today's lesson? Please explain.
7	If you would like to add anything related to the lesson, please write it here.

2. Need Analysis Form: The Need Analysis was used to reflect the multiple perspectives of the participants and gather more detailed information regarding their learning experiences through the collection of qualitative data. The form, organized as a needs analysis, was developed based on the study by Çolak and Efeoğlu (2021). Needs analysis forms were reviewed by three field experts to ensure content validity. Based on the feedback provided by the experts, these forms were finalized. Additionally, a pilot study was conducted prior to the research. In this context, the forms were administered to five students, and unclear points were identified; the forms were then revised accordingly.

The needs analysis questions directed to the students guided the course design in the research. As it is known, needs analysis is applied to identify educational needs. However, unlike the traditional applications of needs analysis, this study did not focus on the expectations of the students, but rather aimed to explore different learning methods beyond their expectations. After different learning methods were applied, the students were asked the same questions again at the end of the training. Thus, the aim was to focus on the perceptual changes of the students before and after the training and to evaluate the effectiveness of the course design. The form consists of both closed and open-ended questions (Table 2).

Table 2.
Questions of the Needs Analysis (Source: Own research)

1	What are the reasons for choosing the 'Destination Management' course?
2	Which activities in the learning process would make you happier?
3	In which environment do you feel more comfortable during the learning process?
4	Which assessment methods during the learning process are more satisfying to you?
5	Which resources are more important to you as learning materials?
6	What competencies have you achieved by the end of this course?

Data Analysis

Thematic content analysis was used for data analysis. Firstly, the findings of the needs analysis and student diaries were transcribed and converted into Word format. A coding scheme was prepared, and the text was examined and analyzed according to the scheme (Şavran, 2012). In other words, a coding list was created and categorized under themes. As a result of the thematic analysis conducted separately by two researchers, final themes and codes were determined through comparison. Student diary findings were interpreted through direct quotations. The findings of the needs analysis were quantified and visualized using graphs.

Course Design

Based on the design-based learning approach, an 8+1 (software training) week activity plan was developed for the 'Destination Management' course (Figure 4). The Hasso Plattner Institute of Design (D.School) at the University of Potsdam in Germany is one of the leading educational institutions focusing on promoting design thinking in education. The curriculum of D.School is designed for university students (Lin et al., 2020). In this context, during the course design for this research, the six-stage 'Design Thinking' process developed by the Hasso Plattner Institute of Design (D.School) was used as a foundation (Figure 3). The practical lessons were conducted in a computer lab, and during this process, an online platform (software) was utilized to allow students to share ideas and collaborate.
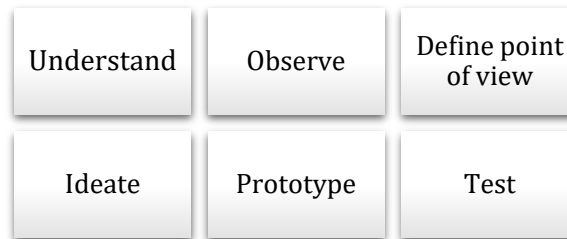
Understand	Observe	Define point of view
Ideate	Prototype	Test

Figure 3. The six phases of the Design Thinking process (Source: Hasso-Plattner-Institut)

The first stage of the Design Thinking process, known as "Understand," involves the design team investigating the design question, conducting research to develop a collective perspective, and gathering information about both the relevant aspects of the topic and general assumptions. At this stage, it is crucial to explore and evaluate insights from both theory and practice thoroughly. During the "Observe" stage, the team creatively applies qualitative research methods to gather data. They begin to understand the context and opportunity areas from the perspectives of relevant stakeholders. Qualitative research techniques, including observations and interviews, are employed in this study. For example, in-depth studies are conducted to gather information about potential users' environments, conceptual worlds, contexts, expectations, and experiences.

