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Exploring the dynamics of design thinking in management education and training: a critical review, taxonomic analysis and practical implications

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Arushi Bathla and Ginni Chawla
Indian Institute of Foreign Trade, New Delhi, India
Mahrane Hofaidhllaoui
ESSCA School of Management, Lyon, France, and
Marina Dabic
Faculty of Economics and Business, University of Zagreb, Zagreb, Croatia;
Department of Economics and Business, University of Dubrovnik, Dubrovnik, Croatia and
School of Economics and Business, University of Ljubljana, Ljubljana, Slovenia

Abstract

Purpose – Applying critical analysis as the methodological framework for assessing the literature, the review seeks to present a summary and evaluation of the existing body of knowledge. This approach helps to establish the basis for developing forthcoming recommendations.

Design/methodology/approach – The articles were selected through a Systematic Literature Review following the PRISMA guidelines, and utilising Scopus, Web of Science, Science Direct, and the Education Resources Information Center database. Field taxonomy is presented based on the outcomes.

Findings – Through a critical review, we offer narrative arguments that document the shortcomings in the existing literature by scrutinising study designs and highlighting suboptimal approaches. Finally, we issue a call to action for future research, envisioning its potential to reorient and reconstruct the field while enhancing the quality of future studies. This proactive stance aims to foster the development of more competent and insightful perspectives, theories, and policy recommendations within design thinking in management education and training.

Practical implications – The research in this field holds significant potential for providing valuable practical and policy insights, contingent upon the rigorous and thorough execution of studies.

Originality/value – This article presents a robust critical review of 57 state-of-the-art articles investigating design thinking in the context of management education and training.

Keywords Design thinking, Management, Education, Training, Critical review, Taxonomy

Paper type Literature review

Introduction

There is an urgent need for management education and training to react and address the contemporary demand of implementing design thinking (DT) in management education

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(Çeviker-Çınar *et al.*, 2017; Dantas de Figueiredo, 2021; Barta *et al.*, 2022; Das *et al.*, 2024). In response to this demand, management research and education have drawn inspiration from DT—a methodology encompassing reflective and innovative activities grounded in empathy (Brown, 2008), and recognized as a creative form of inquiry and knowledge (Katz-Buonincontro, 2015). DT provides a holistic, abductive, and abstract understanding of the world based on context, imagery, and emotions. In contrast, management's ontological and epistemological position is primarily rooted in the objective, inductive, and deductive understanding of the world (Bandera *et al.*, 2020; Chouki *et al.*, 2021). DT is an essential strategy for engaging with complex challenges through systematic analysis, intuitive thinking, and socio-cognitive approaches, contributing to academic and professional excellence (Glen *et al.*, 2014). It consistently enhances creativity, problem-solving, and communication skills (Yalçın and Erden, 2021) while also acting as a catalyst for innovation, in fields such as business, technology, education, and healthcare (Rösch *et al.*, 2023). In education, DT is acknowledged as a potent pedagogical tool, enabling students to evolve into problem solvers, critical thinkers, and effective communicators. It encourages thinking not just "out of the box" but even "without a box." The implementation of a Design Thinking Mindset in educational environments is crucial for addressing complex challenges, also known as wicked problems. Nevertheless, there is a notable lack of a well-defined explanation and measurement method for the Design Thinking Mindset. To bridge this gap, Vignoli *et al.* (2023) developed and validated a specialised scale designed to assess the Design Thinking Mindset. Recently, universities and accreditation agencies have been pivotal in education and training (Mitra *et al.*, 2018), preparing learners for emerging professions and equipping them to tackle challenges not yet recognized as problems using undiscovered technologies (Tarabasz *et al.*, 2018). For example, the Association to Advance Collegiate Schools of Business (AACSB), the globally recognised accreditation body for business and management education, recently endorsed an updated set of accreditation criteria for business schools (Wang and Wang, 2011). This includes "Design Thinking for Creativity and Innovation," in the "Curriculum Design and Development Series" (Benson and Dresdow, 2014). Both academia and industry have accorded significant importance to integrating DT in management education and training (Dunne and Martin, 2006). Consequently, research in this domain has experienced substantial growth, yielding compelling findings (Glen *et al.*, 2014). These studies have demonstrated that DT empowers instructors to establish an inclusive learning environment conducive to nurturing 21st-century competencies among learners (Selvalakshmi *et al.*, 2022). Consequently, DT has emerged as a promising avenue with positive implications that management educators and trainers can and should leverage.

However, the effective implementation of educational and training practices integrating design thinking perspectives and mindset in business and management education remains a question that requires further thorough and more critical research (Magalhaes, 2020). Regrettably, the existing research in DT in management education and training appears somewhat fragmented and piecemeal. The literature is predominantly characterised by relatively small and exploratory studies, lacking a cohesive framework. This fragmentation is in contrast to the standard research approach, which emphasises the importance of a unifying framework, model, or taxonomy for a comprehensive understanding of the field (Hughes *et al.*, 2018). Moreover, the rapid growth of research in this domain underscores the need for meticulous consideration and evaluation of fundamental concerns. This involves ensuring the use of study designs that are not only suitable but also rigorous, thereby, elevating the overall quality of the research endeavours in this area.

In 2022, a meticulous examination of numerous papers using DT in management and business education/training prompted the authors to engage in internal and external discussions with peers in the field. Despite attempts to identify works offering practical guidance and insights to meet scholars' needs, a notable gap emerged—a lack of

comprehensive and straightforward analyses regarding the effective implementation of DT in management education and training. This recognition prompted a more formal study on the subject, aiming to present findings and proposals at academic conferences, research seminars, and discussions with experts in the design thinking domain. The initial frustration with the scarcity of available content evolved into a determined commitment to address this gap, ultimately leading to efforts to craft this article. Previous research on DT, and management education and training has simply summarised the existing body of literature (Bandera *et al.*, 2020; Dantas de Figueiredo, 2021). A few authors, have however, undertaken empirical work, including workshops, exercises, interventions, and trials, among others (Selvalakshmi *et al.*, 2022). The two issues mentioned—lack of a parsimonious framework and conceptual tensions arising from a lax evaluation of the current state-of-the-art literature—underscore the need for a thorough critical review. The paper's objectives are twofold: firstly, to systematically synthesize existing research in the field, presenting a taxonomy encompassing context, process, and outcome. This establishes a structured framework for subsequent investigations towards a more comprehensive and organized approach. Secondly, the paper aims to undertake a critical assessment of the literature's quality to date. This involves identifying potential significant errors in study design that compromise the field's credibility. Subsequently, pragmatic guidance and an action plan are provided to enable future research to transcend these limitations. Failure to address these issues may compromise the scientific and practical value of research in the field of DT in management education and training. In the examination of the literature, a combination of systematic and critical narrative methods is applied, as outlined by Wright and Michailova (2022) and Dabić *et al.* (2022). Thus, this paper adds to the scholarly literature on DT and management education and training by (1) advancing conceptual understanding of the field; (2) highlighting key issues/gaps in order to provide an integrated road-map of future recommendations/agenda. This critique endeavours to examine the subject from a fresh perspective and aims to contribute to the reorientation of the discipline. The goal is to ensure that future insights are more robust and carry substantive policy and theoretical implications. The article is structured as follows: Methodology, Critical review, Discussion, Implications, Conclusion, Limitations and Future scope.

