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Research Article

Design Thinking Approach for Better User Experience: A Systematic Review

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Abstract.

Design thinking works well in user experience (UX) design, but there are few empirical studies on it. Thus, a systematic literature review is needed to understand the research topic better and recommend future research. The review followed the PRISMA 2020 Statement. The selected database is Scopus as it covers reputable publications. The search terminology is "design thinking" AND "experience" OR UX AND app OR application. The final set consisted of 10 publications. According to the Scopus Database, there was a significant increase in research studies on this topic from 2012 to 2022. The trend has continued to increase, indicating that research on design thinking approaches in UX design has become a hot topic for research and discussion. This paper found that Design Thinking is an essential component of user experience design and is used across various topics and industries. However, graphic design remains an unexplored area for research, presenting opportunities for further study.

Keywords: design thinking, user experience, systematic literature review

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1. Introduction

Design thinking is a popular problem-solving method (1). Cited by Lo et al. (2019), design thinking was titled design science in the 1960s. Developed in the 1980s, the recognition model outlines the attitude and thinking throughout product creation. Lately, four design firms merged to form IDEO in 1991 and established design thinking globally.

Many user experience (UX) designs use its principles to improve digital products and services. Design thinking in UX design is successful depending on the researchers' background, the design process's efficiency, and the research's effectiveness. This systematic review examines how design thinking is used in UX design or prototyping.

Design thinking works well in UX design, but few empirical studies exist. Thus, a systematic literature review is needed to understand the research topic better and recommend future research. A key part of systematic reviews is a methodological

approach that is organised, repeatable, and transparent (3). The primary objective of this study was to find academic literature that has studied the design thinking approach to creating user experiences in mobile or web-based applications. Three Three sub questions can answer the research question: (1) What researchers' subject area and context are covered in the literature, (2) How design thinking is used in User Experience design projects, (3) How to design a user experience research effectively. This paper provides a brief explanation of design thinking for lay readers.

2. Research Methods

A systematic literature review method was selected to answer the research questions. An electronic search strategy was developed. The selected database was Scopus as it covers reputable publications. Based on the research aims, the search terminology ("design thinking" AND "experience" OR UX AND app OR application) was used on 14 March 2023 to search full-text journal articles in Scopus databases. The final set consisted of 10 publications. The screening was done using NVivo12 software. The criteria are scholarly journal articles written in English and open access. The author collected, categorised, and analysed the data using NVivo12. The review followed the PRISMA 2020 Statement (4). The analysis uses qualitative content analysis.

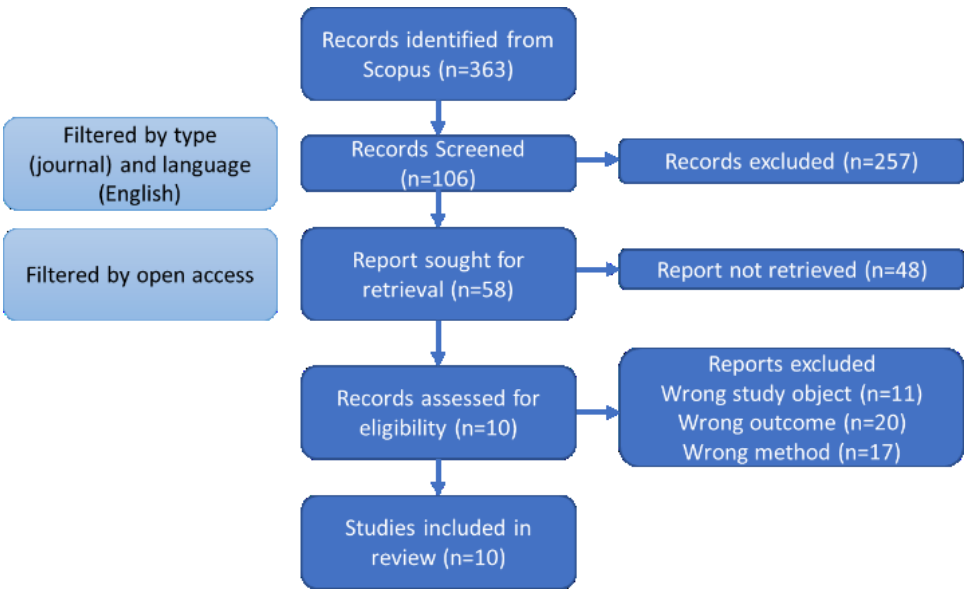

Figure 1: Screening flow.