In the "Define point of view" stage, the team synthesizes the results and data from the previous research-focused process steps. They focus on the insights gathered from the research phase and decide on the direction and target audience for which they aim to develop solutions. Based on these findings, the team creates "Persona" by identifying relevant social groups and fictional characters, forming the foundation for the next ideation phase (Hasso-Plattner-Institut). A Persona is a fictional user profile that helps in developing strategies by understanding and empathizing with the target audience (QuestionPro).

In the next phase of the Design Thinking process, "Ideate," the team generates a wide range of ideas using creative techniques: brainstorming, body storming, role-playing, and design, among other methods, which can be synthesized. In the subsequent stage, the team develops prototypes. A prototype helps them reach a common understanding of the core function of the idea. This approach enables them to materialize their innovative suggestions, facilitates the conveyance of ideas quickly and clearly to third parties, and provides a concrete presentation of the final outcome. Prototypes for ideas may include representations of new products, services, business models, and new forms of interaction and information transfer (Hasso-Plattner-Institut).

The final phase, "Test," involves soliciting feedback from the target audience regarding the prototypes (Doğantan, 2023; Pande & Bharathi, 2020). The team tests their ideas through direct interaction with current and potential users, experts, and project representatives. This way, team members can compare the new findings with their previous perspectives (Hasso-Plattner-Institut).

Course Process

During the course process, students were first asked to consider themselves as part of the design team within the destination management organization. In this context, based on the "Understand" and "Observe" stages of the design thinking approach, students were expected to identify the design challenges and gain insights by analyzing issues related to any destination with low visitor satisfaction, as shared on a web-based platform (Tripadvisor). In this context, first, each group selected a destination in Turkey (Cappadocia, Salda Lake, Cumalıkızık) that received low visitor satisfaction ratings on TripAdvisor. Destinations were identified based on having at least 20 negative reviews. The comments were then converted into Word format. In this process, the students followed a qualitative research process based on secondary data. They conducted a thematic analysis by categorizing the comments according to the predetermined destination elements: attractions, amenities, accessibility, image, pricing, and people. As a result of the analysis, students created a conceptual map of visitor reviews using the 'mind mapping' technique. The entire process was conducted in a laboratory environment, utilizing group work and a collaborative digital platform. At the end of the process, students gained a deep understanding of the target audience (destination visitors).

In the "Define point of view " stage, students were asked to create a "Persona" to develop empathy towards the target audience. By using Persona, students gained insights and empathy regarding the issues within the destination and the visitor profile. In the "Ideate" phase, they employed the "brainstorming" technique to propose solutions to the identified problems, categorizing information under various themes.

In the "Prototype" phase, students were tasked with developing strategies for the proposed solutions and visualizing the key points of their strategies using a strategy presentation template. The "strategy presentation template" served as a tool to visually represent the strategies they developed for addressing the destination's issues. In the final "Test" stage, students were asked to present their prepared presentations to invited subject matter experts and faculty members, receiving feedback on their work.
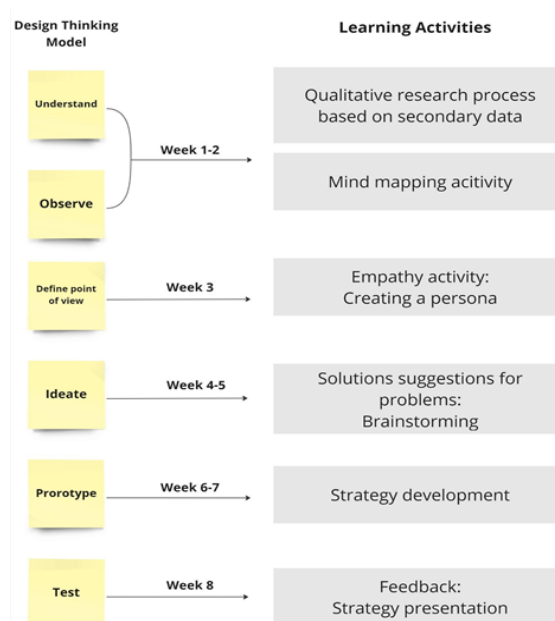

Figure 4. The implementation of DT in the Destination Management course (Source: Own research)

FINDINGS

The findings presented below summarize the comparison of the needs analysis results conducted at the beginning and the end of the semester. Subsequently, the findings from the analysis of data collected through student diaries are presented.

