Integration of Design Thinking in University Educational Innovation: A Scoping Review

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***Abstract*– The objective of this study was to analyze the implementation of Design Thinking (DT) in higher education between 2013 and 2024. To understand its application and its coherence with the changing needs of higher education, 26 research articles were examined. The methodology included a systematic literature search in Scopus, followed by data selection and extraction according to the PRISMA-ScR methodology. The results revealed that DT has been widely adopted in higher education contexts, as it encourages creativity, problem solving and interdisciplinary collaboration. However, challenges were identified, such as the need for training for educators and resistance to change. In conclusion, DT has been effectively implemented in higher education, as it enriches pedagogy and promotes innovation, but attention must be paid to the challenges and sustainable implementation in this context must be guaranteed.**

***Keywords*– Design Thinking, Higher Education, Educational Transformation, Problem-Based Learning, Teaching Challenges.**

I. Introduction

Technological advances have radically transformed society and raised new challenges about the role of humans in the face of automation and artificial intelligence. In this context, higher education must prepare students not only with technical knowledge, but also with skills that differentiate them from machines, such as creativity, critical thinking, and the ability to solve complex problems. Design Thinking (DT) has emerged as a key approach to enhancing these competencies by enabling students to approach problems from multiple perspectives and collaboratively develop innovative solutions [1].

The evolution of higher education has been linked to the different stages of industrial progress. However, today's challenges are multidisciplinary and require a more comprehensive education. A traditional educational model is no longer viable; it is necessary to innovate and adopt disruptive strategies that foster collaboration and experiential learning. In this sense, DT is considered a necessity in the technological age as it provides structured methodologies to address problems, develop products, and design user-centered systems or services [2].

The impact of DT in higher education is significant, as it fosters lateral and critical thinking, and prepares students for a changing environment by instilling in them an agile and real-world problem-solving mindset. A study conducted in three academic institutions that applied DT to address social innovation challenges showed that students achieved a higher level of awareness of user needs and improved their ability to generate high-impact solutions by understanding the complexity of problems [3].

In this context of constant change, companies need professionals who can innovate and generate new ideas to remain competitive in the market. Higher education must respond to this need by fostering transversal skills such as interdisciplinary collaboration and complex problem solving. In disciplines such as engineering, for example, the development of design thinking is considered a higher-order competency that requires more time and effort than traditional technical skills [4].

Despite the growing interest in DT as an educational methodology, review studies on its implementation in higher education are limited. A bibliometric analysis found that 2020 marked a peak in the publication of articles on the application of DT in engineering, with a total of 11 studies in this area, suggesting that this is an expanding area of research [5]. Another study on scientific production in STEM education highlights the progressive consolidation of DT and its relationship with key issues such as computational thinking and human behavior in design [6].

Therefore, it is necessary to further investigate the application of design thinking in higher education. This study aims to review and analyze how this approach has been implemented in educational innovation, and to assess its consistency and appropriateness to address the specific challenges of the academic context.

To this end, Section II describes the methodology used, based on a systematic review of the literature. Section III presents the main findings on the integration of DT in higher education. Finally, Section IV presents the conclusions of the study and implications for future research.

II. Methodology

A. Inclusion and exclusion criteria

This study included only original research published in academic journals between 2013 and 2024 that directly addressed the application of design thinking (DT) in higher education. Literature reviews, non-peer-reviewed articles, and conference proceedings were not included.

B. Literature search

The search for studies was conducted in the Scopus database using the following equation: TITLE ("Design Thinking" AND "Education") AND PUBYEAR > 2013 AND

PUBYEAR < 2024 AND (LIMIT-TO (DOCTYPE, "ar")).

This equation made it possible to identify articles in which the terms "design thinking" and "education" appeared in the title, thus ensuring the relevance of the studies selected for this analysis.

C. Selection of studies

The selection process was developed in three phases, following the methodology of scoping reviews [7]-[9]. First, a title review was performed to discard records that were not related to the central theme. Next, an abstract review was conducted to identify studies that were aligned with the application of DT in higher education. Finally, the full texts of studies that met the inclusion criteria were reviewed to confirm their relevance and to assess their methodological quality.