3. Results And Discussion

The diagram in Figure 2 (A) depicts data on research publications related to the design thinking approach in UX design. The graph shows that between 2001 and 2012, few publications were found in the Scopus database using the inputted keywords. However, from 2012 to 2022, there was a significant increase in research studies on this topic in the past ten years. The trend has continued to increase, indicating that research on design thinking approaches in UX design has become a hot topic for research and discussion.

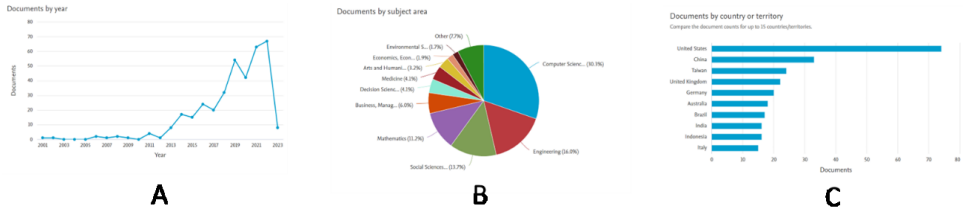

Figure 2: (A) Documents by year; (B) Documents by subject area; (C) Documents by Country.

Figure 2 (B) illustrates the distribution of documents by subject area. The pie chart shows that the dominant subject area is Computer Science (30%), followed by Engineering (16%) and Social Science (13%). Interestingly, the chart also reveals that the subject area of Graphic Design (art and humanities) is very rarely studied, as it appears to have a very small slice of the pie. This suggests that Graphic Design is an area that has yet to be explored in research, and there may be opportunities for researchers to investigate this field further. Figure 2 (C) illustrates that the research majority comes from the United States, China, and Taiwan. The authors' subject areas of health science, medicine, nursing, art and design, and psychology are mostly covered in the literature.

A word cloud of abstracts from the included studies is depicted in Figure 3. From the word cloud, it can be inferred that the design thinking approach is a methodology that centres on people and their needs. Its primary objective is based on users' perspectives and requirements. This approach is commonly applied in the health sector to create applications (apps) that offer customised support to users based on their preferences. By giving priority to user experience, the apps can be developed to be more efficient.

Table 1 shows the included studies, including context, keywords, and methods. The research question "How design thinking is used in User Experience design projects" can be answered based on ten included studies. The keywords suggest that design thinking is essential to user experience and is used across various topics and industries, e.g.,

Figure 3: Word cloud of abstracts from the included studies.

mangrove ecology, class learning assistive systems, telemedicine, and other health-related goals. One of the key components of design thinking is mapping user experiences to identify opportunities for improvement. This involves understanding human factors, lived experience, and multidisciplinary collaboration. The keywords Human-centered design (HCD), user-centred design, and co-design are included in the design thinking study.

Depending on the UX project, design thinking can be applied in various ways. For example, a study by Chai-Arayalert and Puttinaovarat (2020) analysed data from potential users and used a design thinking process to ensure that actual problems or requirements were understood when designing a mangrove ecology self-learning application based on the micro-learning approach. Whereas a study by Lawrence et al. (2022) used Design Thinking to identify (1) medical learners' experiences, needs, preferences, and concerns, (2) critical issues in the existing virtual health training environment, and (3) several alternative solutions and detailed prototypes.

