# Conceptualizations and instructional strategies on critical thinking in higher education: A systematic review of systematic reviews

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**Aim:** This systematic review identified systematic reviews of quantitative and qualitative empirical studies on the promotion and development of critical thinking in higher education students that allowed us to answer the following *research questions*: (1) What are the main definitions of critical thinking found in systematic reviews of critical thinking in higher education, and what are their similarities and differences? and (2) What are the most commonly used teaching strategies in higher education for teaching or promoting critical thinking, and how effective have they proven to be?

**Methods:** Systematic reviews were selected according to the guidelines for systematic reviews and meta-analyzes (PRISMA, 2020) and the eligibility criteria proposed by the PICOS strategy (population, interventions, comparators, outcomes and study design), based on 23 records of scientifically identified registers in the Journal Citation Report databases of the Web of Science.

**Results:** The bibliometric and systematic search of reviews of empirical studies on the topic allowed the selection of five systematic reviews. The results highlighted that conceptually critical thinking is related to both dispositions and skills, and that although there is no consensus on its definition, it is established that it is a higher-order cognitive process that can be trained. However, the results show that more studies have been conducted considering critical thinking as a skill than as a disposition, that the immersion approach has been widely used, and that some instructional strategies have shown greater effectiveness than others when the disciplines are evaluated independently.

**Discussion:** Despite the relative consensus on the importance of critical thinking for professional development in higher education, this review highlights some difficulties in conceptualizing critical thinking, in the relationship between dispositions and skills, and in its assessment in academic disciplines.

KEYWORDS

critical thinking, higher education, teaching strategies, skills, dispositions

# 1. Introduction

How we think has become a fundamental pedagogical discussion, in terms of the kinds of thinking skills needed in particular societies, and the role and possibilities of education in developing or fostering these skills. In this context, critical thinking has become a central notion, understood in educational institutions in the Global North as a key necessity in contemporary societies. In this regard, the UN and UNESCO have gone so far as to define critical and creative thinking, which enables innovation and knowledge sharing, as a requirement for achieving the Sustainable Development Goals and therefore a priority for any educational institution (Fejes, 2006; Beneitone and Yarosh, 2015; Organización de Naciones Unidas, 2018; Sabzalieva et al., 2021). As a result, various higher education (HE) institutions around the world have included critical thinking among their objectives (Zahavi and Friedman, 2019; Cruz et al., 2021). However, despite broad agreement on its relevance, there is neither a single definition of critical thinking that satisfies the complex and diverse aspects that are part of critical thinking discussions, nor agreement on the best method for teaching or fostering critical thinking in HE, or on how to assess or measure it (Halpern, 1998; Van Damme and Zahner, 2022). Moreover, recent studies show that even within HEIs that have established critical thinking as an explicit pedagogical objective and developed specific strategies for teaching it, students do not appear to become significantly more skilled as critical thinkers as a result of their education, with variables such as nationality, languages, gender and socio-economic background having varying degrees of impact in this regard. As suggested by van Damme and Zahner (2022), given the importance that critical thinking has gained in higher education and the limited success of these critical thinking programmes, universities should make greater efforts in this regard.

In terms of its conceptualization, a specific link between critical thinking and education dates back to the beginning of the twentieth century. El Soufi and See (2019) noted that the Deweyan approach had already pointed to the role of education in strengthening critical thinking among students as a key objective. More recently, in 1980, Peter Facione gave rise to the Delphi Project (Facione, 1990). This was based, on the one hand, on the observation in various cases that students did not reason adequately. And on the other, the identification of a lack of agreement about how critical thinking was defined, taught and assessed, despite its agreed relevance to higher education (Facione, 1990). The Delphi project brought together 46 experts from around the world, including philosophers, scientists, and educators, with the aim of defining critical thinking and developing recommendations on how to teach and assess it (El Soufi and See, 2019).

The resulting definition – and one of the most widely quoted – referred to critical thinking as: "purposeful, self-regulating judgment that results in interpretation, analysis, evaluation, and conclusion, as well as an explanation of the evidential, conceptual, methodological, critical, or contextual considerations on which that judgment is based. Critical thinking is essential as a tool of inquiry. As such, critical thinking is a liberating force in education and a powerful resource in personal and civic life" (Facione, 1990, p. 651). However, despite this agreed definition, some authors have noted that there is still a lack of agreement on how to define and approach critical thinking (Niu et al., 2013). For example, there is a debate about whether it is even possible to teach critical thinking. This discussion relates, on the one hand, to the argument that critical thinking is a socio-culturally specific

practice that cannot be easily taught or learned (Ramanathan and Kaplan, 1996; Atkinson, 1997). In this regard, variables such as nationality, culture, language and socio-economic background may be key to differentiating students' critical thinking learning processes (Giacomazzi et al., 2022; Van Damme and Zahner, 2022).

And, on the other hand, a discussion related to this academic talent from the creative perspective or the development of divergent thinking (Crossley-Frolick, 2010), distinguishing nativist, deterministic or dispositional approaches from others that are more developmental or related to formal and informal learning (Andreucci-Annunziata, 2012, 2016; Payan-Carreira et al., 2019). In this last sense, from a relational, socio-constructivist, dialogical, and critical conception, both academic talent and critical thinking are referred to from their possibilities and limitations in the field of pedagogical interaction and problem-solving (Andreucci-Annunziata, 2016; Ahern et al., 2019). In this sense, Puig et al. (2019) suggest that the transition from 'what to think' to 'how to think' adequately summarizes the challenge of teaching critical thinking, a challenge that requires major transformations in instructional paradigms and that, in turn, questions the initial conceptions.