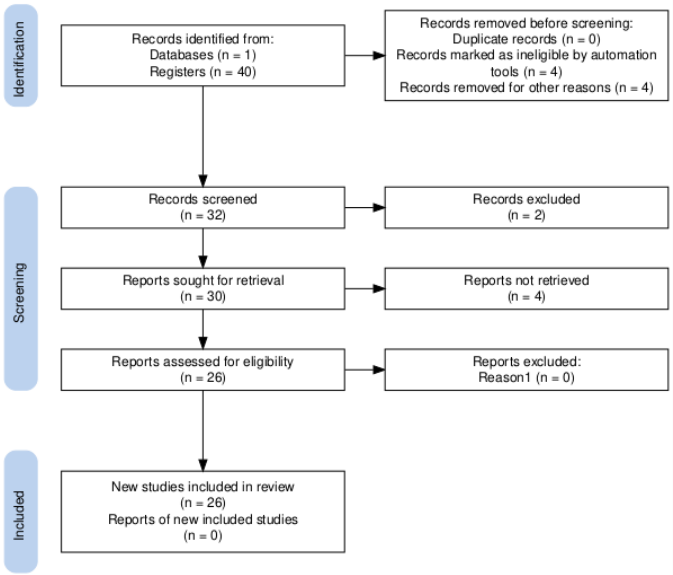

Fig. 1 PRISMA-ScR flowchart illustrating the identification, screening and inclusion process of studies on design thinking in higher education.

Note. A total of 26 studies were included after applying predefined eligibility criteria and methodological quality checks.

D. Data extraction

Following the PRISMA-ScR guidelines [10], key information was collected from each selected study, including the aim of the approach, the methods and tools used, the participants involved, the results obtained, the challenges faced, the relevance to educational needs, the impact on innovation and the lessons learned. The organization of the data made it possible to structure the information in a systematic way and to facilitate comparative analysis.

E. Quality assessment

The quality of the included studies was considered adequate as all selected articles were indexed in the Scopus database. Although no formal assessment tool was used, the fact that the studies were peer-reviewed and from a high-quality database ensured a minimum level of academic rigor. The final selection was based on consensus among the authors after reviewing the full text.

F. Data Analysis

The data were analyzed by grouping them according to the defined variables, which made it possible to identify key patterns and trends in the implementation of Design Thinking (DT) in higher education. The consistency of the findings with current educational needs was examined, highlighting both the reported benefits and limitations. The studies reviewed showed that the application of DT varies according to the academic and disciplinary context, ranging from problem-solving models to approaches based on interdisciplinary learning.

Differences were found in the way institutions integrate DT into their programs, as well as in the importance of teacher training and the availability of resources for its effective implementation. Challenges related to resistance to change and the need to adapt to different educational contexts were also discussed.

G. Synthesis of literature

The findings were summarized in a table to facilitate comparison between the studies reviewed. A narrative summary was also developed, integrating the main findings and highlighting the opportunities and challenges of using DT in higher education. Successful strategies, methodological limitations and areas for further research were identified, allowing for a better understanding of the impact of DT on pedagogical innovation and its potential to transform learning into different academic settings.