Methodology

Elements

The core components of the comprehensive review, as outlined by Dabić *et al.* (2021), involve conducting a Systematic Literature Review (SLR) as the chosen review type, with specific emphasis on exploring the concept of DT within management education and training (Kraus *et al.*, 2022). Employing critical analysis as a methodological toolbox for literature evaluation (Donthu *et al.*, 2021), the review aims to provide an overview and assessment of the current state of knowledge, ultimately laying the groundwork for future recommendations.

Search string

Conducting an SLR in accordance with the PRISMA guidelines (Graham and MacFarlane, 2021) and employing inductive reasoning considerations (Kraus *et al.*, 2022), this review seeks to systematically identify, categorize, and select pertinent papers within the domain of DT, and management education and training. To ensure a comprehensive search, Scopus, Web of Science, Science Direct, and the Education Resources Information Center database are utilized to comprehensively filter relevant papers. We also searched Global Entrepreneurship Monitor (Lepoutre *et al.*, 2013) for data on education and entrepreneurial training; however, we could not find relevant papers adhering to our inclusion and exclusion criteria. However,

this database was found lacking on data on entrepreneurial training and education. The choice of these databases aligns with the approach adopted in previous SLRs within the domain of design (Bhandari, 2023) and education (Galvão *et al.*, 2018).

The search used the following query: ("design thinking" AND ("management training" OR "management education" OR "business education" OR "training and development")), restricted to the title, abstract, and keywords (Dabić *et al.*, 2022). Additionally, inclusion and exclusion criteria, as specified in Table 1 by Hosany *et al.* (2022), were applied.

This approach resulted in identifying 57 relevant articles for the current study. Details on the data curation process are provided in Figure 1, followed by guidance recommendation (Kraus *et al.*, 2022).

Approach to critical literature review (CLR)

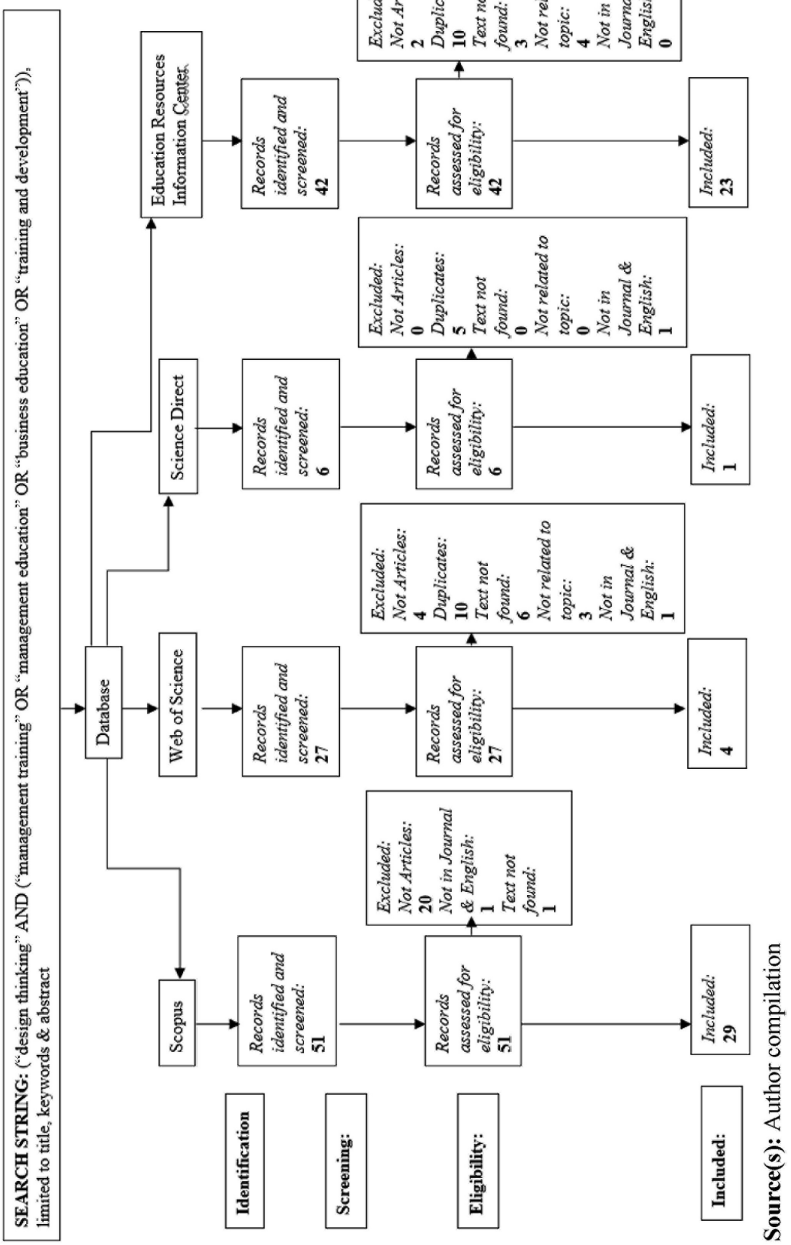
Lately, there has been a noticeable surge in interest around critical review articles (Kunisch *et al.*, 2018; Post *et al.*, 2020). Within organisation and management theory (OMT), the recognition of critical review as a distinct genre in literature review is also a recent phenomenon (Snyder, 2019). Upholding the original definition of the term "critical" and its variations, which prioritize the act of judgement (Graeff, 1983), this paper remains committed to this perspective in the subsequent critique. The term "critical" stems from the Greek word "kritikos," signifying reasoning, judgement, analysis, perception, and examination. This interpretation is a focal point that will be further elaborated upon in subsequent article sections. The overarching objective of this paper is to contribute to the existing body of literature by challenging beliefs, conclusions, habits, ideas, and norms (Weatherall, 2019). It aspires to extend studies that promote more critically informed and advanced scholarship (Millar and Price, 2018) while advocating for meaningful engagement in a dialectical interrogation system with the text and material encountered (Alvesson and Sandberg, 2013). Dialectical inquiry facilitates a form of deep analysis, examination and questioning that is committed to making critical decisions (Alvesson and Sandberg, 2013). In simple terms, it informs how critiques can be accomplished. To engage in dialectic interrogation, we pursued bi-directional interrogation through continuous reflexive questioning and mapping of interpretations and evaluations of the texts we read. To accomplish dialectical inquiry, we adopted the problematization (Wright and Michailova, 2022) approach. This approach involves a conscientious analysis and critical examination of every article and ensures that a stringent and challenging attitude is embraced through-out, which means continuously questioning the arguments, beliefs and assumptions in the article assessed (Alvesson and Sandberg, 2013).