Findings of the 'Needs Analysis' Applied at the Beginning and End of the Semester

The first question in the needs analysis conducted was, "What are the reasons for choosing the 'Destination Management' course?" As seen in Figure 5, it was determined that the majority of students who responded at the beginning of the semester chose the course primarily due to the convenience of the class schedule and day. However, when the same question was asked at the end of the semester, it was observed that the majority of participants had shifted towards options such as "I want to apply the knowledge I gained during the learning process to my life outside of school" and "I believe it will be professionally beneficial." These results indicate that the design-based learning process, which emphasizes students' experiences, had an experiential impact on the students.
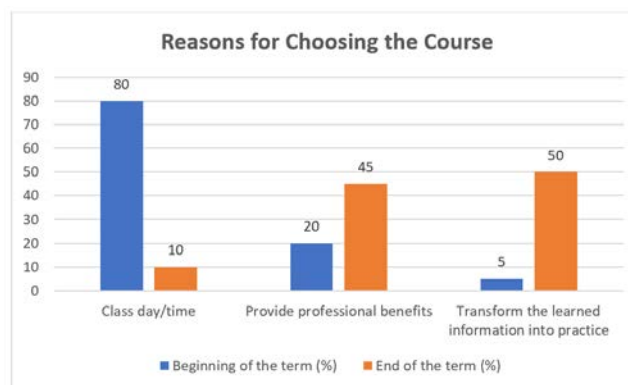

Figure 5. Reasons for Choosing the Course (Source: Own research)

The second question administered at the beginning of the semester was, "Which activities in the learning process make you happiest?" The responses to this question were, in order: 'direct instruction,' 'question-answer,' 'discussion,' and 'technology-supported activities.' When the same question was asked at the end of the semester, phrased as "Which activities in the learning process made you happiest?", the responses were ranked as follows: technology-supported activities (interactive), discussion, team/group work, and brainstorming. As shown in Figure 6, students who experienced technology-supported teaching in the course expressed a preference for interactive and technology-supported content in future educational processes, rather than traditional teaching methods such as direct instruction and question-and-answer.
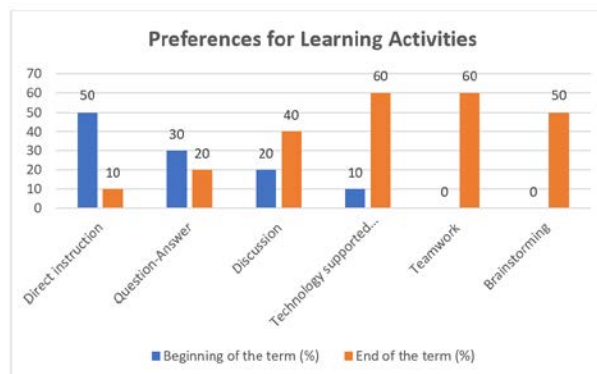

Figure 6. Preferences for Learning Activities (Source: Own research)

Another question posed within the scope of the needs analysis was, "In which environment do you feel better about the learning process?" Upon examining the data collected

for this question, it was found that students preferred a blended learning approach. Therefore, it can be stated that most students preferred a combination of online and face-to-face learning environments. At the end of the semester, when this question was rephrased as "In which environment did the learning process make you feel better?", the preference for blended learning environments, along with the option of conducting lessons in computer laboratories, became more prominent. The fact that part of the lessons took place in computer laboratories during the design-based teaching process, meaning that students experienced learning through technology, can be seen as an influencing factor in this preference. This is reflected in Figure 7.
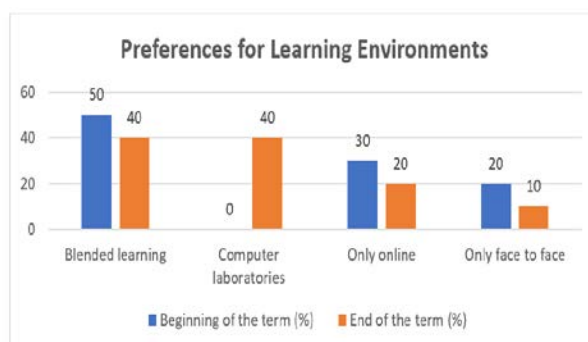