III. Results And Discussion

A. Definition and Approach of Design Thinking (DT)

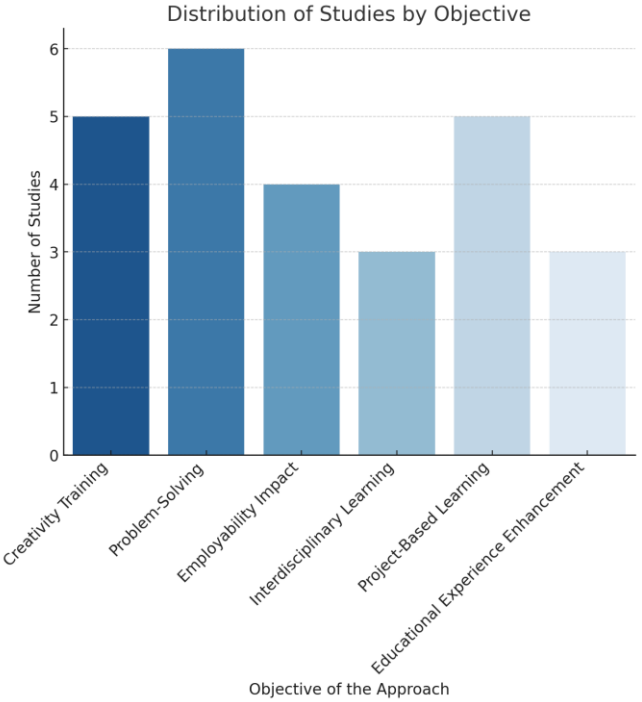

Figure 2. Distribution of programs by objective.

The reviewed studies agree that Design Thinking (DT) is an innovative approach that fosters creativity, user-centered problem solving, and interdisciplinary collaboration. Its integration into higher education is highlighted as a key strategy for developing relevant skills for the labor market [11, 12].

B. The link between creativity and employability

Several studies highlight the link between creativity and employability, pointing out that DT enhances students' ability to solve complex problems and generate innovative ideas, skills that are highly valued in today's work environment [12, 13, 14].

Figure 2 shows the distribution of studies by objective, and most of the research on DT in higher education focuses on creativity training (5 studies), problem solving (6 studies), impact on employability (4 studies), interdisciplinary learning (3 studies), project-based learning (5 studies), and enhancing the educational experience (3 studies). This strengthens the argument that DT prepares students for real-world challenges and provides them with essential 21st century skills.

C. The role of design thinking in fostering creativity

Studies confirm that DT enhances creativity by fostering empathy, teamwork, and the exploration of unconventional solutions. These elements are essential for innovation across disciplines [15, 16].

D. Positive effects of integration

Most of the reviewed articles indicate that the use of DT in higher education significantly improves problem solving and creativity. In addition, students report increased engagement and motivation in their learning process [17, 18, 19].

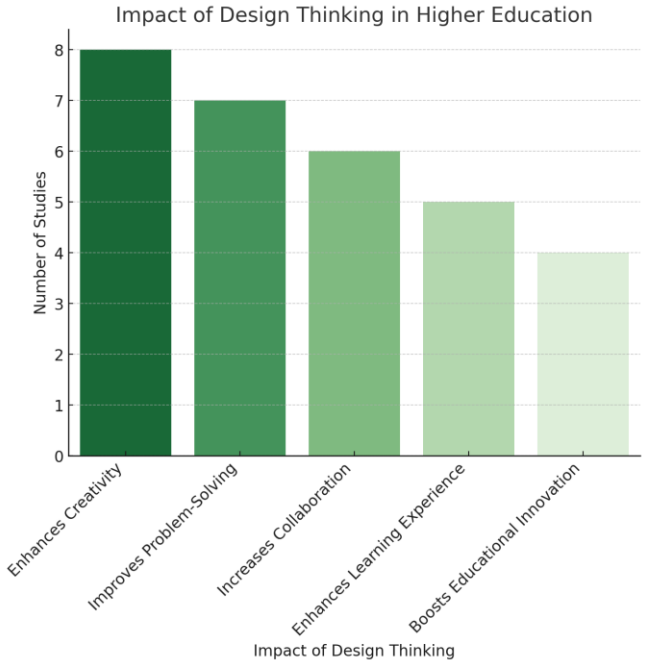

Figure 3. The impact of design thinking in higher education.

Figure 3 highlights the impact of DT in higher education, noting that the most reported effects include enhancing creativity (in 8 studies), strengthening problem solving (in 7 studies), increasing collaboration (in 6 studies), improving the learning experience (in 5 studies), and fostering innovation (in 4 studies). These findings reinforce the importance of DT as a transformative tool in education, making it more dynamic and effective.

On the other hand, Figure 4 shows the most used methods and tools in the studies on DT in higher education. It shows that the most used approaches are creative projects (six studies), problem-based learning (five studies), co-creation strategies (four studies), use of technology (three studies), and interdisciplinary workshops (two studies). These findings suggest that DT is effectively implemented through active and participatory strategies that promote student engagement in learning.

