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Design thinking as an active teaching methodology in higher education: a systematic review

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Design thinking stands out as a methodology that promotes creativity, user-oriented approach and interdisciplinary collaboration and has emerged as an active teaching methodology that encourages the development of practical skills and effective solving of complex problems. A documentary type research was carried out whose objective was to identify studies that explore the use of design thinking as an active methodology in higher education. Methodologically, it was approached from the principles of the PRISMA declaration, establishing as inclusion parameters research included in the period from 2014 to 2024, studies disseminated in scientific publications, studies that directly address design thinking, containing at least one of the descriptors "design thinking" or "higher education," disseminated in Spanish or English and studies with open access format, which yielded a total of 28 documents included in the review. The findings of this review highlight the effectiveness of design thinking to improve the learning experience of students by encouraging their active participation, critical thinking and interdisciplinary collaboration.

KEYWORDS

design thinking, teaching methodology, higher education, educational innovation, student participation design thinking

1 Introduction

University-level education is in a constant challenge of adjusting to a constantly evolving environment, where creative potential and solving complex problems are fundamental skills for educational performance. In this context, design thinking (DT) has emerged as an active teaching methodology that encourages user-centered approach, creativity and interdisciplinary collaboration (Henriksen et al., 2017; Serrano and Blázquez, 2016). In addition to these skills, the DT has been associated with the development of problem-solving skills, critical thinking and the ability to work in dynamic and complex environments, crucial aspects in the training of university students to face the challenges of today's working world (Bertão et al., 2023; González-González, 2015).

The DT is based on an iterative process that includes five main phases: empathy, definition, ideation, prototype and testing. These phases not only serve to address problems effectively, but also promote innovation by challenging assumptions and generating novel solutions (Cabana et al., 2019; Mosely et al., 2018). Within these phases, the importance of the prototype and testing phase is highlighted, as it allows students to experiment with concrete solutions and receive feedback, which contributes to continuous improvement and the development of more effective solutions adapted to the needs of the end user (Krüger and Cejas Sainz, 2022).

The user-centered approach of the DT implies understanding the needs, aspirations and experiences of end users (Calavia et al., 2023). This holistic perspective allows educators to design educational activities that are relevant, meaningful and motivating for students (Vargas Márquez et al., 2021). In addition to understanding the needs of the end user, the user-centered

approach also involves considering their emotions, values and previous experiences, which contributes to the creation of more personalized and meaningful educational experiences (Oliveros Niebles et al., 2016).

A fundamental characteristic of the DT is its ability to foster originality and innovation. By exploring multiple ideas and solutions, students acquire reflective and creative analysis skills that are fundamental in an increasingly diverse and dynamic environment (Latorre-Cosculluela et al., 2020). Likewise, the DT also promotes students' ability to question the status quo, propose disruptive ideas and generate solutions that address complex challenges in an innovative and effective way (Lara Carabi et al., 2023).

In addition to creativity, the DT promotes cooperation and collaboration in groups. By involving students from different disciplines in interdisciplinary projects, collaborative learning and the appreciation of diverse perspectives are promoted, guiding students to address challenges of the current environment that require integrative solutions (Arias Flores et al., 2019). This interdisciplinary collaboration not only enriches the learning process by incorporating diverse perspectives and knowledge, but also prepares students to work in multidisciplinary teams in their professional future, thus improving their ability to face complex challenges in a collaborative way (Moreira-Cedeño et al., 2021).

Additionally, design thinking encourages experimentation and learning through error. Students are encouraged to try new ideas, accept feedback and adjust their approaches in an iterative cycle of continuous improvement. This active and adaptive learning mentality prepares them to face the changing and complex challenges of today's society, developing a mindset of resilience and capacity for constant innovation (Del Moral Pérez et al., 2018). Within this learning cycle, it is important to highlight the importance of reflection on students' experience and ability to learn from failures and challenges, transforming them into opportunities for growth and improvement in their educational and professional process (Barbosa-Quintero and Estupiñán-Ortiz, 2023).

Based on what has been pointed out in the preceding paragraphs, the following research question arises: how has the DT been explored and used as an active methodology in higher education? In response to this question, this systematic review seeks to explore how the DT is used in higher education to develop skills such as problem solving, critical thinking and the ability to work in complex environments. Thus, the research objective is to identify studies that explore the use of design thinking as an active methodology in higher education.

By understanding more in depth how the DT can optimize the educational experience of students and prepare them to address the challenges that arise, it will be possible to move towards a more innovative, relevant higher education focused on the holistic development of students. This article focuses on examining the use of DT as an active methodology in higher education, particularly in its pedagogical application by instructors and its impact on the development of key competencies in students. Through a review of studies that analyze its implementation in university education, the aim is to offer an overview of the benefits and challenges of integrating the DT into teaching, with emphasis on pedagogical innovation and the improvement of teaching practice. This approach will identify patterns, good practices and possible areas for improvement in the implementation of DT as an educational strategy in the training of university students, providing a basis for future research and pedagogical applications.