Figure 7. Preferences for Learning Environments (Source: Own research)

When examining the responses given by students to the question, "Which assessment and evaluation activities in the learning process would satisfy you the most?" posed at the beginning of the semester, it was found that the majority favored "midterm and final exams to be held at the end of the course." However, when the same question was asked at the end of the semester, rephrased as "Which assessment and evaluation activities in the learning process satisfied you the most?", the responses indicated a preference for more student-centered activities, such as "performance assignments" and "discussion forum activities." This shift in preference aligns with the design-based learning process, where learners are placed at the center and given responsibility for their learning. A summary of the student responses is shown in Figure 8.
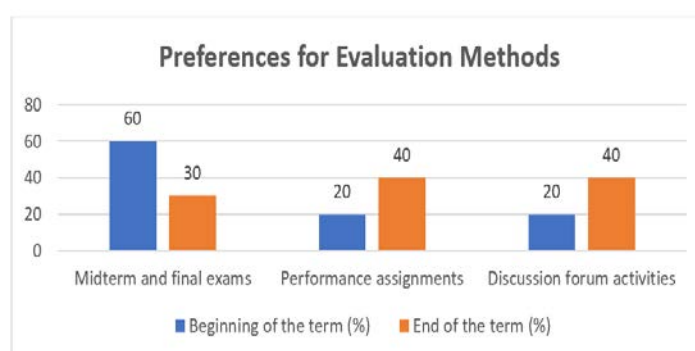

Figure 8. Preferences for Evaluation Methods (Source: Own research)

As part of the needs analysis conducted, another question was posed to students: "Which sources are most important for you to use as learning materials?" Upon reviewing the responses gathered at the beginning of the semester, it was found that the majority favored "textbooks" and "slides." As seen in Figure 9, however, when the same question was asked at the end of the semester, there was a noticeable shift toward preferences for "interactive content" and "technology-based software." Based on these findings, it can be concluded that the design-based teaching method, which places students at the center of the learning process and allows them to create content, has had a significant impact on students' preferences. In this context, students who

initially preferred traditional learning materials shifted toward interactive and technology-driven materials by the end of the semester.
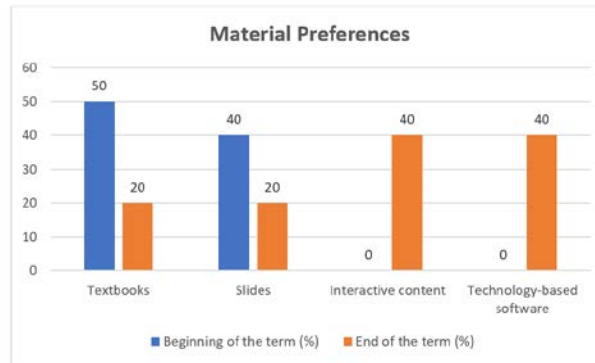

Figure 9. Material Preferences

In the study, when considering the responses to the question "What competencies have you managed to acquire by the end of this course?" which was posed only at the end of the semester, the following competencies were reported: "productive, questioning, entrepreneurial, problem-solving, applying learned knowledge, and team work." The proportional representation of these competencies is shown in Figure 10. According to the results of the learning activities carried out throughout the semester, 23% of students believe they developed teamwork skills, 21% developed problem-solving skills, 20% developed questioning skills, 19% developed teamwork skills, and 17% developed entrepreneurial skills. Thus, it has been determined that the design-based learning process has helped students acquire important competencies and supported them in developing the skills required by constructivist teaching techniques.