Finally, to answer the research question "How to design a user experience research effectively", this study reviews the methods of Design Thinking used in the included studies. Design thinking is a problem-solving approach commonly used in User Experience (UX) design projects to create solutions that meet the users' needs. A five-step design thinking approach (consisting of empathy, define, ideate, prototype, and test steps) is commonly used in UX design projects (5–9). However, those steps usually involve qualitative interviews or focus groups. A study adapted Shifra's human-centred design process for a Design Thinking Process, which includes empathising & defining, ideating & design, and launching & sharing (10). Another study used a participatory case study that involved the application of a design-thinking process (11).

Table 1: The included studies.

Authors and year	Scope/ context	Abstracts	Methods
Chai-Arayalert S, Puttinaovarat S., 2020 (5)	mangrove ecology self-learning application	Design thinking; Mangrove ecology; Micro-learning	5 stages of Design Thinking
Sam J, Richardson CG, Currie LM., 2022 (12)	Application of Two-Eyed Seeing in Adolescent Mental Health	adolescence; Indigenous methodologies; information and communication technology; mental health	a Two-Eyed Seeing perspective to integrate Indigenous and human-computer interaction methodologies to identify end-user preferences
Tung FW, 2021 (11)	Rediscovering herb lane: Application of design thinking to enhance the visitor experience in a traditional market	Design thinking; Multidisciplinary collaboration; Research through design; Tourist experience; Traditional market	a participatory case study that involved the application of a design-thinking process
Lawrence K, Cho J, Torres C, Alfaro-arias V., 2022 (6)	Building Virtual Health Training Tools for Residents	Design Thinking; graduate medical education; human-centered design (HCD); telemedicine; user-centered design; virtual health	model of “Empathise, Define, Ideate, Prototype, and Test” via a mixed methods approach
Puebla C, Fievet T, García J, Tsopanidi M, Clahsen H., 2022 (7)	a smartphone app prototype	App prototype; Germany; Human factors; Older language learners; User-centered design	5-step design-thinking model conducted in three phases: (I) need-finding, (II) Brainstorming and (III) Prototyping
Hou IC, Lan MF, Shen SH, Tsai PY, Chang KJ, Tai HC, et al., 2020 (8)	a mobile health app for breast cancer self-management support	Breast cancer; Design thinking; Mobile health application; Self-management	A 5-step design thinking approach, comprising empathy, define, ideate, prototype, and test steps, was used in the focus groups and individual interviews
Jarman HK, McLean SA, Rodgers R, Fuller-Tyszkiewicz M, Paxton S, O’Gorman B, et al., 2022 (13)	Informing mHealth and Web-Based Eating Disorder Interventions	app-based intervention; co-design; design thinking; eating disorders; interviews; lived experience; mHealth; mobile health; young women	incorporated a design thinking approach with traditional qualitative interview research.
Lo JS, Lo CH, Huang SC, Wang WC., 2019 (2)	a class assistance system for hearing-and speech-impaired people	Class learning assistive system; Hearing and speech impairment; User experience	Design thinking and user experience
Nimmolrat A, Sutham K, Thinnukool O., 2021 (9)	Patient triage system for supporting the operation of dispatch centres and rescue teams	Dispatch centre; Emergency development system; Emergency medical services; Mobile application; Triage	5 stages of Design Thinking
Bartlett R, Boyle JA, Simons Smith J, Khan N, Robinson T, Ramaswamy R., 2021 (10)	a healthcare app for refugee communities	Design thinking; Evaluation; Human-centred design; Refugee health	Design Thinking Process Adaptation for Shifra’s human-centred design process: empathise & define, ideate & design, launch & share

4. Conclusion

Design thinking is a popular method for developing user experiences across multiple industries. Although there are limited empirical studies on the subject, analysing existing literature systematically can help researchers comprehend the research domain and make recommendations for future studies. A design thinking approach with qualitative research is essential to ensure the effectiveness of the UX design projects and fulfil users' needs. Interestingly, this study indicates that Graphic Design remains an unexplored area for research, presenting opportunities for further exploration. As the novelty is obtained through primary data, this paper can be a foundation for further research. A future study might use a design thinking approach to design a web-based application of a colour palette, logo, or packaging design generator.

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