This systematic review is justified in the context of the need to continuously adapt and improve educational practices in higher education. Design thinking offers a methodological framework that can revolutionize the way current educational challenges are addressed. Its user-centered approach, constant innovation and creative problem solving provides a unique opportunity to enrich the learning experience of university students. By deepening the research on how design thinking is implemented and its effects in the university context, this review seeks to provide valuable knowledge to inform pedagogical decision-making and promote an educational culture that values creativity, collaboration and adaptability in the teaching-learning process.

2 Methodology

This study is based on a systematic descriptive review, following the guidelines established by PRISMA ACTUALIZADA in 2020 (Page et al., 2021). In this sense, the recommendations of Urrútia and Bonfill (2010) were adopted, who propose a series of steps or moments to approach this type of research in a rigorous way. First, the objective of the review was formulated, clearly establishing what the research would seek to achieve. Then the search equations were defined, that is, the key terms and the search criteria that would be used to identify the relevant studies with respect to the topic of study were determined.

Subsequently, the parameters of inclusion and exclusion of documents were defined, which served to determine which studies would be considered in the review and which would be excluded. The review of the selected texts was carried out, where the studies and educational practices that use the DT as a pedagogical approach in university education were analyzed in detail. Then an analysis of the selected sources was carried out, evaluating the quality and relevance of each study to respond to the research objective and finally, the results and conclusions were presented.

For the search of information, the databases Scopus, Dialnet, and Google Scholar were selected. Scopus is widely recognized in the academic community for its extensive coverage of peer-reviewed journals and its ability to offer reliable bibliometric data, which ensures a high level of quality in published studies (Scopus, 2017). Dialnet, on the other hand, is an outstanding platform in the Ibero-American field for its access to a wide range of academic documents, especially in social sciences and humanities and its rigorous selection process (Gregorio-Chaviano et al., 2021). Google Scholar is valued for its ability to index a large amount of academic literature, including articles, theses and books, which makes it an essential tool for the exhaustive search of academic literature (Torres-Salinas et al., 2009). These databases were selected due to their recognition and reliability in the scientific community, ensuring that the documents considered meet high standards of quality and academic rigor.

Once the search engines had been determined, the inclusion and exclusion criteria were defined, with the inclusion criteria being: (a) research included in the period from 2014 to 2024, (b) studies published in scientific publications, (c) studies that directly address design thinking, (d) studies that contained at least one of the descriptors "design thinking" and "higher education," (e) research published in Spanish or English and (f) studies with Open Access

format, while the exclusion criteria were: (a) studies prior to 2014, (b) undergraduate or postgraduate theses, (c) editorials, opinion articles and (d) studies with restricted access.

For the recovery of the literature, key words that helped to construct the search equations were determined, being these ""design thinking," "higher education," "active methodology," "teaching model," "formative processes" "teaching-learning," which helped to configure the search equations:

- "Design thinking and higher education."
- "Design thinking AND teaching methodology" OR "Design thinking AND teaching model.
- "Design thinking AND teaching AND training process" OR" Design thinking AND teaching/learning process."

A review and selection of the bibliography obtained was carried out, considering criteria such as the date of publication, authorship details, geographical origin and source of the documents. Initially, the emerging publications were identified according to the search equations in the Scopus, Dialnet and Google Scholar databases. First of all, duplicate documents were removed, resulting in a total of 152 unique publications. From these, those investigations prior to the year 2014, undergraduate or postgraduate thesis were excluded; and finally discarding editorials, blogs, opinion articles and studies of restricted access. This process resulted in a total of 28 documents selected for review (see Figure 1).

3 Results

After carrying out the search and selection of documents, it was possible to identify a set of twenty-eight ($n = 28$) that were selected for review. These documents have been structured and organized, providing information of the publication, giving details about the authorship/year, the database where they were obtained and the country of origin of each study, as detailed below:

[1] Yao, L., Chen, X., & Wu, Q. (2024). Undergraduate nursing students' learning experiences using design thinking on a human development course: A phenomenological study. Scopus, China.

[2] Hsing-Yuan, W. (2023a). Design thinking competence as self-perceived by nursing students in Taiwan. Scopus, China.

[3] Hsing-Yuan, W. (2023b). Measuring design thinking competence in Taiwanese nursing students: A cross-cultural instrument adaptation. Scopus, China.

[4] Yi-lin, L., et al. (2023). Enhancing university students' creative confidence, learning motivation, and team creative performance in design thinking using a digital visual collaborative environment. Scopus, China.