Figure 10. Acquired Competencies

Findings Related to Students' Learning Experiences

This section presents the findings obtained from analyzing student diaries. In this context, a table was created to include themes, codes, and sample quotations. The findings were then enriched with direct quotations and interpretations under the respective themes. The themes, codes, and sample quotes that emerged from the analysis of student diaries were as follows (Table 3):

Table 3.
Codes and Themes Regarding the Students' Diaries

Themes	Codes	Sample quotes
Learning Process	Feelings, fun, enjoy, motivating-motivational, easy, pleasurable, enjoyable, understandable, educational and informative, stress reducing, enthusiastic, reassuring, challenging, and complex	'…I enjoy the practical lessons more.' '…I am excited to learn a new application.' '…I felt good that we were doing something with the group.'
Technology Used	Software, learning technologies, program, Miro software, application	'…I saw the Miro software for the first time, and it was a little more complicated than I expected. I think I can handle it in time.'
Developing Skills and Individual Development	Group work, cooperation, active learning, foreign language, software learning, internalization of the subject, taking responsibility, leadership, problem determination and solving, analysis and synthesis, planning, developing ideas, empathy, creative thinking, scenario creation, fast decision making, time management, communication, individual development	'…I transformed the theoretical knowledge I learned about tourism into practice.' '…We created scenarios by thinking creatively.' '…I think my cooperation and teamwork skills have improved.' '…I think I have improved in solving problems and developing ideas.'
Learning Environment	Efficient, productive, constructive, problem-based, interactive, collaborative, applied	'…The classes are very productive and I feel that I am really improving.'
Instructor Engagement	Supportive, educational, mentor, mediator, relevant	'…The Miro application was a bit difficult, but with the support of our teacher, I learned the application better.'

Learning Process: The majority of students emphasized that the classes were conducted in an enjoyable manner, with the process far from boring. They also noted that this positively contributed to their motivation throughout the course.

'… It would be great if we could do our assignments on this application. It's easy to understand and fun to use.' 'While other classes were always monotonous, I was happy that this course was hands-on.' (Student diary)

It was observed that the constructivist approaches followed in the design-based learning processes by the course instructor also contributed to enhancing students' motivation.

'I am learning new features of the application and improving myself with every class.' 'This class was very enjoyable. It was nice to collaborate with my friends to create a 'Persona.' (Student diary)

Technology Used: In courses that utilized software throughout the semester, students reported that they benefited from instructional technologies during the lessons and became familiar with their use. This can be considered an important outcome in terms of enabling students to acquire the necessary competencies.

'Since they explained the application to us at the beginning of the course, I didn't have difficulty using it.' 'It was difficult for me when the system's usage was explained verbally in the first class. I understood much better when it was demonstrated practically.' (Student diary) 'The program helped me think quickly, but I wish I had been faster during the usage stage.' (Student diary)

Developing Skills: During the learning process, students stated that their skills such as group work, cooperation, active learning, foreign language, software learning, internalization of the subject, taking responsibility, leadership, problem identification and solving, analysis and synthesis, planning, empathy, creative thinking, scenario creation, quick decision-making, time management and communication were improved. Throughout the semester, students were

divided into specific groups, and by completing performance tasks assigned to them, they were able to collaborate and actively participate in the learning process. In collaborative learning processes, students formed working groups among themselves and became part of the discussion process. The brainstorming activities conducted during these processes were considered particularly important in terms of giving students a voice and allowing them to share their ideas. It was observed that many students helped each other, and the group dynamics were positive due to the group work.

'I think the application contributed to my teamwork skills and my English.' (Student diary)
'I felt very good because I formed a group with my friends and worked on something together.' (Student diary)

The analysis of student journals revealed that students had a strong command of the topics covered in the learning process. The phrase "I have learned the topics very well" was frequently encountered in the student diaries.