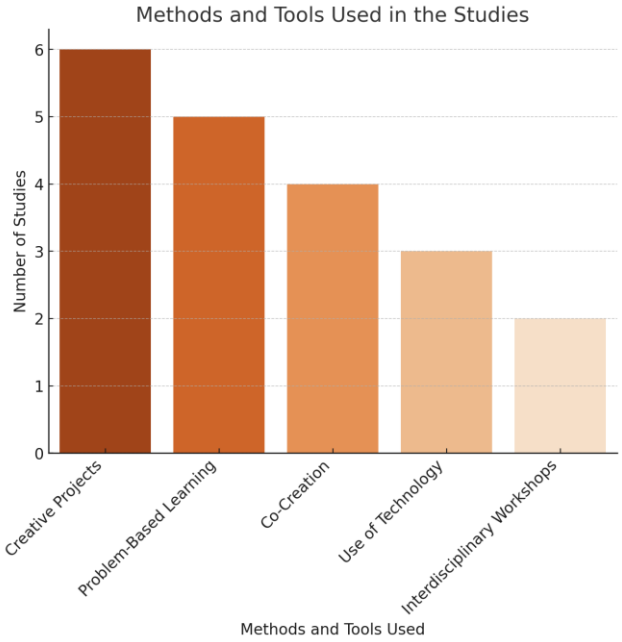

Figure 4. Methods and tools used in the studies.

E. Multidisciplinary Approach

DT has been shown to be effective in a variety of disciplines, including social sciences, arts, technology, and STEM. However, its use in interprofessional education remains limited, limiting its potential to promote interdisciplinary approaches [20, 21].

F. Consistency and Appropriate Use

While many studies highlight the benefits of DT, they also identify challenges to its effective and consistent use. The need for teacher training, resources, and structured approaches to achieve successful integration are mentioned [22, 23].

Figure 5 shows the degree of alignment of DT with educational needs and shows that 15 studies found it to be highly effective, 7 studies found it to be partially effective, and 4 studies indicated that it was not effective. These results suggest that while DT is a valuable tool for promoting educational innovation, its success is highly dependent on institutional support and proper implementation.

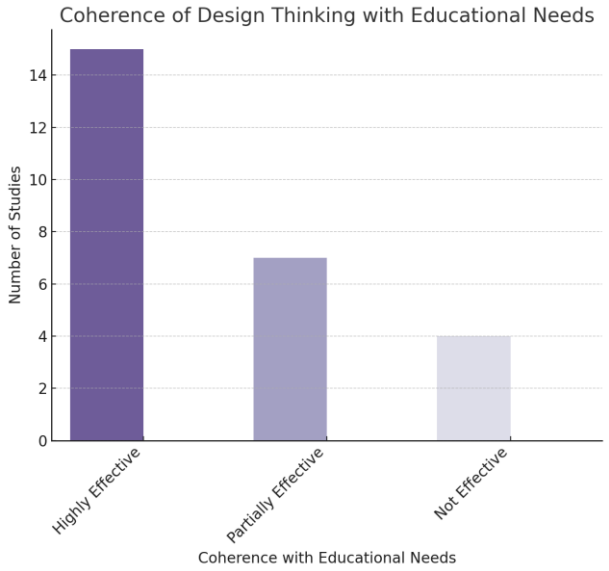

Figure 5. Alignment of design thinking with educational needs.

G. Challenges to Implementation

Several barriers to the implementation of DT have been identified, including resistance to change in traditional education systems, lack of time for curriculum development, and the need to adapt DT to different cultural contexts [24, 25, 26].