[5] Shiyu, Z. & Chengfeng, Z. (2023). Promoting design thinking and creativity by making: A quasi-experiment in the information technology course. Scopus, China.

[6] Ní Shé, C. & Farrell, G. (2021). Integrating design thinking into instructional design: The #OpenTeach case study. Scopus, Scotland.

[7] González-Granados, L. (2022). Design thinking as an agent of transformation in training processes. Scopus, Colombia.

[8] Meng-Fang, T. (2021). Exploration of students' integrative skills developed in the design thinking of a Psychology course. Scopus, China.

[9] Thi-Huyen, D., et al. (2021). The Impact of Design Thinking on Problem Solving and Teamwork Mindset in A Flipped Classroom. Scopus, China.

[10] Jamal, S., et al. (2021). Re-Visiting Design Thinking for Learning and Practice: Critical Pedagogy, Conative Empathy. Scopus, USA.

[11] Lynch, M., et al. (2021). Combining technology and entrepreneurial education through design thinking: Students' reflections on the learning process. Scopus, Norway.

[12] Albay, A. & Eisma, E. (2021). Performance task assessment supported by the design thinking process: Results from a true experimental research. Scopus, Philippines.

[13] Magro Gutiérrez, M. & Carrascal Domínguez, J. (2019). Design Thinking as a resource and methodology for visual literacy and learning in preschools of multigrade schools in Mexico. Dialnet, Spain.

[14] Campodonicus-Centurion, F., et al. (2019). Design thinking traits of teachers immersed in the orange economy. Dialnet, Peru.

[15] Deitte, L. & Omary, M. (2019). The Power of Design Thinking in Medical Education. Scopus, USA.

[16] Laferriere, R., et al. (2019). Addressing cognitive challenges in applying design thinking for opportunity discovery: Reflections from a design thinking team. Scopus, Australia.

[17] Beaird, G., et al. (2018). Design thinking: Opportunities for application in nursing education. Scopus, USA.

[18] Ejsing-Duun, S. & Skovbjerg, H. (2018). Design as a Mode of Inquiry in Design Pedagogy and Design Thinking. Scopus, Denmark.

[19] Wrigley, C., et al. (2018). Design Thinking Education: A Comparison of Massive Open Online Courses. Scopus, Australia.

[20] Gachago, D., et al. (2017). Developing eLearning champions: a design thinking approach. Scopus, South Africa.

[21] Henriksen, D., et al. (2017). Design thinking: A creative approach to educational problems of practice. Scopus, USA.

[22] Çeviker-Çınar, G., et al. (2017). Design Thinking: A New Road Map In Business Education. Google Scholar, Turkey.

[23] Castellanos Escobar, O. & Rodríguez Díaz, E. (2016). The project management of design: contributions from communication, visual thinking and design thinking. Scopus, Colombia.

[24] Córdoba, E., et al. (2015). Fundamentals of design thinking. Dialnet, Colombia.

[25] Blizzard, J., et al. (2015). Using survey questions to identify and learn more about those who exhibit design thinking traits. Scopus, USA.

[26] Castillo-Vergara, M., et al. (2014). Design thinking: how to guide students, entrepreneurs and entrepreneurs in their application. Dialnet, Chile.

[27] Leinonen, T. & Durall, E. (2014). Design thinking and collaborative learning. Scopus, Finland.

[28] Laakso, M. & Clavert, M. (2014). To promote creativity and design thinking skills among university students. Dialnet, Finland.