Two authors meticulously scrutinised each of the 57 articles, systematically documenting instances where assumptions were unexplained or when relevant assumptions were subject to questioning. Their analysis identified missing content, potential reverse directionality of relationships, and methodological errors, including issues related to construct clarity, methods, sample units, sample size, constructs, processes, accuracy, validity, and reliability.

Inclusion criteria	Exclusion criteria
Time period – no limit	Text not available
Subject area – no limit	Manual Screening by authors jointly to remove paper not related to the topic
Document type – article	
Publication stage – final	
Source type – journal	
Language – english	

Source(s): Author compilation

Table 1. Inclusion and exclusion criteria



Source(s): Author compilation

Figure 1.
Data curation process

Articles exhibiting such concerns were segregated and distinctly marked in a designated folder, accompanied by critical reflections that featured fresh insights and assertive judgements by the first author. These critical reflections and detailed summary notes served as the foundation for creating the initial draft of this research study. Simultaneously, other authors were requested to rigorously question perceptions, interpretations, and intricate conceptualisations and understandings (Rerup and Feldman, 2011).

The bi-directional nature of dialectic conversations during this process prompted ongoing questioning of reviews and introspections on the implications of such questioning. This iterative procedure ultimately led to a unified and conclusive judgement (Wright and Michailova, 2022).

Critical literature review

In adopting a critical stance, integrating the "creative destruction" ethos (Wright and Michailova, 2022) is proposed for DT processes within the management education and training literature. Over the past decade, extensive efforts have been dedicated to advancing the understanding of these processes, contributing significantly to the field's current state. Acknowledging and appreciating these endeavours is crucial. However, the potential to deepen comprehension appears to be limited by persisting on the established trajectory cultivated over several years. Rather than adhering solely to the existing status quo, research will gain significantly from a critical examination of inconsistencies and contradictions within the DT processes in management education and training.

A consolidated taxonomy—a structured framework facilitating an understanding of concepts and relationships (Glass and Vessey, 1995)—is initially presented through an analysis of the burgeoning yet nascent body of literature. Figure 2 elucidates how DT in

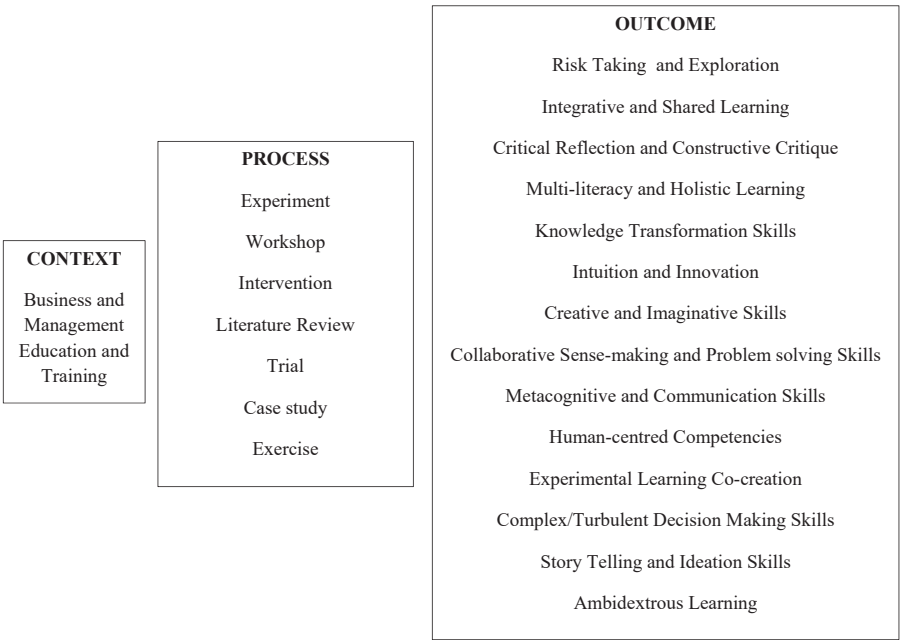


Figure 2.
Design thinking in management education and training taxonomy

Source(s): Author compilation

management education and training contributes to outcomes, such as creativity, innovation, and shared learning.

Notably, the increasing recognition of DT in educational and training contexts for addressing twenty-first-century challenges is evident (Çeviker-Çınar *et al.*, 2017), reflected in the burgeoning number of studies. The acquisition of knowledge about and through DT appears to foster the integration and enhancement of problem-solving, critical thinking, and digital literacy skills (Vallis and Redmond, 2021). A descriptive profile of the field is presented in Table 2.