Given the polysemy of the concept and the divergences around it, critical thinking is generally understood as doubly constituted: on the one hand, as an ability (skill) and, on the other, as a disposition, both dimensions being closely related (Dumitru et al., 2018). The former understands critical thinking as a cognitive skill, or a set of cognitive skills necessary to think critically. As a disposition, critical thinking refers to a set of basic, predetermining affective dispositions, toward life in general and toward specific thinking situations (Cruz et al., 2021). These dispositions are considered necessary (as prerequisites) for the development of the cognitive skills that constitute critical thinking. Understood as dispositions, critical thinking is close to what Dewey (1910) calls "good mental habits" or what Siegel (1988) has conceptualized as "critical spirit." Facione (1990) proposes a list of affective dispositions grouped into two categories: approaches to life in general (e.g., confidence in one's own reasoning abilities, interest in keeping informed, openness to different world views, flexibility in considering other alternatives and opinions, etc.) and approaches to specific issues, questions or problems (e.g., clarity in formulating questions and concerns, diligence in seeking relevant information, etc.). The distinction between these two categories is important because it emphasizes that critical thinking is not developed exclusively in relation to specific aspects of reasoning but is rather a way of approaching different aspects of everyday life and questioning this process of approach (Facione, 2000; Braun et al., 2020).

Simultaneously, critical thinking studies point out that it is not enough to teach cognitive skills, but that people should: "understand the value of critical thinking and have an interest and enthusiasm in applying it. While critical thinking skills can be explicitly taught, dispositions need to be modeled and nurtured so that students progressively adopt an identity as critical thinkers" (Al-Ghadouni, 2021, p. 241). However, while many educators agree that critical thinking is an important skill to teach, not all agree on the best way to teach it. The disagreement falls mainly on whether it is a generic skill that can be transferred between different dimensions and that can be taught independently of the subject or topic, or whether it is specific to each dimension and, therefore, requires positioning (McPeck, 1981; Bailin et al., 1999; Moore, 2013). Therefore, a detailed analysis of how critical thinking is translated into teaching-learning

processes shows several possible paths. Generally, however, there is agreement among educational researchers on the key principles that should shape teaching and learning processes to promote critical thinking, including: "facing open-ended problems, encountering real-world complexity, using multiple knowledge sources, developing knowledge artifacts to explicate thinking, utilizing collective efforts and group resources instead of favoring individual student work, and integrating rich use of modern technologies into the work processes" (Hyytinen et al., 2019, p. 71). Regarding these teaching-learning processes, three relevant concepts are identified in the literature: (1) approaches, (2) instructional strategies, and (3) learning materials.

The concept of approaches is usually used in critical thinking studies referring to Ennis (1989)'s distinction between four different ways of teaching critical thinking mainly differentiated according to the explicit or implicit teaching of critical thinking (Ahern et al., 2019; El Soufi and See, 2019). These pedagogical approaches to critical thinking have been synthesized into four types: general method; infusion; immersion and mixed method, which we briefly explain below (Al-Ghadouni, 2021). The general method consists of the explicit teaching of critical thinking, to acquire or developing critical thinking skills as the sole focus. In the infusion method, critical thinking constitutes an explicit objective but in parallel to a specific topic of study. Critical thinking is taught in relation to the topic at hand, and students are encouraged to think critically about it, while the basic principles of critical thinking are explicitly taught as well. In the immersion approach, critical thinking is not an explicit teaching objective. The focus is on immersion in a specific theme or subject, which is taught in a way that provokes critical thinking. Critical thinking principles are not explicitly addressed, and students are not necessarily aware that they are being trained to think critically. Finally, the mixed method consists of a combination of the general method and the infusion or immersion method.

The second key concept in relation to critical teaching-learning processes is instructional strategies. These refer to more specific kinds of activities through which teachers expect students to develop and engage in critical thinking practices. Some of these strategies are: defining arguments, evaluating the reliability of sources, identifying fallacies and assumptions, using inductive and deductive logic, synthesizing information, making inferences, assessment techniques like peer-review, teacher evaluation, and self-evaluation, debates, brainstorming techniques, journal writing, scaffolding, active learning strategies, FRISCO (Ennis, 1996), the guidelines of Elder and Paul (2003), the 'IDEALS' technique of Facione (2011), Lecture-Discussion Teaching (LDT), Problem-Based Learning (PBL) (Ennis, 2016), problem-solving (inquiry), lecture discussions (argumentation), group work, role-play, self-study, self and peer-assessment, context-based learning (Dominguez, 2018a), constructing maps with structured arguments, concept mapping, dialog (learning through discussion), authentic instruction (presenting real problems, simulation, sequential assignments, and performance-based assessment).

The third concept, learning materials, is suggested by Puig et al. (2019) to identify relevant materials that are part of critical thinking teaching-learning processes, such as literary and narrative texts (articles, essays), E-learning activities, and authentic problems.

In addition to the conceptual and methodological discussion around the critical thinking pedagogical approach, critical thinking studies have also focused on discussing the possibility of evaluating it. Various instruments have been developed for this purpose, such as the

California Test, which is based on the work of Facione (2000) and focuses on skills, or the Cornell Test, which is based on the work of Ennis and Weir (1985) and focuses on dispositions.

Given the current relevance of critical thinking in higher education and the breadth of its conceptual approaches and the heterogeneity of pedagogical methods used to address it, this article discusses the results of a systematic review of systematic reviews that have addressed critical thinking in relation to higher education. This review responds to the need to identify the main definitions and didactic approaches that have emerged from the establishment of critical thinking as a pedagogical objective in different HE institutions worldwide, systematizing what has been learned in this process to facilitate the formulation of guidelines. Theoretical and methodological support to those academic institutions that intend to implement critical thinking among their teaching objectives and hallmarks in the present and future. In this way, the article develops by answering the following questions.

- What are the main definitions of critical thinking found in systematic reviews of critical thinking in higher education? What are their similarities and differences?
- What are the most commonly used teaching strategies in higher education to teach or promote critical thinking, and how effective have they been shown to be?

In what follows, the materials and methods of the systematic reviews are presented, and then the findings are presented and discussed.