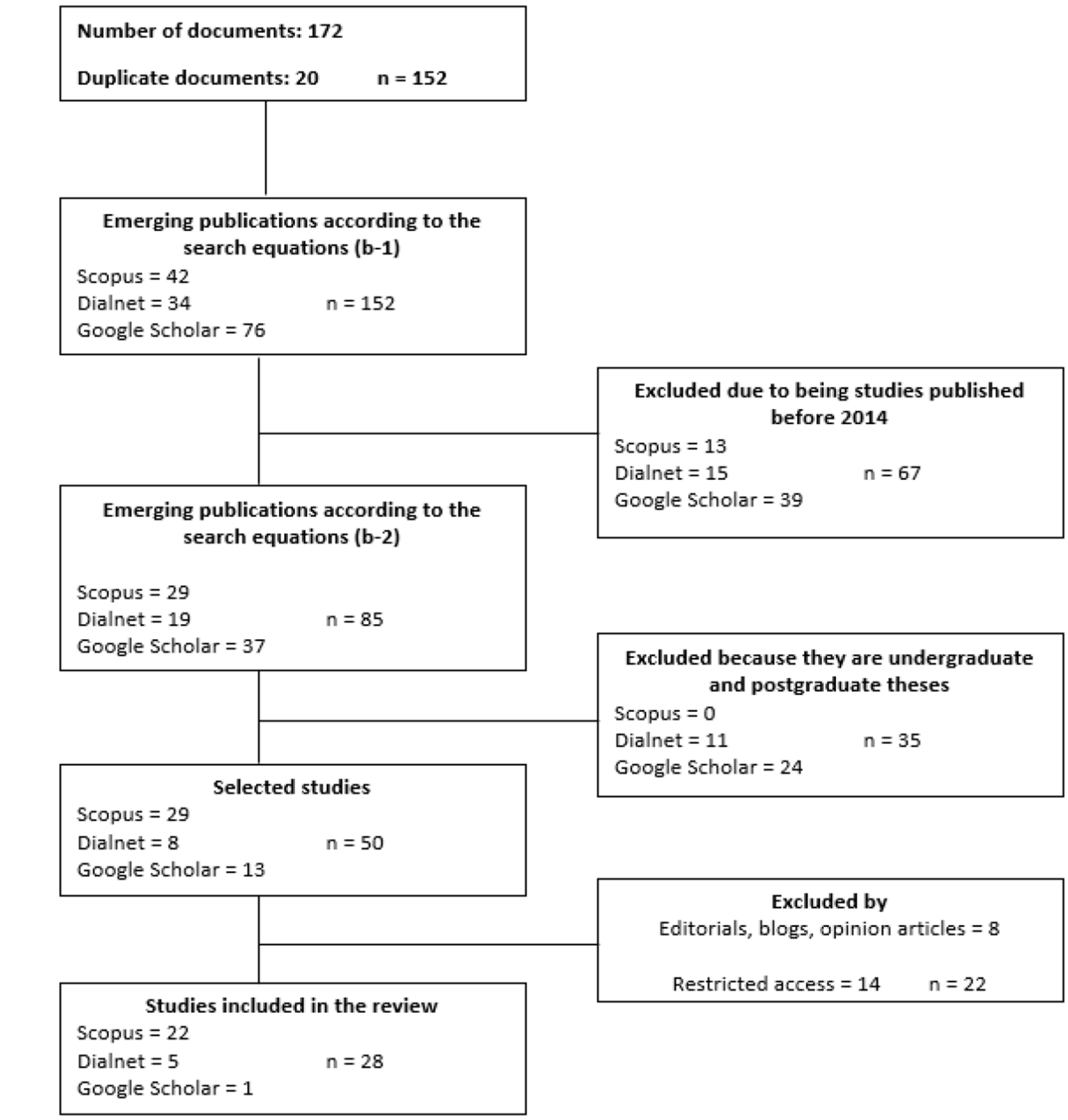

FIGURE 1
PRISMA flowchart.

Of the selected works, the 14.30%.se posted in Thinking Skills and Creativity with 4 posts, on 21.43.% in the magazines Kepes, Nurse Education Today and She Ji. The Journal of Design, Economics and Innovation with 2 publications each and the rest (64.27%) in the various journals such as Academic Radiology, Australasian Journal of Educational Technology, BMC Medical Education, Comunicar, Design Studies, Economics and Business, among others. However, beyond the specific journals, it is relevant to highlight the thematic areas in the reviewed studies. Most of the articles concentrate on topics related to education and educational technology, reflecting a significant interest in the use of the DT to innovate in higher education. In addition, studies in the field of humanities, social sciences, engineering and business were identified, which demonstrates the versatility of the DT as an active teaching methodology applied in various academic contexts. This thematic distribution highlights the impact of the DT in different disciplines, providing a more complete overview of its application in higher education.

3.1 Geographical distribution of publications

Regarding the country of origin, it was found that most of the publications come from China, representing 25% of the total articles. It is followed by the USA with 17.9%, Australia with 7.1%, Colombia

with 10.7% and Spain and Finland, both with 7.1% each. Other countries represented in the study include Scotland, Norway, the Philippines, Peru, Denmark, South Africa, Turkey and Chile, each accounting for 3.6% of the reviewed publications. These data highlight the diversity of origin of the research, evidencing the global participation in the topic addressed.

The prominence of China in the number of published articles could be related to the remarkable growth of higher education and innovation in that country during the last decade. According to Villadiego Sánchez (n.d.), the significant increase in investment in educational and technological programs in the Asian country has promoted favorable environments for research, which could be boosting interest and academic production in active methodologies such as the DT.

On the other hand, the prominent presence of the United States and Australia may be linked to the tradition of research and development in higher education in these countries, as well as to the early adoption of innovative approaches in teaching (Ramírez Ramírez, 2020). Colombia, Spain and Finland, with a similar representation could reflect the global interest in exploring new methodologies to improve the quality and effectiveness of higher education (Mora Ramírez and Chacón, 2019; Vázquez-Cupeiro and López-Penedo, 2016).