As stated in the study objectives, this research scrutinizes the study designs employed in the field to identify potential contradictions. The analysis includes assessing whether the articles align with the claims made by the authors, investigating the rationale behind the adoption of specific methods, approaches, or techniques and exploring why alternative methods were not chosen. Additionally, this study explores any drawbacks of the methods,

S. no.	Description	No. of papers	Papers
1	Teaching approach or method or pedagogy or technique	20	Chongwatpol (2020), Gotzsch (2017), Kainzbauer and Lowe (2018), Selvalakshmi *et al.* (2022), Pande and Bharathi (2020), Sheehan *et al.* (2018), Vijayakumar Bharathi and Pande (2019), Wang and Wang (2011), Welsh and Dehler (2013), Biffi *et al.* (2017), McDonald *et al.* (2019), Cummings and Yur-Austin (2022), Das and Nguyen (2019), Wrigley and Straker (2017), Larson *et al.* (2019), Thacker and Berardi (2021), De Waal and Maritz (2022), Zafar *et al.* (2023), Shahrasbi *et al.* (2021), Junior *et al.* (2020)
2	Core topic or course	8	Bhalla (2019), Lugmayr *et al.* (2014), Nielsen and Stovang (2015), Parris and McInnis-Bowers (2017), Schumacher and Mayer (2018), Solodikhina and Solodikhina (2022), Vallis and Redmond (2021), Zapata-Ramos (2020)
3	Workshops	4	Lugmayr *et al.* (2014), Pande and Bharathi (2020), Sheehan *et al.* (2018), Vijayakumar Bharathi and Pande (2019)
4	Experiment or intervention or trial	9	Bautista-Arredondo *et al.* (2018), Gotzsch (2017), Selvalakshmi *et al.* (2022), Solodikhina and Solodikhina (2022), Vallis and Redmond (2021), Wang and Wang (2011), Welsh and Dehler (2013), Lin *et al.* (2019), Chen *et al.* (2018b)
5	Design thinking case studies	5	Chongwatpol (2020), Gerlitz *et al.* (2016), Lancione and Clegg (2015), Sheppard (2020), Withell and Haigh (2018)
6	Design thinking exercises	6	Kainzbauer and Lowe (2018), Schumacher and Mayer (2018), Stock *et al.* (2018), Bodine *et al.* (2021), Meepung and Pratsri (2022), Foster (2021)
7	Review	18	Bandera *et al.* (2020), Benson and Dresdow (2014), Çeviker-Çınar *et al.* (2017), Dantas de Figueiredo (2021), Dorst (2011), Magalhaes (2020), Sathya (2020), Tarabasz *et al.* (2018), Zheng (2018), Zidulka and Kajzer Mitchell (2018), Earle and Leyva-de La Hiz (2021), Wastell (2014), Glen *et al.* (2014), Ewin *et al.* (2017), Walsh and Powell (2020), Donar (2011), Cualheta and Abbad (2021), Matthews and Wrigley (2017)

Source(s): Author compilation

Table 2.
Descriptive profile

such as biases, generality, and reliability, and how the authors have addressed these challenges. Table 3 presents a breakdown of the general problems identified across papers, and categorised into five groups, which will be discussed in detail in the paper.

Inconsistent use of terminology

The terminology within the discourse has been observed to be somewhat equivocal. The lack of precision in terminology usage may undermine the reliability and methodological rigour of the measurement methods and tools available to researchers and authors, potentially hindering the realisation of the field's full potential. Consequently, there is an imperative to exercise precision in terminology usage and to develop new tools and methods that provide accurate and requisite measurement of these terminologies (Hughes *et al.*, 2018).

To illustrate, Dorst (2011) initially framed his title as "The core of 'design thinking' and its application," but towards the conclusion of the article, he asserted, "This paper has concentrated on frame creation as a core practice that is particular to the designing disciplines, and explored how that design practice could interface with an organisation" (p. 531), transitioning from DT to a broader concept of designerly thinking. Another instance involves Zidulka and Kajzer Mitchell (2018), who initially addressed the forms and modes of creativity that disrupt relationships of "power and dominance"; however, later, they altered the vocabulary to disrupt the "status quo". The literature on theoretical conceptualisations of power and dominance diverges from discussions on the status quo. Such inconsistencies pose challenges for scholars navigating the literature.

Addressing these concerns is crucial because the advancement of DT in management education and training research may be impeded if ambiguous or inconsistent terminology persists.

Claim specificity

Clarity in the specificity of claims is essential to ascertain whether authors have fulfilled their stated objectives and contributions in their studies. For instance, Dantas de Figueiredo (2021) articulated that "The purpose of this section is to establish the antecedents of this (design

S. no.	Comment	Citations
1	Inconsistent use of terminology	Dorst (2011), Zidulka and Kajzer Mitchell (2018)
2	Claim Specificity	Dantas de Figueiredo (2021)
3	Lack of in-depth description of the methodology	Bhalla (2019);Chongwatpol (2020), Lugmayr *et al.* (2014), Selvalakshmi *et al.* (2022), Parris and McInnis-Bowers (2017), Schumacher and Mayer (2018), Vallis and Redmond (2021), Cummings and Yur-Austin (2022), Larson *et al.* (2019), Thacker and Berardi (2021), Junior *et al.* (2020)
4	Lack of supporting arguments for the methodology	Selvalakshmi *et al.* (2022), Pande and Bharathi (2020), Parris and McInnis-Bowers (2017), Tarabasz *et al.* (2018), Vallis and Redmond (2021), Biffi *et al.* (2017), Ewin *et al.* (2017), Sheppard (2020), Dorst (2011), Withell and Haigh (2018), Zapata-Ramos (2020), Stock *et al.* (2018), Meepung and Pratsri (2022), Foster (2021), McDonald *et al.* (2019), Das and Nguyen (2019), Shahrasbi *et al.* (2021), Wrigley and Straker (2017), De Waal and Maritz (2022)
5	Lack of rigorous and comprehensive theoretical backgrounding	Parris and McInnis-Bowers (2017), Solodikhina and Solodikhina (2022), Zheng (2018)

Table 3.
General problems

Source(s): Author compilation

thinking) movement in the works of Simon (1967, 1969) to understand the potential of the design perspective to influence management education, in the sense of integrating theory and practice." However, the paper should have provided consolidated and distinct antecedents for management education and training; instead, it focuses solely on the evolution of DT in management education. Scholars may benefit from adopting a more rigorous approach, such as the Antecedents, Precedents, and Outcomes (ADO) framework (Tonelli *et al.*, 2018).

Lack of in-depth description of the methodology used

Some studies omit details on how they designed proposed pedagogies using DT in management education and training. This creates ambiguity, leaving an open ground for assumptions about the use of theoretical literature, expertise from academic peers, and personal practical experience, which might be challenging for inexperienced scholars (Chongwatpol, 2020; Selvalakshmi *et al.*, 2022). Furthermore, instances were noted where authors did not explicitly mention the methods they had employed such as sampling strategies (Cummings and Yur-Austin, 2022; Larson *et al.*, 2019; Thacker and Berardi, 2021; Junior *et al.*, 2020), manual coding or software-based analyses, or any other technique used to derive the outcomes (including principles, themes, codes, time slots/durations, models, course structures, among others). Noteworthy examples include Bhalla (2019), Dorst (2011), Lugmayr *et al.* (2014), Parris and McInnis-Bowers (2017), Schumacher and Mayer (2018), and Vallis and Redmond (2021). Additionally, aspects of instrument validity, such as survey validity, reliability, and pilot testing, were occasionally omitted (Thacker and Berardi, 2021), among other methodological issues. The lack of a clear and comprehensive description of the methodology, techniques, or tools employed in the research may impede scholarly contributions to advancing the field.