## 2. Materials and methods

In this review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA, 2020) guidelines (Page et al., 2021a,b) were used, and the PICOS (participants, interventions, comparators, outcomes, and study design) strategy was used to establish the eligibility criteria for the articles (Methley et al., 2014). In addition, the initial search for articles was performed using bibliometric procedures (Porter et al., 2002). Systematic reviews of systematic reviews and bibliometrics have recently been used separately to address educational topics related to learning in general and critical thinking competencies in HE students (Djamnezhad et al., 2021; Pagán Castaño et al., 2022). Both methods blend allows for increased accuracy and replicability of study (Andreucci-Annunziata et al., 2022).

A set of articles was used as a homogeneous citation base, avoiding the impossibility of comparing indexing databases that use different calculation bases to deter-mine journals' impact factors and quartiles (Bakkalbasi et al., 2006; Falagas et al., 2008; Chadegani et al., 2013; Harzing and Alakangas, 2016; Mongeon and Paul-Hus, 2016), relying on the Web of Science (WoS) core collection, selecting articles published in journals indexed by WoS in the Science Citation Index Expanded (WoS-SCIE) and Social Science Citation Index (WoS-SSCI), from a search vector on critical thinking TS = ((critical NEAR/0 (thinking OR perspective OR approach)) AND (Higher NEAR/0 Education)), without restricted temporal parameters, performing the extraction on 3 October 2022. The following types of documents were included: articles and review articles.

A complementary bibliometric analysis was carried out on a set article obtained for the topic under study. Using two fundamental bibliometric laws:

(1) Exponential science growth or Price's Law, through the exponential adjustment degree of the annual growth of publications, as a measure of a strong interest among the scientific community to develop studies on critical thinking in HE, conforming a critical researcher mass developing this knowledge topic (Price, 1976; Dobrov et al., 1979), and determining the time median and its contemporary and obsolete periods.

(2) Then we have excluded proceeding papers, book reviews and editorial materials and other languages, for estimate the publications concentration in journals by Bradford's Law, distributing the journals in thirds according to the decreasing number of documents published in them, establishing as the nucleus of journals with the highest concentration that cover at least 33% of the total publications (Bulik, 1978; Morse and Leimkuhler, 1979; Pontigo and Lancaster, 1986; Swokowski, 1988; Kumar, 2014).

According to the checklist of the PRISMA 2020 guidelines (Page et al., 2021a,b), the following quality steps for systematic reviews were verified according to the following sections: 1 (title), 2 (structured abstract), 3 (rationale), 4 (objectives), 5 (eligibility criteria), 6 (sources of information), 7 (search strategy), 8 (selection process), 9 (data extraction process), 10a and 10b (data items), 16a and 16b (study selection), 17 (study characteristics), 19 (results of individual studies), 23 (discussion), 24 (registration and protocol), 25 (support), 26 (competing interests), and 27 (availability of data, code and other materials). The following sections were excluded because, as a review of reviews or umbrella review (Aromataris et al., 2015), the data from each study to satisfy their criteria were not considered pertinent within the narrative synthesis of the present review, or were not available, or were presented only in a general way after having been part of a respective protocol: 11 (study risk of bias assessment), 12 (effect measures), 13 (synthesis methods), 14 (reporting bias assessment), 15 (certainty assessment), 18 (risk of bias in studies), 20 (results of syntheses), 21 (reporting biases), and 22 (certainty of evidence).

Through PRISMA guidelines, the selection of articles was specified based on eligibility criteria: the target population (participants), the interventions (methodological techniques), the elements of comparison of these studies, the outcomes of these studies, and the study designs (the criteria of the PICOS strategy as shown in Table 1). Screening of the preselected systematic reviews was first performed independently by the following authors, PA-A, AR, SC, AM, and AV-M. Then, the final review of the included reviews was done in the following pairs: PA-A, AM; AR, SC; and AV-M, AM. In case of doubt, it was decided to include a third reviewer among the six authors.

## 3. Results

The bibliometric systematization over an unrestricted period in the WoS main collection resulted in 1999 documents between 1965

TABLE 1 Eligibility criteria using PICOS (participants, interventions, comparators, outcomes, and study design).

| PICOS | Description |
|---|---|
| Participants | Reviews including undergraduate and technical university students |
| Interventions | Evaluating approaches and methodologies for developing critical thinking skills and dispositions |
| Comparators | Groups of students as control groups, comparison between methods for the teaching of critical thinking, etc. |
| Outcomes | Feasibility of teaching critical thinking, identification of effective methods, achievement of certain critical thinking skills |
| Study design | Systematic reviews including quantitative and qualitative studies |

and 2022, showing a continuous publication record from 1994 onwards. Figure 1 shows an exponential publication growth between 1994 and 2022 with an $R^2$ adjustment of 78% (trend line and value in red). In addition to highlighting as a semi-period of more recent publications between 2018 and 2022 (green shaded area), with an analysis set reduced to 1,084 documents for this period.

After the exclusions are made, 847 documents are fragmented in search of the Bradford core (Table 2). This estimate narrows the core to 38 journals that concentrate the publication of 276 articles between 2018 and 2022 (See detail in Table A1 in Appendix A, and data in Supplementary Table S1).

The absolute percentage error is estimated at 3%, therefore the adjustment achieved by the nuclear zone is considered adequate (See Equation 1).

$$\varepsilon_p = \left( \frac{(\text{Empirical} - \text{Theoretical})}{\text{Empirical}} \right) *100 = \left( \frac{(480 - 494)}{480} \right) *100 = -3\% \quad (1)$$

This 276-document set is entered as input to the PRISMA diagram flow (Figure 2), according to the eligibility criteria (PICOS) set out in Table 1.

Thus, this search identified a total of 276 articles from five different databases in the collection Web of Science (SSCI, Social Sciences Citation Index; SCI-E, Science Citation Index Expanded; ESCI, Emerging Sources Citation Index; BKCI-SSH, Book Citation Index – Social Sciences & Humanities; A&HCI, Arts & Humanities Citation Index). Excluding records by type of document, particularly articles (224), book chapters (9), and early access (20), 23 records were obtained for the screening, corresponding only to systematic reviews of the subject.