The revised documents covered a publication period from 2014 to 2024. In methodological terms, it was found that 32.14% of the documents ($n = 9$) used a qualitative approach, while 25% ($n = 7$) corresponded to literature reviews. In addition, 17.86% ($n = 5$) used a quantitative approach, and there were 21.42% ($n = 2$ each) of documents that adopted a mixed and case study approach. Finally, one paper followed a comparative descriptive methodology. The diversity in the methodologies used is crucial to understand the different perspectives and approaches applied to DT in higher education. By presenting this methodological variety, it is highlighted how DT is investigated and applied from different angles, which allows to obtain a broader vision of the studied phenomenon. The methodological findings are presented in Table 1, which organizes and clarifies how DT has been addressed in the reviewed literature.

The studies retrieved refer mainly to a wide range of research focused on DT. These studies address crucial questions related to students' perception and competence in DT, the adaptation and validation of tools to assess key components of DT, the effects of engaging learners in specific learning environments, the influence of DT on the improvement of team problem solving skills, among other relevant topics. In addition, there has been a growing interest in research on the implementation of design thinking in different academic disciplines, exploring how this methodology can be effectively applied and adapted to the specific needs of each subject area.

This diverse set of studies provides a comprehensive view of the DT as a teaching methodology in higher education, highlighting its applicability in different contexts and its potential to improve understanding, problem solving, originality and other fundamental skills in students. In addition, some studies have explored how design thinking can be effectively integrated into existing curricular programs, identifying strategies and good practices for its implementation in the educational field. Likewise, an emphasis has been observed on the evaluation of the impact of design thinking on the development of soft skills such as effective communication, teamwork and leadership, crucial aspects for the integral formation of university students.

Table 2 presents a detailed compilation of the most outstanding contributions of the selected articles, which represent a diversity of perspectives and approaches within the field of DT in higher education. The individual findings of each study are highlighted to offer a more precise and detailed view of how each research contributes to the understanding and application of DT in different educational contexts. This choice allows us to appreciate the richness of the contributions and how each article addresses specific aspects, from the development of competencies in DT to its impact on the students' learning experience, promoting a comprehensive understanding of the topic.

4 Discussion

The implementation of the DT in higher education has proven to be an effective tool for promoting creativity, innovation and the development of collaborative skills in different educational contexts. The analyzed studies reinforce the idea that the DT not only facilitates more active and participatory learning, but also improves educational quality by providing students and educators with tools to address problems creatively and effectively (González Granados, 2022; Laakso and Clavert, 2014).

Several studies have underlined the importance of the DT in specific educational contexts. For example, it has been observed that DT not only improves students' creative confidence (Yi-Lin et al., 2023), but also offers an effective framework for the integration of empathy and user-centered approach in teaching (Deitte and Omary, 2019; Ní Shé et al., 2021). These findings are consistent with the literature that highlights the versatility of the DT as a pedagogical tool in a variety of disciplines.

The DT in Higher education underlines its potential as a transformative tool for teachers. It not only facilitates active and participatory learning, but also drives innovation in teaching and the creation of more collaborative and student-centered learning environments. For teachers, this means that integrating the DT into their practice can provide a structured framework for addressing pedagogical challenges, commenting on creativity, and tailoring their teaching methods to the specific needs of their students.

For example, in nursing education, the DT stands out as a clear example of how this methodology can enhance experimental and creative learning, resulting in meaningful experiences for students (Yao et al., 2024). Teachers in this field could consider the application of DT strategies to design activities that better integrate empathy and user-centered approaches, which in turn could enrich the educational experience.

In addition, the adaptation of the DT to different cultural and educational contexts has proven to be a challenge and an opportunity to optimize teaching practices (Hsing-Yuan, 2023b; Thi-Huyen et al., 2021). Teachers should be attentive to the different individual in the self-perceived competence of their students when necessary, as suggested in recent studies (Hsing-Yuan, 2023a). This approach can help create a more inclusive and equitable learning environment, where all students can develop their skills effectively.

In broader educational contexts, DT has been shown to be effective in creating a collaborative learning environment and in developing a problem-solving-oriented mindset. For example, the integration of the DT in inverted classrooms has been associated with an increase in students' cooperation and creative mindset (Thi-Huyen et al., 2021). In addition, in the field of higher education, the DT has

TABLE 1 Objectives and methodology of the selected studies.