'I believe I have taken my computer skills to the next level.' (Student diary)
'I think my creative thinking, problem-solving, collaboration, and teamwork skills have developed.' 'I believe I have developed more in teamwork and generating ideas.' (Student diary)

Another expression frequently encountered in student journals was "it was a very beneficial process for my individual development." Both the instructional technique used in the class and the instructor's interest were positively received by the students.

Another code derived from the student journals is the awareness of responsibility. It was observed that students, who were divided into groups and assigned leaders as part of their tasks, shared responsibilities within the group and fulfilled these responsibilities.

'As a group leader, I noticed that my leadership skills have improved. Seeing that I was achieving things made me feel good.' (Student diary)

Learning Environment: Students emphasized that throughout the semester, they felt they had a voice during lessons and contributed to the development of content. The steps of the design-based learning process enabled students to engage in the learning process within a constructivist environment. This can be considered an important factor in developing constructivist learning environments.

'The class was very productive because we stepped outside the traditional lesson framework and actively participated in the class. I was very happy about that.' (Student diary)

Based on the student journals, it was found that students developed problem-based learning experiences. The process of encountering and solving problems during the learning process helped support the development of students' algorithmic thinking skills.

'...in the class, we performed a personality analysis, determined the profile of visitors to the destination, and after establishing the profile, we developed the tourist product and the destination.' 'We identified the problems of a destination and worked in groups to develop solutions.' (Student diary)

Instructor Engagement: Upon reviewing the student journals, it became evident that the students did not remain indifferent to the instructor's engagement in the course. In this regard, students were quite satisfied with the attention they received throughout the course. This can be considered a crucial factor in enhancing learning outcomes.

CONCLUSION AND DISCUSSION

This study aimed to develop a design-based learning environment grounded in information and communication technologies and to evaluate students' learning experiences. In this context, students were invited to solve real-world problems within a collaborative work environment. The application of design thinking in tourism primarily occurs within the scope of service design innovation (Clack & Ellison, 2019). In this study, the focus was on developing students' problem-solving and creative thinking skills within the context of sectoral issues. Within this framework, students identified the weaknesses of the selected destinations using design-based thinking and developed various strategies for their improvement. The design of the course

was based on the 'Design Thinking' process. Experiential learning methods, such as design-based learning, enable students to create and engage in real-life scenarios that apply their knowledge and theory (Doğantan, 2023). In this process, software was integrated that enabled students to develop creative ideas collaboratively, and practical lessons were conducted in the computer laboratory.

The needs analysis questions directed to the students guided the course design in the research. When the needs analysis was applied before the training and the results were evaluated, it was determined that students preferred learning techniques such as direct lectures, question-and-answer sessions, and measurement methods, including traditional final and midterm exams. Additionally, students preferred learning tools like presentations, textbooks, and a hybrid learning environment. In the course design, instead of traditional methods and tools, technology-supported collaborative applications in the computer laboratory, mentoring, and discussions were used, replacing direct lectures with interactive content and performance-based assignments. Thus, the perceptual changes in students before and after the training were focused on, and the effectiveness of the course design was evaluated. As a result of the research, the design-based learning environment, which prioritizes students' experiences, had an experiential impact on the students. Furthermore, it was determined that students who were introduced to technology during this process preferred interactive and technology-supported learning methods over traditional teaching methods, such as direct instruction and question-and-answer sessions. While traditional learning methods tend to focus more on structured and conceptual content (Hancock et al., 2002; Baker & Baker, 2012), the teaching method adopted in this study went beyond conventional approaches. In this process, instead of the classical midterm and final exams, performance assignments were given as an assessment and evaluation technique. The analysis of the data revealed that activities and methods centered around the students were preferred by them. Design thinking, as a learner-centered process that promotes higher-order thinking skills (Yao et al., 2024), and the integration of technology into this process, were key factors in meeting expectations.

At the end of the semester, students reported that they had shown development in areas such as "being productive, inquisitive, entrepreneurial, problem-solving, transforming learned knowledge into practice, and working collaboratively in teams." Other aspects that students believed they had developed include taking responsibility, content creation, mastering the use of technological tools, adapting to collaborative working environments, and actively participating in learning processes. These elements are crucial for students to acquire the learning skills they need to succeed in the 21st century. Furthermore, when compared to the learning outcomes of the course, these outcomes align with the competencies intended to be achieved, which enhances the approach's applicability.