Then, 17 systematic reviews were excluded because they presented literature reviews (6); critical reading and writing reviews (6); specific critical thinking teaching techniques, because they focus on how to implement a specific technique and marginally on the development of critical thinking (2) or were outside the focus of this review (3), reducing the corpus to be analyzed to six full-text systematic reviews in English, retrieved and screened using the selection criteria defined
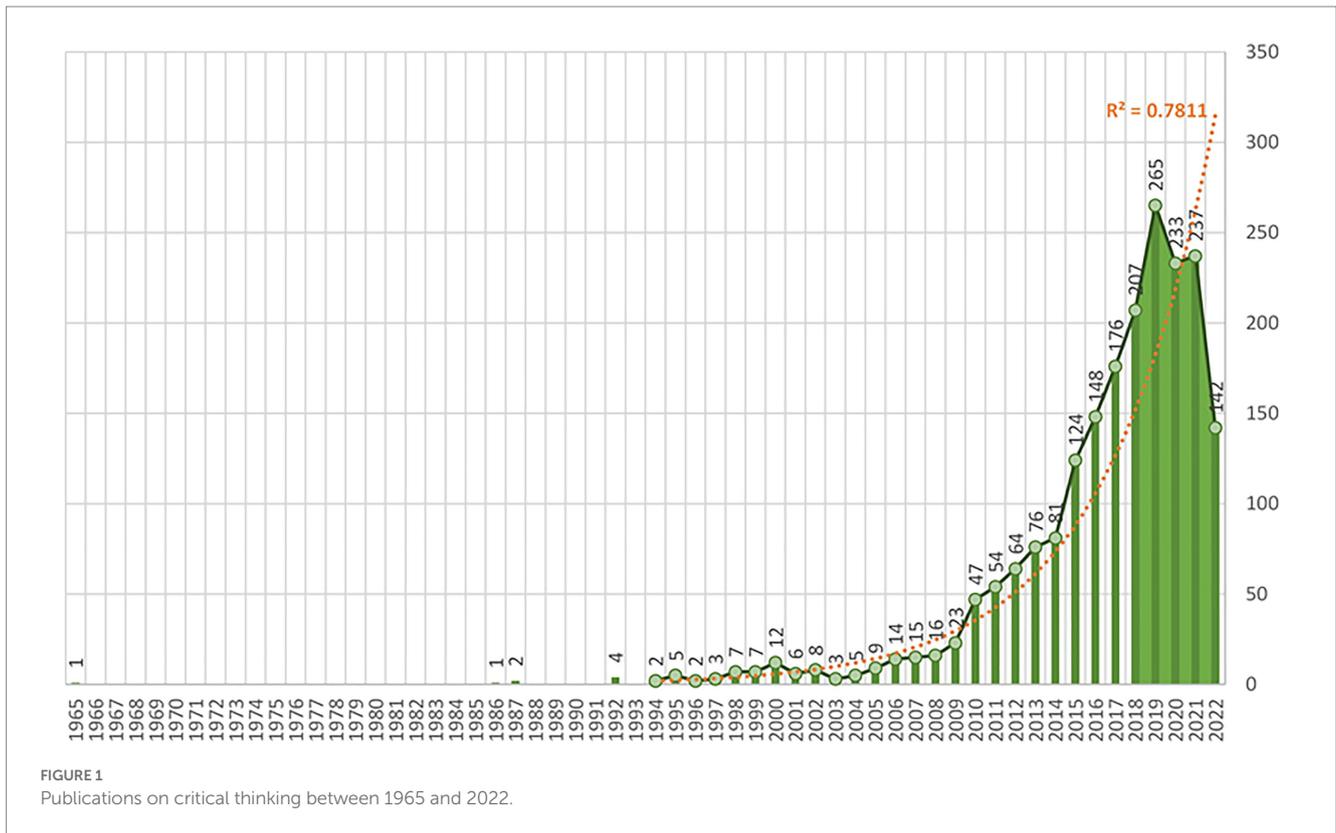
**FIGURE 1**
Publications on critical thinking between 1965 and 2022.

TABLE 2 Bradford zones estimation, articles by journal zones.

| Zone | Number of articles in thirds (%) | | Journals (%) | | Bradford multipliers | Journals [Theoretical serie (SSB)] | |
|---|---|---|---|---|---|---|---|
| Nucleus | 276 | 33% | 38 | 8% | | $38 \times (n\text{^}0)$ | 38 |
| Zone 1 | 232 | 27% | 103 | 21% | 2.71 | $38 \times (n\text{^}1)$ | 114 |
| Zone 2 | 339 | 40% | 339 | 71% | 3.29 | $38 \times (n\text{^}2)$ | 342 |
| Total | 847 | 100% | 480 | 100% | 3.00 | | 494 |
| | | | | | | % error ($\varepsilon$p) = | −3% |

with the PICOS strategy. Finally, a last review that included studies on the assessment of critical thinking through standardized instruments was excluded at this stage. Thus, the screening made it possible to identify five systematic reviews that met the inclusion criteria, as shown in Figure 2. A summary of the general characteristics of the included systematic reviews can be found in Table 3.

The selected reviews included studies with different methodological designs, both quantitative (2) and a mixture of quantitative and qualitative design (3). The reviews addressed 29.8 critical thinking studies on average, all chosen following PRISMA 2020 guidelines for their respective selection. It was not possible to conduct a meta-analysis mainly due to the heterogeneity of the studies included in the reviews. One of them considered the Hedge's g effect size, although not all the studies reviewed by their authors provided the necessary data to perform the calculation (El Soufi and See, 2019). Another review reported three types of statistically significant gains (general, specific, and no gain) assessed from standardized tests in their studies, but without giving values or effect sizes (Payan-Carreira et al., 2019). Finally, the remaining revisions informed methodological

limitations of the studies they selected and/or did not report specific statistical tests from the studies (Ahern et al., 2019; Puig et al., 2019; Tuononen et al., 2022).