Author/year	Objective	Methodology
Yao et al. (2024)	To investigate how nursing trainees perceive their DT learning experiences in a human development course.	Qualitative
Hsing-Yuan (2023a, 2023b)	Examining Taiwanese nursing students' self-perceived competence in design thinking.	Quantitative
Hsing-Yuan (2023a, 2023b)	To adapt and validate the use of the creative synthesis inventory (CSI) that assesses the four components (visualization, discovery, prototyping, and evaluation) of design thinking in nursing students in Taiwan.	Mixed
Yi-lin et al. (2023)	To analyze the effects of engaging students in a DVC environment in a design thinking course on students' creative confidence, learning motivation, and team creative performance.	Mixed
Shiyu and Chengfeng (2023)	Investigate the effects of design-oriented creation on learners' learning of programming, creativity and DT.	Quantitative
Ní Shé et al. (2021)	Report on a case study that focused on using design thinking to design and develop the #OpenTeach course.	Case Study
González Granados (2022)	Create a transmedia model that fosters problem solving, identifies the competencies developed in early childhood and adolescence, is based on continuous learning and understands and recognizes the process of team problem solving by learners.	Qualitative
Meng-Fang (2021)	Exploring students' integrative skills developed in the design thinking of a psychology course	Quantitative
Thi-Huyen et al. (2021)	Determine how design thinking aids in the growth of problem solving and teamwork mentality in a flipped classroom.	Quantitative
Jamal et al. (2021)	Highlight the importance of DT as a valuable interdisciplinary approach to guiding fair and equitable learning and practice (praxis) in hospitality and tourism	Mixed
Lynch et al. (2021)	Improve understanding of how design thinking can be effective in teaching entrepreneurial skills to science and engineering students.	Case Study
Albay and Eisma (2021)	Analyze student performance on a performance task assessment, supported by the principles of the design thinking process.	Quantitative
Magro Gutierrez and Carrascal Domínguez (2019)	Explore the impact of DT as a tool and methodological approach in educational settings.	Bibliographic review
Campodónico Centurión et al. (2019)	Assess whether higher education teachers exhibit DT characteristics and analyze their methodological approaches to innovation in their professional and pedagogical practice.	Descriptive-comparative
Deitte and Omary (2019)	Explore and understand the educational experiences of learners in the field of educational medicine in order to design inspiring educational activities using design thinking	Qualitative
Laferriere et al. (2019)	Examine how teaching design thinking in graduate business education addresses cognitive challenges identified by Lissack and how activities based on this approach can mitigate those challenges	Qualitative

(Continued)

TABLE 1 (Continued)

Author/year	Objective	Methodology
Beaird et al. (2018)	To introduce design thinking, its main fundamentals and its applications in health and nursing education.	Bibliographic review
Ejsing-Duun and Skovbjerg (2019)	To provide a theoretical framework to strengthen DT in the context of teaching through productive processes and their use to generate knowledge.	Bibliographic review
Wrigley et al. (2018)	Analyze and classify the various modalities of online DT courses in June 2017. Reveal the what (content), how (pedagogy and assessment) and why of online design thinking courses.	Qualitative
Gachago et al. (2017)	Explore how to promote a design thinking mindset among professions identified as e-learning champions to improve their educational practices and promote innovation in the use of technology in teaching and learning in Higher Education.	Qualitative
Henriksen et al. (2017)	To qualitatively evaluate a graduate program focused on the use of DT to creatively address educational problems in practice.	Qualitative
Çeviker-Çınar et al. (2017)	Explore current trends in the application of DT in university education, with a particular focus on the strategies of leading schools.	Case Study
Castellanos Escobar and Rodríguez Díaz (2016)	Analyze the relevance of visual thinking and DT in all stages of project development, implementation and evaluation.	Qualitative
Córdoba et al. (2015)	Describe the epistemological principles underlying DT analysis and the general elements that characterize each theoretical principle associated with this concept.	Bibliographic review
Blizzard et al. (2015)	Recognizing DT attributes in U.S. college students	Qualitative
Castillo-Vergara et al. (2014)	Describe the methodology and tools to be used in the application of Design Thinking.	Bibliographic review
Leinonen and Durall (2014)	Show the DT as a different option for investigating collaborative learning with technology.	Bibliographic review
Laakso and Clavert (2014)	Broaden understanding by presenting a recent case that exemplifies efforts to facilitate DT skills development at multiple educational levels.	Bibliographic review

allowed teachers to develop new strategies to guide and transform the teaching process, resulting in a more dynamic and innovative educational environment (Magro Gutierrez and Carrascal Domínguez, 2019).

In terms of practical implications, these findings highlight the importance of integrating the DT into higher education curricula to not only improve students' technical skills, but also to foster a mindset of innovation and creativity that is crucial in the modern world. Moderna the connection between DT and effective learning suggests that its application could be extended to more areas of study, beyond those already explored in this work.

Finally, the integration of the DT into higher education not only benefits students, but also offers teachers valuable tools to innovate in their pedagogical practice. The application of these principles in teaching can facilitate the creation of a more dynamic educational environment aligned with the demands of the XXI century, better preparing students to face future challenges.