Lack of supporting arguments for the methodology used

Methodological rigour and precision in measurement constitute foundational elements in any discipline, serving as the bedrock for all empirical endeavours by ensuring the creation of clear, reliable, and efficient study procedures (Hughes *et al.*, 2018). During our review of articles, we identified instances where a more explicit description and justification of methods against opposing or alternative approaches were warranted.

For example, Selvalakshmi *et al.* (2022) opted for a small intervention study rather than a comprehensive experimental study, typically considered the norm and gold standard in scientific research (Hughes *et al.*, 2018). To yield meaningful policy suggestions, it is necessary to advance by designing methods capable of delving deeper into the phenomena under investigation. Experimental methods, recognized for mitigating endogeneity biases and offering valuable evaluations of causal relationships, present a robust research design (Antonakis *et al.*, 2010).

Moreover, certain studies employed specific techniques or models, such as case studies or the GROW model, without explicitly addressing why other approaches, such as the studio model, flipped classroom, or project-based learning, were not considered (De Waal and Maritz, 2022; Selvalakshmi *et al.*, 2022; Pande and Bharathi, 2020) when these alternatives are highly regarded in DT research. Additional concerns included the type, focus, and considerations for reviews (Ewin *et al.*, 2017), the use of convenience sampling (Withell and Haigh, 2018; McDonald *et al.*, 2019), insufficient sample sizes (Biffi *et al.*, 2017; Meepung and Pratsri, 2022; Das and Nguyen, 2019), and the application of specific analysis methods (Shahrasbi *et al.*, 2021; Wrigley and Straker, 2017), such as sentiment/emotion analysis of textual data versus the more advanced AI-based video analysis of emotions, body movements, and behaviours (Sheppard, 2020).

A notable omission in previous research pertains to the detailed description of how a particular exercise (Foster, 2021) has been designed and its validity (Stock *et al.*, 2018). In these cases, authors

have not addressed potential drawbacks or outlined solutions for their chosen methods. Several studies, including Selvalakshmi *et al.* (2022), Parris and McInnis-Bowers (2017), and Vallis and Redmond (2021), utilized student feedback/reflective essays without adequately addressing potential placebo effects or biases in the study findings. Biases were also seen in research exploring specific case studies related to business schools (Tarabasz *et al.*, 2018). Existing research fails to comprehensively explain why a particular approach was chosen over possible alternatives and how it could assist future scholars in overcoming challenges or addressing gaps.

Lack of rigorous and comprehensive theoretical backgrounding

Methodological rigour and precision in measurement constitute foundational elements in any discipline, serving as the bedrock for all empirical endeavours by ensuring the creation of clear, reliable, and efficient study procedures (Hughes *et al.*, 2018). During the review of articles, instances were identified where a more explicit description and justification of methods against opposing or alternative approaches were lacking. Based on the analysis of the review text judgements were made regarding the authors' onto-epistemological stance. Authors' positions is acknowledged when clearly stated; in cases where they were not, the decision was based on the delivery or framing of the central theme. Although assessments may differ, epistemological claims were deemed credible after an exhaustive reading of the texts. Following this, certain claims were pondered, which were made based on assumptions that were not explicitly theoretically backed; for instance, Zheng (2018) stated that "in the context of this research, to be particular, the author assumes that DT influences learning behaviour and eventually affects innovation." However, the article falls short of elaborating on the theoretical underpinnings of such assumptions in the model.

Similarly, Solodikhina and Solodikhina (2022) created a DT chart presenting the optimum motivation, while the article did not account for the support of any motivation theories. Another interesting possibility was the exploration of reverse relationships. In their study, Parris and McInnis-Bowers (2017) discussed how casual managerial thinking led to effectual entrepreneurial thinking while training the mindset of a socially conscious practitioner (sustainability changemaker and design thinker). However, effectual entrepreneurial thinking may likely lead to casual managerial thinking, as both modes are interwoven and iterative.

Discussion

Despite the burgeoning demand in industry and academia for DT and its significant potential in shaping creative and engaging pedagogies for education and training, ongoing debates persist on effectively imparting DT education (Schumacher and Mayer, 2018). A potential source of this conflict and ongoing discourse may be the absence of concrete, in-depth practical implementations, resulting in a need for a clear and intricate procedure for teaching and training in multidisciplinary approaches (Selvalakshmi *et al.*, 2022). This absence, in turn, creates a sense of uncertainty among educators and academicians when teaching or training for DT (Schumacher and Mayer, 2018).

This paper aims to provide a comprehensive taxonomy, offering a structured framework to the existing body of literature. It elucidates how future studies can enhance this critical research domain, advancing it in a structured, systematic, comprehensive, and robust manner to overcome existing challenges. By departing from the contingency orthodoxy approach, this article contends that perspectives on study design, informed by accumulated knowledge over the years, can be combined to form a new creative and intellectual foundation grounded in the principles of astute experimentation. Following an analysis of current approaches in the field, as depicted in Table 4, the results elicit specific calls and recommendations for future research study designs, deemed crucial for advancing the domain.