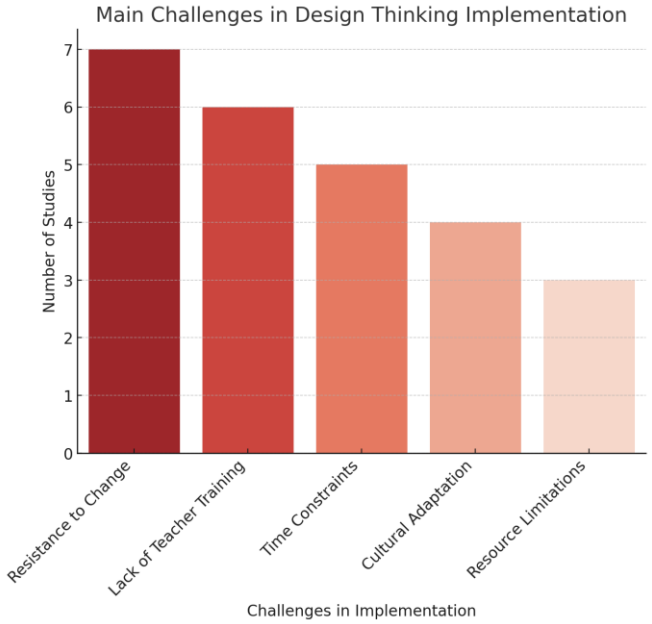

Figure 6. Key challenges in implementing Design Thinking.

Figure 6 summarizes the main challenges in implementing DT and highlights that the most reported problems are resistance to change (seven studies), lack of teacher training (six studies), time constraints (five studies), cultural adaptation (four studies), and lack of resources (three studies). These findings highlight the importance of institutional support, teacher training programs, and flexible implementation models to ensure successful implementation of DT in different educational settings.

It was also found that most studies collected results at the individual level, which is contrary to the collaborative nature of DT. This methodological limitation suggests the need for future research that evaluates the impact of DT from a group or institutional perspective [27].

H. Impact on innovation

Several studies suggest that the integration of DT in higher education promotes the development of innovative solutions and an entrepreneurial mindset in students [28, 29, 30].

The analysis of the reviewed studies confirms that DT has a positive impact on higher education by fostering creativity, problem solving and innovation, as shown in Figure 7. To address the challenges identified, it is essential to strengthen teacher training, ensure adequate resources and promote an interdisciplinary approach. Overall, DT emerges as a key tool to prepare students for the new challenges of the labor market and to foster an innovative mindset in higher education [31, 32].

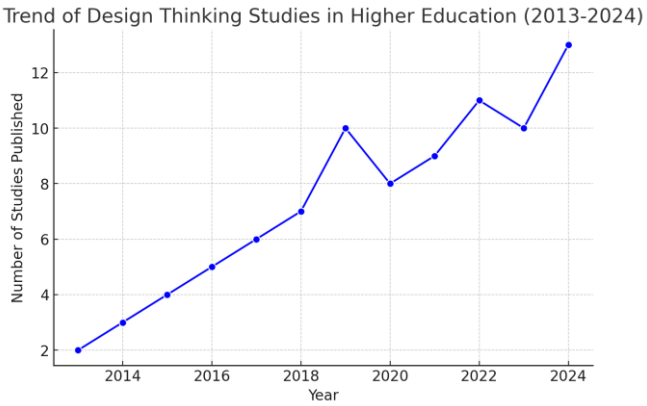

Fig. 7 Trends in Design Thinking studies in higher education (2013-2024).

IV. Conclusions

This study analyzed the implementation of Design Thinking (DT) in higher education and evaluated its coherence and effectiveness in educational innovation. From the analysis of 26 research articles, trends in its application, benefits and limitations were identified.

The results show that DT has been used in different areas of higher education, mainly to develop creative skills, solve problems and apply interdisciplinary methodologies. Its implementation has been flexible, adapting to different pedagogical and structural contexts.

The impact of DT in education is reflected in the improvement of collaboration, critical thinking and problem solving. However, the studies analyzed highlight some challenges in its implementation, such as the lack of teacher training, resistance to institutional change, and variability in its application depending on the discipline. The lack of a

standardized model was also noted, making it difficult to accurately measure its impact.

To improve the application of DT in higher education, it is necessary to strengthen teacher training, establish more structured implementation criteria, and develop rigorous evaluation methods. The information obtained in this study can serve as a basis for future research and improvements in the integration of DT in educational settings.

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