5 Conclusion

The systematic search carried out in this study allowed an analysis of how design thinking has been successfully integrated into various educational contexts of higher education. The findings of this review highlight the effectiveness of design thinking to improve the learning experience of students by encouraging their active participation, critical thinking and interdisciplinary collaboration. In addition, it was evidenced how the application of the DT not only benefits students, but also transforms the pedagogical practices of educators, promoting innovation in the design of more effective and student-centered educational activities.

Through this review, it has been evidenced how the DT has been successfully applied to optimize the educational experience of the students, promoting active involvement, reflective analysis and problem solving in a collaborative way. In addition, its ability to adapt

TABLE 2 Highlights of selected articles.

Author/year	Contribution
Yao et al. (2024)	The research highlights how design thinking enhances the educational experience in nursing. In addition to promoting creativity, the role of design thinking in encouraging active student participation and facilitating more experiential and hands-on learning is emphasized.
Hsing-Yuan (2023a)	It suggests the need to offer additional support to those students who perceive themselves to have lower proficiency in design thinking, which could lead to more effective strategies to improve their skills and confidence in this area.
Hsing-Yuan (2023b)	Its contribution lies in the adaptation and validation of the CSI to assess the components of design thinking in nursing students. This adaptation provides a specific and reliable tool to measure design thinking competency within this particular context, which facilitates the assessment and monitoring of skill development in this area among students.
Yi-lin et al. (2023)	The beneficial effect on learners' creative confidence, as well as on their motivation for learning and creative team performance is highlighted.
Shiyu and Chengfeng (2023)	It provides a deeper understanding of how integrating design thinking into problem solving can positively influence programming learning, creativity, and the development of design thinking among students. In addition, it highlights how the DT approach not only enhances technical skills in programming, but also promotes a more innovative mindset and an ability to creatively and effectively address problems in a variety of areas
Ní Shé et al. (2021)	It shows how the DT process can be effectively applied to achieve greater empathy with students. In addition to highlighting the importance of empathy in educational design, this contribution underscores how DT not only focuses on problem solving, but also on understanding the needs and experiences of students, leading to more user-centered design and enriching the educational experience
González Granados (2022)	It offers a comprehensive view of how transmedia design can foster the development of team problem-solving skills from an early age, which facilitates the lifelong learning process for students. In addition, this contribution highlights how transmedia design promotes collaboration, effective communication and critical thinking, crucial aspects for students' academic and professional success in an increasingly complex environment.
Meng-Fang (2021)	It highlights how the application of DT in a psychology course can foster interactive collaboration and an integrative learning experience among students. This contribution highlights how design thinking in the context of psychology can promote a deeper understanding of theoretical concepts, facilitating the practical application of these concepts in real-world situations and enhancing the learning experience of students
Thi-Huyen et al. (2021)	It shows how the implementation of DT contributes to the development of students' mindsets, including skills such as empathy, holistic vision, problem reframing and teamwork. It also highlights how DT fosters a proactive and adaptive mindset in students by preparing them to face complex challenges and promoting a holistic approach to problem solving in different educational contexts.
Jamal et al. (2021)	Highlights how design thinking, used as a teaching methodology, effectively guides both learning and practice in the development and education of students. Emphasizes how this methodology promotes active and participatory learning, fostering student engagement and facilitating the practical application of learned concepts in real situations.
Lynch et al. (2021)	Highlights how the application of design thinking teaches entrepreneurial skills to science and engineering students and also enables them to develop tangential skills and knowledge of technology commercialization. Underscores how DT promotes an entrepreneurial mindset and innovative approach in students, preparing them to meet the challenges of the job market and fostering their ability to identify opportunities and develop creative solutions
Albay and Eisma (2021)	By applying the principles of design thinking, a more innovative and learner-centered perspective is fostered, which facilitates the creation of a more dynamic and productive educational space for learning. An additional contribution is that it points out how DT promotes a participatory and collaborative approach in the educational process, stimulating creativity and autonomy of the students in their educational process.
Magro Gutierrez and Carrascal Domínguez (2019)	It suggests that design thinking can represent a valuable resource for enhancing pedagogical practices and promoting a more innovative and student-centered educational environment. This approach highlights how DT stimulates creativity and active engagement of learners, creating an environment conducive to meaningful learning and innovative problem solving.
Campodónico Centurión et al. (2019)	It offers valuable insight into how teachers use design thinking in their professional and pedagogical practice to innovate and improve their educational approaches. This contribution highlights how DT not only benefits learners, but also transforms teaching practices, encouraging experimentation, collaboration and continuous adaptation in the educational process.
Deitte and Omary (2019)	The research contributes to the design of inspiring and effective educational activities in the field of educational medicine, employing design thinking to optimize the quality of teaching and meet the needs of learners. It highlights how DT promotes more active and student-centered learning, increasing students' motivation and engagement in their educational process.
Laferriere et al. (2019)	It highlights the importance of user-focused DT to develop effective solutions and address the complexities of society. This contribution highlights how DT is not limited to the educational environment, but also has a significant impact on problem solving in social and professional contexts, fostering creativity and innovation to address complex challenges.