S. no.	Description	No. of papers	Citations
1	Randomized experimental designs	2	Bautista-Arredondo *et al.* (2018), Selvalakshmi *et al.* (2022)
1.a.i	Compared design thinking intervention to a pertinent and proactive comparative condition	3	Bautista-Arredondo *et al.* (2018), Selvalakshmi *et al.* (2022), Solodikhina and Solodikhina (2022)
1.a. ii. first	Employed empirical testing on real life business or managerial challenges	2	Biffi *et al.* (2017), Sheppard (2020)
1.a. ii. second	Used corporate professionals as clients or partners in pedagogy design	2	Parris and McInnis-Bowers (2017), Biffi *et al.* (2017)
1.a. ii. third	Used field research for their design thinking courses or off campus training	1	Parris and McInnis-Bowers (2017)
1.a. ii. fourth	Used real life assessments and evaluations techniques	1	Nielsen and Stovang (2015)
1.a. ii. fifth	Made changes to physical space	1	Nielsen and Stovang (2015)
1.a. ii. sixth	Inspected technological aspects	2	Parris and McInnis-Bowers (2017), Earle and Leyva-de La Hiz (2021)
1.b	Used monetary incentives	0	–
2	Employed a longitudinal design	2	Kainzbauer and Lowe (2018), Biffi *et al.* (2017)
3	Included reflective essays or diary journal	4	Kainzbauer and Lowe (2018), Lugmayr *et al.* (2014), Parris and McInnis-Bowers (2017), Wang and Wang (2011)
	Used qualitative feedback	8	Gotzsch (2017), Sheehan *et al.* (2018), Vallis and Redmond (2021), Vijayakumar Bharathi and Pande (2019), Wrigley and Straker (2017), Biffi *et al.* (2017), Sheppard (2020), Meepung and Pratsri (2022)
	Identify interesting themes	4	Kainzbauer and Lowe (2018), Parris and McInnis-Bowers (2017), Vallis and Redmond (2021), Vijayakumar Bharathi and Pande (2019)
	Used virtual logbooks	1	Nielsen and Stovang (2015)
	Used creative self-exploration techniques	0	–
4	Compared different types of pedagogies/ thinking models theoretically	3	Bandera *et al.* (2020), Nielsen and Stovang (2015), (Glen *et al.*, 2014)
	Compared different types of pedagogies empirically	1	Selvalakshmi *et al.* (2022)
5	Used design thinking immersion for more than 3 days	11	Bautista-Arredondo *et al.* (2018), Chongwatpol (2020), Gerlitz *et al.* (2016), Gotzsch (2017), Kainzbauer and Lowe (2018), Lugmayr *et al.* (2014), Pande and Bharathi (2020), Parris and McInnis-Bowers (2017), Vallis and Redmond (2021), Vijayakumar Bharathi and Pande (2019), Welsh and Dehler (2013)
6	Investigated the role of students as design partners and role of facilitators/ instructors	0	–
7	Employed auxiliary creative exercises	2	Chongwatpol (2020), Kainzbauer and Lowe (2018)
8	Definition and measurement of constructs and/or outcomes	0	–
9	Invited experts for sessions	2	Parris and McInnis-Bowers (2017), Meepung and Pratsri (2022)

Source(s): Author compilation

Table 4.
Current approaches

There is a need for randomised experiments as a study design to enhance methodological rigour (Antonakis and House, 2014). Even though randomised experiments allow for the most reliable and valid research method, it is quite concerning that only two studies in our sample of 57 studies used these protocols. By randomly assigning students and trainees from the population and further allocating each one to differentiated experimental classes, it becomes logical to assume that participants from various groups would be mirrored on most traits. When researchers administer an experimental manipulation to one group and not to another, they can be confident that any variations in results between the two groups are solely due to the manipulation. Nevertheless, we urge researchers to prioritize two vital aspects when planning experiments: determining accurate experimental effects through (1) fair comparisons and (2) mitigating ecological validity concerns.. The question of unfair comparisons pertains to methods that assess an experimental intervention to an inactive control group (Cooper and Richardson, 1986). In these cases, the participants in the intervention group can show substantial impacts due to placebo or expectancy effects. Instead, researchers may compare DT intervention to a pertinent and proactive comparative condition, which accounts for unexpected impacts on findings across treatment groups and approximates the relative effects of a treatment condition compared with a competitive approach (Chambless and Hollon, 1998). Three studies in the sample adhered to such criteria. Further, randomised experimental designs with multiple treatment conditions and a proactive control condition are urged (Boies *et al.*, 2015).

A second significant problem is a long-standing dispute about ecological validity, with critics claiming that experimental designs mostly need to truly simulate organisational settings (Hauser *et al.*, 2017). Undoubtedly, experiments documented in the organisational literature have frequently been criticised for employing unreal tasks and failing to represent genuine interactions. Such critiques are routinely valid, so a few design elements that can assist in alleviating these concerns and produce useful results are proposed. From an ontological standpoint, we argue that business, management education and training is a practise of "becoming" in which the trainee must be subjected to experiences through which (s)he can embrace the ways of thinking, doing, and being representative of their personal or individual experience(s) in the hopes of disseminating knowledge about this practise on a disciplinary basis (Mintzberg, 2004).

Firstly, the importance of incorporating genuine and significant aspects in experiments, mirroring the necessity for originality and creativity in organisational contexts, is emphasised. Creating an environment with real-organisational VUCA (Volatile, Uncertain, Complex and Ambiguous) elements is crucial. This setting allows the skills acquired by management scholars through creative pedagogies to be tested. It is emphasised that considering real-life business problems in DT challenges and ideas is essential for the authenticity of experiments (Vallis and Redmond, 2021). However, despite this consideration, only one study in the sample focused on real-life innovation ideas.

Secondly, future researchers should consider involving corporate professionals as clients or partners in pedagogy design. This approach is advocated to enhance the authenticity and relevance of the study. However, only two studies in the sample sought professional aid in their study designs (Zidulka and Kajzer Mitchell, 2018).

Thirdly, it is endorsed that valuable insights can be unearthed if students engage in real-life settings for their design thinking courses or off-campus training, moving beyond traditional classroom confines. Several authors, including Joshi (2014), advocate for a future beyond conventional classrooms and campuses, emphasizing the incorporation of real context-based classes and activities (Tarabasz *et al.*, 2018). Some innovative business schools, such as the Tokyo Institute of Technology, integrate projects based on real-world challenges into their courses, utilizing design thinking as a crucial toolkit under the guidance of organizations like IDEO. Stanford Design School conducts boot camps applying design thinking methodology to

real-world projects for innovators, leading companies, and non-profit organizations to assist instructors in integrating DT into education and training (Çeviker-Çınar *et al.*, 2017). However, the empirical use of such elements is limited to only one study.

Fourthly, for comprehensive and experiential training and learning sessions, adopting real-life assessment and evaluation techniques in business school's design thinking pedagogies, such as peer assessments, grading, 360 feedback, BARS, and balanced scorecards, could provide valuable insights. This transformative approach may reduce cultural shock resulting from students' transition from business schools to the corporate world and foster a culture of continuous improvement. Additionally, it aligns with the recommendations and requirements of accreditation agencies (e.g. AACSB, ACBSP, and IACBE) and meets the expectations of students, organizations, government, and society. As academicians, the understanding is that employers value community-focused innovative projects, internships, and problem-solving projects, the recommended techniques in design thinking pedagogies (Benson and Dresdow, 2014; Coates and Seifert, 2011). Notably, only one study employed corporate evaluation and assessment techniques in their research, highlighting a potential gap in replicating the reality of organizational settings in business education. Consequently, future research in DT is suggested to address this void (Çeviker-Çınar *et al.*, 2017).