Throughout the course, the students' motivation was increased by their role as active participants rather than passive observers, and the instructor's role as a learning facilitator rather than a traditional lecturer. In this regard, Sangpikul's (2020) research also suggests that the facilitator role of the instructor is a key factor in the success of implementing experiential learning projects for students.

The Tourism Education Handbook, published by the United Nations World Tourism Organization (UNWTO, 2022), recommends developing a sustainable and inclusive curriculum through innovative methods that aim to ensure quality in tourism education. Therefore, institutions offering tourism education with this awareness are transforming, not only focusing on traditional methods but also integrating experiential learning approaches such as creative drama, design-based learning, research-based learning, and project-based learning into their course content (Doğantan, 2020; Doğantan, 2023; Espinoza-Figueroa et al., 2021; Özoğul et al., 2015; Ruano-Borbalan, 2019). A review of the literature highlights the importance of integrating technology with education to enhance teaching and learning processes and prepare more qualified individuals for future generations (Lötter & Jacobs, 2020). Considering the importance of technology integration in contemporary tourism education, the research findings are expected

to encourage the creation of learning environments that not only equip students with 21st-century skills but also integrate technology and design-based thinking into the processes.

The findings of this study highlight the effectiveness of design-based learning (DBL) in tourism education, particularly in integrating technology and fostering 21st-century skills. Based on these insights, the following suggestions for practitioners and policymakers can be made:

Curriculum Development: Higher education institutions should prioritize integrating DBL into tourism programs. Policymakers can incentivize universities to develop courses that emphasize experiential learning through technology-based applications.

Faculty Training and Support: Faculty members should receive training in DBL methodologies and digital tools to ensure the effective implementation of these approaches. Workshops and certification programs on design thinking for educators can be promoted.

Industry Collaboration: Practitioners in the tourism sector can collaborate with academic institutions to provide real-world problem scenarios for students, fostering a deeper understanding of industry challenges. Policymakers can facilitate partnerships between universities and tourism enterprises to enhance hands-on learning.

Technology Infrastructure: Governments and institutions should invest in digital learning environments, ensuring that students have access to software and platforms supporting interactive and collaborative learning.

Assessment and Accreditation: Educational policy frameworks should include performance-based assessments that align with DBL principles. Standardized guidelines for evaluating design-thinking-based projects in tourism education can be developed.

Limitations and Future Research

This study effectively demonstrates the benefits of DBL in tourism education, but has certain limitations that should be acknowledged:

Sample Size and Scope: The study was conducted with a limited number of students from a single university. Future research should investigate the effectiveness of DBL across various institutions and cultural contexts to enhance its generalizability and applicability.

Data Diversification: While student experiences were analyzed, the study does not incorporate the perspectives of instructors. Future studies could explore how educators adapt to and perceive DBL methodologies. Additionally, the reliability of the research can be increased through classroom observations.

Long-Term Impact: The research primarily evaluates short-term learning experiences, although its findings may have long-term implications. A longitudinal study tracking the long-term effects of DBL on students' career success in the tourism sector would provide deeper insights.

Comparison with Traditional Methods: A comparative analysis between DBL and conventional teaching methods in tourism education could strengthen the argument for the effectiveness of DBL. Future research could implement experimental designs with control and experimental groups.

Scalability and Resource Constraints: Implementing DBL requires technological resources and trained faculty, which may not be available in all institutions. Further studies could investigate strategies for scaling DBL in resource-limited settings.

Technology Constraints: This study's technology integration is limited to software in the course design. In the design-based learning process, learning experiences can be enriched by receiving support from various technologies, including gamification, virtual simulations, artificial intelligence, and virtual and augmented reality.

By addressing these limitations, future research can refine and expand the applicability of DBL in tourism education, contributing to more robust educational frameworks.

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