(Continued)

TABLE 2 (Continued)

Author/year	Contribution
Beaird et al. (2018)	It presents in detail the DT, its main fundamentals and its specific applications in the field of health and nursing education. Provides a comprehensive view of DT as applied to health education, highlighting its relevance for improving the quality of teaching, patient care and the development of clinical skills among health professionals.
Ejsing-Duun and Skovbjerg (2019)	This research provides a solid theoretical framework that strengthens DT in the educational context. It highlights how the integration of productive processes in teaching can effectively generate knowledge, strengthening the capacity of learners to apply DT in practical situations and develop creative and efficient solutions.
Wrigley et al. (2018)	The key contribution of this research is to point out the limitations and challenges faced by online design thinking MOOCs, focusing especially on their educational methodology. This allows for a clearer understanding of the areas that could be improved to optimize design thinking learning, thus promoting a deeper and more effective mastery of this methodology.
Gachago et al. (2017)	Emphasizes the importance of promoting a design thinking mindset among education professionals, which can lead to the development of creative confidence in them. Emphasizes how DT fosters the ability of education professionals to address challenges in innovative ways and develop creative solutions that enhance the quality of teaching and learning
Henriksen et al. (2017)	It highlights how the use of DT in a graduate teaching course can provide beneficial thinking skills for teachers, which can significantly raise educational standards. Further emphasizes how DT promotes critical reflection and adaptability in educators, enhancing their abilities to design meaningful and effective learning experiences.
Çeviker-Çınar et al. (2017)	They propose the integration of design thinking into business school curricula to ensure effective and comprehensive learning in this area. In addition to this proposal, the study highlights how DT can enhance learners' ability to analyze complex problems, make informed decisions, and develop innovative solutions in the context of business and management.
Castellanos Escobar and Rodríguez Díaz (2016)	It highlights the relevance of design thinking as a methodology for effective project development in diverse contexts. It also highlights how DT fosters interdisciplinary collaboration, creativity and continuous iteration in the project development process, resulting in solutions that are more robust and adaptive to the needs of the context in which they are applied.
Córdoba et al. (2015)	Exposes the epistemological foundations of DT, highlighting its nature as a method of intuitive thinking and a point of methodological convergence between ethnography and originality.
Blizzard et al. (2015)	Provides a deeper understanding of how design thinking can influence the training of college students in the United States, highlighting its relevance to education and preparation for contemporary challenges
Castillo-Vergara et al. (2014)	The contribution of this research lies in describing the methodology and tools needed to apply Design Thinking effectively. It provides education professionals with a practical guide to successfully implement this methodology and obtain significant results in the educational process.
Leinonen and Durall (2014)	It presents DT as a different methodology for conducting research on cooperative learning using technology. By highlighting the relevance of design thinking in this context, it provides an innovative perspective that can enrich the understanding and analysis of computer-mediated collaborative learning.
Laakso and Clavert (2014)	Contributes to the understanding of how to simplify the development of DT competencies at various educational levels. Emphasizes the importance of adapting DT teaching strategies according to the needs and characteristics of each educational level, which ensures effective implementation and continuous improvement of students' DT skills and competencies.

to different disciplines and educational environments has been highlighted, which underlines its versatility and potential to enrich the quality of higher education.

The findings have also highlighted the importance of integrating the DT into teacher education, providing educators with innovative tools to design more effective and learner-focused learning experiences. Likewise, an increase in the interest and commitment of students has been observed when applying approaches based on design thinking in their studies. This includes strategies for the creation of dynamic learning, the implementation of activities that encourage creativity and problem solving, and formative assessment to continuously improve the educational process.

As a recommendation, it is essential to continue promoting the research and implementation of the DT in university education. This involves developing training programs for educators, promoting interdisciplinary collaboration between faculties and departments, and fostering pedagogical innovation based on this methodological approach. In addition, it is suggested to continuously evaluate the impact of design thinking on students' learning and development in order to adjust and improve its application in the university environment.

It is important to note that this study was limited by some aspects. Firstly, the search for studies was limited to sources available online and to works published in academic databases, which excluded research not available in these media. In addition, most of the studies reviewed focused on specific educational contexts, which may restrict the applicability of the results. These limitations should be considered when interpreting the findings and conclusions of this review. However, this study provides a valuable insight into the contributions and potential of design thinking in the transformation of educational processes at the university level.

Author contributions

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The author(s) declare that no Gen AI was used in the creation of this manuscript.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2025.1462938/full#supplementary-material

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