Fifth, the role of physical space in study designs is proposed as it may unveil valuable insights into DT research in management education and training. Elements such as lighting, layout, flexibility, furniture, walls, and resources within the physical environment convey institutions' culture, behaviours, and intentions for their training and learning processes (Oblinger, 2006). Participants should perceive the learning ambience as a sandbox where activities can be worked out, played with, and prototyped. The design of the learning setting and planning of learning in the space are integral aspects (Nielsen and Stovang, 2015). Notably, social learning hangouts at the Hasso Plattner-Institute, in Germany, are highly regarded for fostering collaboration and commitment outside the university context. However, only one study changed the physical space to investigate the impact.

Sixth, trainers have consistently shown that passive lessons and conventional instructional strategies are outdated for today's learners. With active simulation as the tip of the iceberg, dynamic, authentic, AI-infused, omnipresent computing and advanced technology seem crucial for success. The classrooms and campuses of the future, grounded in AI, VR/AR, DT, and innovation labs, are the passport to success in the upcoming digital world (Tarabasz *et al.*, 2018). Despite technological advancements, the rewards of sophisticated collaboration technologies such as virtual and augmented reality have yet to be experienced in educational and training scenarios (Siu *et al.*, 2018; Vallis and Redmond, 2021). However, only one study has inspected the impact of technological aspects in their research (Parris and McInnis-Bowers, 2017), and one study has designed a conceptual model using AR (Earle and Leyva-de La Hiz, 2021). Therefore, a creative cornerstone concept could harmoniously combine these ideas (Tarabasz *et al.*, 2018).

Incentivising participants enhances the external validity of experiments (Hertwig and Ortmann, 2001). In our sample, experimental studies utilized designs with non-consequential tasks in no-stake situations. Motivators, such as instilling competitiveness, awarding certificates of accomplishment, giving performance evaluations, team-member approval scores, and monetary pay-outs are used to strengthen ecological validity of the studies (Lönnqvist *et al.*, 2011). Monetary rewards are incredibly popular as they increase students/trainees' probability of perceiving the task as meaningful and experiencing genuine emotional responses (Falk and Heckman, 2009). Nevertheless, researchers are encouraged to use monetary rewards with caution when studying creativity, as they elicit external drive, which may conflict with the experimental effects of interest.

Next, moving away from the reliance on cross-sectional designs is advocated. Longitudinal or pseudo-longitudinal designs with theoretically appropriate time lags can be employed (Fischer *et al.*, 2017). Only two studies employed a longitudinal design. The best possible design is perceived as a multi-study or multi-method paper including two or more studies (Hughes *et al.*, 2018). Additionally, future studies can complement research through comprehensive qualitative analysis of artefacts employed in the study, such as student reflection essays and visual logbooks, to trace prominent themes and insights embedded in the process. Design research suggests that students must be assessed more on the process than the outcome. Only four studies in our sample included reflective essays or diary journals, and eight used qualitative feedback for analysis.

Furthermore, only four studies used the collected qualitative data to identify interesting themes. Participants may also develop a visual learning log that includes drawings, pictures, drafts, and photos of models or concepts illustrating their learning process. At the end of the course, the visual logbook can provide the starting point for an oral examination. Only one study used virtual logbooks.

It has been noted that a shadow or overlooked side of our role as design-thinking educators is neglecting other interesting and valuable forms of creativity in instructional designs and pedagogies. To address this oversight, arts-based learning techniques, such as creative self-expression for personal enrichment, self-understanding, and exploration, have been suggested. Reflecting on our experiences as educators, we recognise that we do not create space for participants to explore forms of creativity rooted in self-exploration that might complement the DT curriculum. For instance, while students engage in seemingly artistic activities like creating storyboards, visual methods serve as a means to articulate and iterate useful ideas rather than a source of self-exploration (Zidulka and Kajzer Mitchell, 2018).

In contemporary education, there is a lack of encouragement for any form of creativity, rather it tends to stifle it. The current system emphasizes memorizing "one true answer," designing standardized, knowledge-driven curricula and pedagogy that drain creativity from the mind. In contrast, DT offers a creative opportunity to explore multiple answers before converging toward the most feasible one. Therefore, the education and training focus needs to shift from delivering recycled standardized bundles of knowledge to design thinking's learner-centred approach, which means focusing solely on the learner and authentic problem-solving rather than exclusively on the structured or quantitative analysis of curriculum content (Fadel and Groff, 2019; Selvalakshmi *et al.*, 2022). No study in our sample used such creative self-exploration techniques.

In this analysis, the recognition of the importance of conducting a comprehensive experiment that compares various pedagogies, including regular/control group learning methods, case studies, project-based learning, studio learning, DT, flipped classrooms, AI, and other technology-aided learning (e.g. self-paced tutorials, interactive robotic teaching agents), is emphasised. This approach aims to trace the impact of these innovative pedagogies on management education and training, contributing to advancing knowledge in the field. Through interviews and questionnaires, researchers can analyse the differences in skills, knowledge, and competencies developed before and after experiencing DT pedagogies. However, it is noteworthy that only four studies undertook such a theoretical and empirical analysis.

Existing studies suggest an ideal minimum standard time of three days (Wright and Wrigley, 2019) for DT immersion pedagogies to explore and uncover potential advantages thoroughly. The recommendation is made for future studies to corroborate such findings through empirical testing. It is important to mention that only eleven studies in the sample implemented immersion for more than three days.

Research indicates that studying group dynamics in DT research is crucial, especially when learning occurs in groups. Understanding the role of the instructor as a co-learner within the group, mentor, collaborator, or facilitator and how it affects outcomes is considered essential. It is advisable to have two facilitators instead of one (Pande and Bharathi, 2020). Trust between students and teachers are of utmost importance, and the teacher needs to actively engage with students to build a positive and constructive class atmosphere. Recommendations are also given for future studies to explore the suggestions by Sathya (2020), such as course pairing and co-teaching, in their study designs.