The narrative synthesis of the selected systematic reviews made it possible to answer the proposed research questions. For this purpose, we consulted the guidelines for narrative syntheses in systematic reviews (Popay et al., 2006) suggested by the document PRISMA-P 2015 (Shamseer et al., 2015).

A summary of the objectives, definition of critical thinking, associated concepts and variables, and background and/or assumptions of each of the selected reviews can be found in Table 4, while Table 5 presents a summary of the relevance of critical thinking to HE, key findings and challenges for future research arising from each of the selected reviews.

Table 6 synthesizes the findings of the approaches and strategies applied for the development of critical thinking in HE in each of the selected reviews.

One of the selected reviews sought to examine the teaching of generic competencies in HE (Tuononen et al., 2022) and another one

**FIGURE 2**
PRISMA 2020 diagram flow. *SSCI, Social Sciences Citation Index; SCI-E, Science Citation Index Expanded; ESCI, Emerging Sources Citation Index; BKCI-SSH, Book Citation Index Social Sciences & Humanities; A&HCI, Arts & Humanities Citation Index.
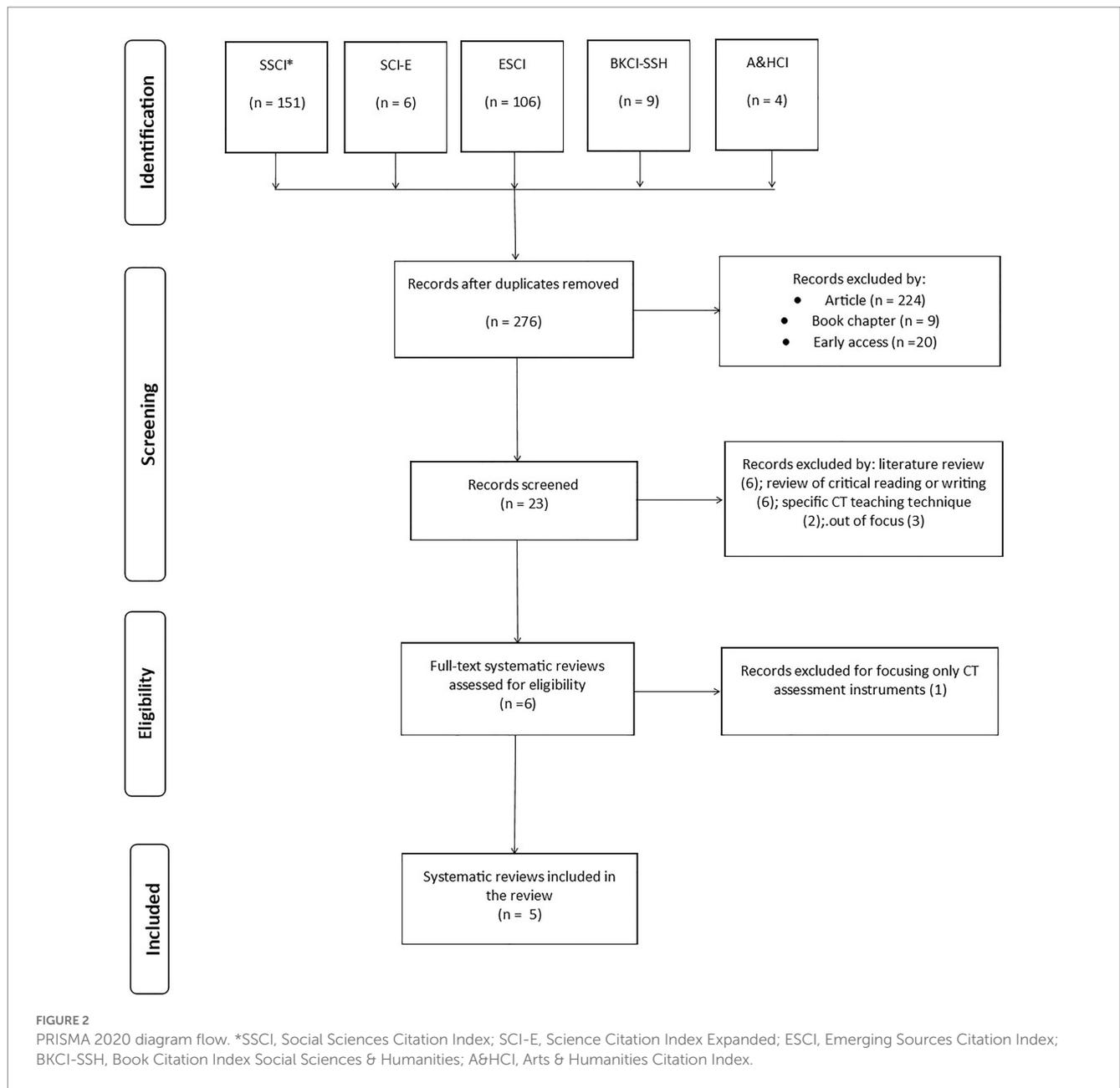
examined critical thinking in different disciplines, such as biomedical sciences, STEM (science, technology, engineering, and mathematics), social sciences, and humanities (Puig et al., 2019). The other three studies have referred to the teaching of critical thinking in specific disciplines: English as a second language (El Soufi and See, 2019), engineering (Ahern et al., 2019), and health sciences (Payan-Carreira et al., 2019).

Regarding the definition of critical thinking, in two of the five systematic reviews addressed, the definition used by the authors is literally the one proposed by Facione (1990), who led the Delphi project on this topic.

Reviews argue that the critical thinking literature suggests that critical thinking is a disposition and skill (Ahern et al., 2019; Puig et al., 2019). However, our results - that analyzed the set of the above five systematic reviews - show that, currently, the concept of skill is more prevalent in the literature than that of disposition. Two of the

five reviews do not refer to dispositions at all (El Soufi and See, 2019; Tuononen et al., 2022), and the other three do so only narrowly (Payan-Carreira et al., 2019; Puig et al., 2019). In contrast, the five systematic reviews highlight the skills aspect, and two of them go deeper into it, highlighting the specific role of cognitive skills (Payan-Carreira et al., 2019; Tuononen et al., 2022).

The different existing conceptualizations of critical thinking in the academic field have in common that it is a type of thinking that enables a reflective process and the ability to make evidence-based judgments. In addition to reflexivity and judgment, other terms and verbs highlighted in the conceptualizations are competence, ability, disposition, understanding, analyzing, inferring, and concluding, among others.

Regarding the approaches and methodologies used to teach critical thinking, the first reassuring finding is that the greatest effect is in the explicit teaching of general critical thinking skills (El Soufi

TABLE 3 Characteristics of the included reviews.

| Authors and year | Journal | Journal Impact Factor (Best quartile) | Authors' countries | Countries of the reviewed studies | Number of documents reviewed and type of studies | Title | Method | CRITHINKEDU group |
|---|---|---|---|---|---|---|---|---|
| El Soufi and See (2019) | Stud. Educ. Eval. | 2.704/Q2 | Lebanon; United Kingdom | Unreported | 1794 (36 included)/quantitative | Does explicit teaching of critical thinking improve critical thinking skills of English language learners in HE? A critical review of causal evidence | PRISMA | No |
| Ahern et al. (2019) | Stud. High. Educ. | 4.017/Q1 | Ireland; Portugal | Unreported | 900 (25 included)/quantitative; qualitative | A literature review of critical thinking in engineering education | PRISMA + PICO + CRITHINKEDU rubric | Yes |
| Puig et al. (2019) | Stud. High. Educ. | 4.017/Q1 | Spain | Portugal, Italy, Greece, Ireland, Belgium, Lithuania, Czech Republic, Romania, and Spain | 276 (27 included)/quantitative; qualitative | A systematic review on critical thinking intervention studies in HE across professional fields | CRITHINKEDU Project | Yes |
| Payan-Carreira et al. (2019) | Stud. High. Educ. | 4.017/Q1 | Portugal; Greece; Belgium | Unreported | 744 (28 included)/quantitative | The effectiveness of critical thinking instructional strategies in health professions education: a systematic review | PRISMA + PICOS | Yes |
| Tuononen et al. (2022) | Front. Educ. | N/A (ESCI) | Finland | Unreported | 907 (116 included) 23 articles include critical thinking within the generic category "generic skills," and 10 articles directly consider it a "specific generic skill"/ quantitative, qualitative | Systematic Review of Learning Generic Skills in HE-Enhancing and Impeding Factors | PRISMA | No |

TABLE 4  Summary of the objectives, definition of critical thinking, associated concepts and vari-ables, assumptions, and relevant authors of each of the reviews.

| Authors | Objective | Critical thinking definition | Associated concepts and variables | Background/Rationale/ Relevant assumptions | The reviewed articles refer to the importance of promoting dispositions (No/Yes and how) | The reviewed articles contribute to the development of skills (No/Yes and how) |
|---|---|---|---|---|---|---|
| El Soufi and See (2019) | To establish the feasibility and impact of explicitly teaching critical thinking skills to English language learners in HE, and to identify the most effective strategies and approaches. | The ability to understand assumptions, make claims that are supported by evidence and make conclusions that are warranted by the evidence presented. | Ability to make arguments; skills; skills instruction | Universities have a significant role in developing critical thinkers (Mitchell et al., 2003; Halpern, 2014). The inability to develop critical thinking led to the critical thinking movement (Facione, 1990). There is a lack of evidence on the explicit and systematic teaching of critical thinking (Coil et al., 2010). | No | Yes, the approach involving instruction in general critical thinking skills is identified as the most promising. |
| Ahern et al. (2019) | (i) To improve the understanding of how critical thinking is being developed in EE; (ii) identify best practices for critical thinking teaching and evaluation; (iii) highlight the challenges and barriers found by teachers in the adoption and implementation of critical thinking educational practices and (iv) present recommendations for addressing knowledge gaps in the current literature. | A 'purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which judgment is based' (Facione, 1990). | Skills (set of capacities, such as analysis, evaluation, interpretation, and capacity for self-correction (Behar-Horenstein and Niu, 2011). Dispositions (characteristics or predispositions of the individual, such as curiosity, openness of mind, prudence in making decisions, etc. (Facione et al., 1994). | The connection between critical thinking and problem solving in engineering involves the evaluation of available information and the subsequent evaluation of decisions made (Saiz and Rivas, 2008). In contrast, debates on critical thinking in engineering are often associated with pedagogical approaches related to problem solving, decision-making, experimental achievements, and the impact of technology on society (Claris and Riley, 2012). | Yes, it incorporates them as part of critical thinking, in search of pedagogical strategies currently used in engineering to promote critical thinking and its level of effectiveness. It is not limited to the promotion of the dispositions, emphasizing their possible development in a more systematic way. | Yes, it incorporates them as part of critical thinking, in search of pedagogical strategies currently used in engineering to promote critical thinking and its level of effectiveness. |
| Puig et al. (2019) | To identify and describe the teaching approaches, methods, resources, and assessment strategies that are currently used to promote critical thinking in engineering education | Definition based on the concepts of self-regulated and purposeful judgment that generates interpretations, evaluations and explanations (Facione, 1990). | Skills and dispositions: Analysis, Inference, Explanation, Evaluation, Interpretation, Inquisitiveness, Open mindedness, Analyticity, Instructional paradigms. | Critical thinking can be taught and learned (Niu et al., 2013). Thinking skills can be improved through instruction which has been specifically designed for that purpose (Halpern, 2001). Changing from 'what to think' to 'how to think' requires a major shift in instructional paradigms. | Yes, but only on a declarative level: the study conceptualizes critical thinking both as a set of skills and as a set of dispositions. | Yes. Nevertheless, and although a large majority of the papers focused on teaching critical thinking skills (rather than dispositions), limited information has been provided about how and to what extent learning materials enhance critical thinking skills (and dispositions). |