Similarly, the involvement of students as design partners or leaders in shaping these pedagogies is deemed essential. Students should be actively encouraged in the classroom to collaborate positively on projects, fostering an environment of inspiration rather than individual competition (Gotzsch, 2017). Future research should explore the roles of instructors and students in their studies, as currently, no study in our sample had undertaken such an investigation.

Furthermore, we urge future researchers to incorporate additional creative exercises, such as metaphors, role plays, wild card challenges, and props like toys, charts, recycled material, and other craft activities to increase students' interest in learning. Despite the apparent benefits of such activities, only two studies in our sample utilised them. While business and management schools acknowledge the need for these creative exercises, which designers have embraced, their adoption has been largely neglected (Glen *et al.*, 2014).

We also emphasise the urgent need for a clear definition and measurement of constructs. As discussed earlier in Table 3, there has been inadvertent carelessness regarding the definition of DT and the measurement of its outcomes (creativity, integrated learning, innovation, and problem-solving skills). In this regard, previous research recommends broad definitions of DT, creativity, or other variables because research in this arena is nascent, requiring greater and wider discoveries (Zidulka and Kajzer Mitchell, 2018).

Further, we recommend a clear and precise articulation of the form of creativity endorsed during DT sessions to minimise the risk of participants leaving the class with the perception that they are not "creative" (Zidulka and Kajzer Mitchell, 2018). For example, divergent thinking tasks provide a viable and well-established technique for analysing creativity in experimental studies (Batey, 2012). These tasks are commonly used to evaluate both the quantity and quality of innovative and creative ideas, with participants generating multiple alternative answers to open-ended or abstract challenges, scored objectively (counts of total ideas or novel ideas) and subjectively (expert ratings). Future studies should aim to develop stringent and robust protocols for divergent thinking examinations under real-life conditions, mapping participants' skill development at each level of the creative problem-solving process using DT (i.e. problem definition, ideation, prototyping, implementation planning, testing).

In devising DT pedagogies, experts could be invited for panel discussions, focus group discussions, or even engage in DT exercises, treating wicked challenges for designing transformational pedagogies. These experts could be industry professionals, academics, or even alumni of prestigious business schools who have applied DT to epistemological and philosophical education and career training. Regrettably, only two studies in our sample involved experts in their sessions.

In conclusion, we explicitly encourage researchers to think imaginatively to address the study above design concerns, allowing the discipline to be developed and investigated in a way that provides trustworthy and precise contributions to the business and management education and training arena.

Implications

In business and management education and training, DT has departed from traditional instructional orthodoxy, embracing a spirit of creativity and a revolution of freshness, which

extends guidance and control points to various stakeholders, including educators and trainers responsible for shaping the next generation of managers and scholars, policymakers seeking insights into DT pedagogy for educational policies, managers eager to stay informed about emerging topics in management education and training for decision-making, and researchers contemplating potential contributions to the field.

This implies that education and training now demand a re-evaluation of the ontological and epistemological aspects, emphasising how individuals engage in creative DT and dynamic processes to construct and present knowledge. The focus should be on comprehending and enhancing thinking processes. DT is a creative catalyst for educators and trainers, infusing novelty into pedagogical processes and constructive methods to instil open-mindedness, creativity, experimentation, communication, empathy, ideation, and collaboration (Pande and Bharathi, 2020). By acknowledging its transformative potential, policymakers should contemplate proposing reforms to management and business schools centred on a central theme: design thinking and discourse change. The transformation in management education and training necessitates radical shifts in teachers', students', and administrators' functioning, attitudes, and mindsets. This can be achieved by reshaping institutional discourse through DT, particularly through policies crafted by policymakers (Magalhaes, 2020). Policymakers emphasising greater creativity can explicitly communicate this intention.

Recognising challenges in the field, managers can contribute to the successful transformation of management and training by actively participating in pedagogy, curriculum development, or course design to cultivate relevant and creative skills for future managers in the learning environment.

The discussion section is dedicated to future researchers who can advance this field of study by addressing the challenges associated with anticlimactic study designs.

Conclusion, limitations and future scope

While engaging in this critical review, we recall Hans Andersen's narrative "The Emperor's New Clothes," describing two shyster tailors who could instill dread in the emperor and subjects by revealing that the emperor's new clothes were non-existent until a chaste child yelled out that the emperor had no clothes (Hans Christian Andersen, 1837). We have the incredibly unsettling feeling that we are acting in the shoes of this naive and plausibly false child in a profession that must know better than to disregard the overwhelming proof (Wright and Michailova, 2022) for the plausible inconsistencies in the research in DT processes in management education and training. Only a realistic and empirical examination of setting would be able to supply novel and productive wisdom in the very end. As acclaimed in the research community, movement in mindset is at the heart of continuous and dedicated improvement (Benson and Dresdow, 2014). Is our trust in a purported unanimity in the field regarding design thinking's elevated position so powerful that we have all been unwilling to express our opinions? The field has experienced imperial prestige in recent years. How many myopic outcries are needed before the field is ready to perform like the characters in Andersen's story and surrender the emperor to reality? We simply don't know, but we're hoping that our "cry" will prompt the field to transition on to more constructive undertakings. We hope future researchers know what they are not just wearing but also weaving. Now that could be truly designedly and educative!

Nonetheless, a procedure of continuous critique will have to be encouraged and appreciated in the DT and management training research (study designs and curriculum) through empirically testing recommendations while moving away from the reproduction of confusing and problematic sets of approaches. Iconic as it may be, DT will revolutionize management education and training. To conclude, we undertook a rigorous critical analysis

of the field to highlight the inconsistencies in the study design and offer recommendations for future research.

Although robust, this study has a few limitations. To begin with, it uses articles (Obradović *et al.*, 2021) in English only (Zupic and Čater, 2015), omitting conference proceedings due to academic rigour (de Battisti and Salini, 2013). Also, during the extraction of articles, some articles from year 2023 were not available due to the time-period based limitation of the process. However, despite these limitations, this review provides an integrated map of the research area and outlines the challenges and pitfalls to offer recommendations. Our goal is to assist researchers in advancing their studies in this field, and to identify and understand some of the unique challenges of study designs that most often than not, are grounded from experience. Because the emblem of a researcher's contribution is its ability to expose inherent confusions and push insights, hopefully the sagacity and knowledge provided in this article will encourage more scholars to study the field rigorously. Future researchers can further design comprehensive conceptual models, theoretical frameworks, and improve study designs.

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Corresponding author
Marina Dabic can be contacted at: mdabic@net.efzg.hr

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