*(Continued)*

TABLE 4 (Continued)

| Authors | Objective | Critical thinking definition | Associated concepts and variables | Background/Rationale/ Relevant assumptions | The reviewed articles refer to the importance of promoting dispositions (No/Yes and how) | The reviewed articles contribute to the development of skills (No/Yes and how) |
|---|---|---|---|---|---|---|
| Payan-Carreira et al. (2019) | To identify the status of the instructional practices used to enhance critical thinking, Clinical Reasoning and Clinical Judgment (CJ) skills and dispositions in health sciences HE programs. | Set of skills and dispositions that lead to the intentional reflective process that results in the interpretation, analysis, and evaluation of data, as well as the use of multiple considerations to arrive at a judgment (Cruz et al., 2017). | Constructs defined by the general and domain-specific standardized tests used. Domain-specific rubrics, surveys, or questionnaires. | Critical thinking and clinical reasoning (CR) are similar, arguing that they share skills and attitudes and have an overlapping conceptualization. | Yes, but to a limited extent | Yes, development of cognitive skills when using different learning strategies [Simulation (32%), Problem Based Learning -PBL- (18%), reflective writing (14%)]. Case Based Learning -CBL- and concept mapping were mentioned in three papers (11%). Two papers investigated a combination of strategies. |
| Tuononen et al. (2022)) | To review theoretical, methodological, and empirical viewpoints on learning generic skills (including critical thinking) and synthesize the empirical evidence about the factors that enhance and impede student learning of generic skills. | Critical thinking as part of higher order thinking and cognitive skills, which help shape the competences and literacy of future citizens. | Constructs defined by the standardized tests and assessment tools used. | Generic competences are learning objectives in a considerable number of HE curricula. Recent evidence suggests that there is a conceptual inconsistency in research on generic skills, as well as a lack of clear theoretical frameworks and robust instruments. | No | Yes, development of cognitive skills by using, among others, inquiry-based learning methods; instruction that considers critical thinking; scaffolding and sequential tasks. Yes, assessment of academic performance, noting that students' primary knowledge improves performance and motivation in reasoning. |

| Authors | Relevance of critical thinking for HE | Main findings | Challenges for future research |
|---|---|---|---|
| El Soufi and See (2019) | Academics in different regions of the world - among them, Europe Eurydice (Eurydice, 2011), the United States Association of American Colleges and Universities (Association of American Colleges and Universities, 2004, 2015), and Australia, Moore (2014) – have identified critical thinking as a main aim of undergraduate teaching and an essential skill in HE. Because of the proliferation of information in diverse sources, young people need to be able to discriminate facts from opinions, evaluate and judge the credibility of evidence. | Only explicit instruction in general critical thinking skills was found to have evidence of effectiveness. However, because most of the studies were small-scale and/or methodologically flawed, the evidence is not strong enough to be conclusive. The most common instructional approaches found in this review concerns teaching general critical thinking skills ($n=13$ studies), followed using literary and narrative texts ($n=6$) and assessment techniques ($n=5$) like peer-review, teacher evaluation, and self-evaluation. Other approaches include the use of debates, brainstorming techniques, journal writing, scaffolding, and active learning strategies. In summary, there is indicative evidence that explicit teaching of general critical thinking skills can improve English language learners' critical thinking skills. | The findings suggest that research in this field is still rather immature and more large-scale, replicable robust studies are needed to advance the field. There is absence of a single agreed-upon definition for critical thinking, which makes comparison of studies difficult as different studies may be measuring different things. |
| Ahern et al. (2019) | critical thinking is a demand for engineering employability and a requirement of Accreditation Board for Engineering and Technology (ABET) (Ahern et al., 2012; Naimpally et al., 2012). | The relative impact of different teaching strategies and interventions on the attainment of critical thinking skills and dispositions in engineering is difficult: there have been few studies in the discipline that have clearly defined what is meant by critical thinking or have clearly assessed critical thinking in students or evaluated critical thinking interventions in a quantifiable way. | The need to implement research programmes to develop and test different methods over extended periods of time in HE engineering programmes, ensuring that critical thinking is integrated into university curricula. Focus groups conducted with engineering employers (Dominguez, 2018b) indicated that there is a disconnect between employers' and educators' understanding of critical thinking. Further analysis of these disconnects (which also includes critical thinking theorists) is needed. In addition, there is little consensus on how critical thinking should be assessed (Liu et al., 2014) in engineering. |
| Puig et al. (2019) | Critical thinking is a seminal goal in HE, and it is one of the key competences included in the European Reference Framework (Hoskins and Deacon Crick, 2010). It is considered as a set of skills which are necessary to foster students' success in college and in the workplace (Partnership for 21st Century Skills, 2003). | One of the most remarkable findings is the use of an immersion approach in all fields. This shows a tendency of encouraging the embedding of critical thinking within domain-specific fields as a way of helping students to become critical thinkers, rather than teaching critical thinking as a separate subject. | To make critical thinking instruction explicit, critical thinking must be integrated directly into the course goals, activities, and assessment, making sure that the students are aware of the critical thinking development within the domain-specific instruction. |
| Payan-Carreira et al. (2019) | Stakeholders in health education expect graduates not only to master the basic scientific and technical knowledge of the profession, but also advanced thinking skills and dispositions that enable them to engage in reasoning and judgment processes, mainly in the complex and uncertain nature of health situations (e.g., in an emergency) (Hildenbrand and Schultz, 2012; Aglen, 2016; Dominguez, 2018b). For healthcare professionals, critical thinking is especially important to improve reasoning during diagnosis (e.g., pattern recognition, medical screening), prescribing (e.g., to evaluate alternative scenarios or to prioritize actions in a time-limited situation), and monitoring the treatment of a particular patient, as well as to self-monitor their own performance during clinical practice (Dominguez, 2018b). | Regarding the instructional approach, 82% of the papers used immersion and one the infusion (4%), while four papers (14%) used the mixed approach. When comparing the different strategies, in general, the most effective ones seem to be simulation and reflective writing, followed by concept mapping, PBL and CBL. Furthermore, when comparing studies using the same strategy, their effects on students' critical thinking are not similar, and for any instructional strategy, there were studies reporting conflicting results. | There is no clear evidence on the most effective learning strategy for improving critical thinking skills. |

*(Continued)*

**TABLE 5 (Continued)**

| Authors | Relevance of critical thinking for HE | Main findings | Challenges for future research |
|---|---|---|---|
| Tuononen et al. (2022) | The European Parliament Council (2008) has identified key generic skills (including critical thinking) to be covered in HE. Generic skills are learning objectives in a variety of HE programs. | Most of the factors related to critical thinking were contextual, relating to the teaching and learning environment, rather than focusing on individual factors. Active learning methods that emphasize students' activity and role in the learning process were most often found to be enhancing factors. | Results related to learning and the development of critical thinking skills were contradictory, depending on the study design, methods, and sample size. |

and See, 2019). In relation to teaching English, the methodologies identified as effective are the use of literary and narrative texts, assessment techniques such as peer review, teacher assessment and self-assessment, and approaches such as conducting debates, brainstorming, daily writing, scaffolding and active learning strategies (El Soufi and See, 2019). In relation to engineering education, it is concluded that to date there has been no quantifiable evaluation of interventions implemented to enhance critical thinking (Ahern et al., 2019). This review, which looked at critical thinking in different professional fields, concludes that the most commonly used teaching approach across all fields is the so-called immersion approach (Puig et al., 2019). This finding suggests that the teaching of critical thinking is more effective when it is integrated transversely into the teaching of different fields than when it is treated as a separate subject. The reviews that have addressed critical thinking in the health sector are consistent with this review in highlighting the high use of the immersion approach. Within this approach, the most effective strategies appear to be simulation, reflective writing, concept mapping, problem-based learning [PBL] and case-based learning [CBL] (Payan-Carreira et al., 2019). Finally, this review, which focused on the learning of generic skills in higher education, shows that active learning methods, i.e., those that promote students' activity and role in their learning process, are factors that enhance the learning of critical thinking (Tuononen et al., 2022).

These systematic reviews agree that the development of critical thinking skills is a key objective of different higher education programmes. They also agree that critical thinking contributes to the integration and performance of professionals in different work settings. Two of the reviews offer arguments to support this relevance. Firstly, a pedagogical argument suggests that, given the large amount of information available today, it is relevant that students can distinguish facts from opinions and evaluate and judge the credibility of the evidence presented to them (El Soufi and See, 2019). In the same vein, it is pointed out that health science students should complement scientific and technical knowledge with advanced thinking dispositions and reasoning and decision-making skills (Payan-Carreira et al., 2019). A second argument, of a more technical nature, relates to the requirements of university accreditation processes with assessment agencies (Ahern et al., 2019).

# 4. Discussion

This systematic review of critical thinking in HE with PRISMA 2020 guidelines identified the main definitions of critical thinking, their commonalities, and differences, instructional strategies, and their effectiveness. The revision was conducted with five reviews from WoS databases which allowed focusing the search according to the PICOS strategy (Porter et al., 2002; Liberati et al., 2009; Moher et al., 2009; Methley et al., 2014; Andreucci-Annunziata et al., 2022).

This work has shown that there are several definitions of critical thinking, which has implications for the formulation of theoretical and methodological guidelines in the teaching and learning process in higher education. Through the analysis (Table 4), we found that critical thinking involves complex cognitive activities, which in turn need to be applied to specific contexts in which HE students operate.

Facione's (1990) definition appears to be the most comprehensive, emphasizing critical thinking as evaluation carried out in a

TABLE 6 Approaches and strategies applied for the development of critical thinking in HE from selected reviews.

| Authors | Discipline(s) in which the studies were carried out | Kinds of critical thinking instructional approaches or modes covered | Teaching strategy/ concrete instructional strategies covered | Learning materials | Findings around instructional approaches, teaching strategies, and learning materials | Conclusions from the reviews |
|---|---|---|---|---|---|---|
| El Soufi and See (2019) | English learning as a second language. | Mixed instructional approach. | Define arguments, evaluate reliability of sources, identify fallacies and assumptions, use inductive and deductive logic, synthesize information, make inferences, etc. Assessment techniques like peer-review, teacher evaluation, and self-evaluation. Debates, brainstorming techniques, journal writing, scaffolding, and active learning strategies. | The use of literary and narrative texts. | Most promising instructional approach: General critical thinking skills. Less promising strategies: Strategies such as debate, use of self/peer assessment and feedback, use of literary and narrative texts, brainstorming techniques, scaffolding and other active learning strategies (e.g., collaborative writing, journal writing, and dialogic thinking). | The approach involving instruction in general critical thinking skills looks the most promising, but more large-scale and robust evidence is needed to confirm its effect. |
| Ahern et al. (2019) | Engineering education | General approach, infusion, immersion and mixed. | FRISCO (Ennis, 1996), the guidelines of Elder and Paul (2003), the 'IDEALS' technique of Facione (2011), Lecture-Discussion Teaching (LDT), Problem-Based Learning (PBL), problem solving (inquiry), lecture discussions (argumentation), group work, role-play, self and peer-assessment and context-based learning Dominguez, 2018a). Constructing maps with structured arguments. | Not mentioned | This review shows that from the educator's standpoint there is a disconnect between critical thinking theory and the practice of teaching critical thinking in engineering. | There is a need for a more cohesive approach to critical thinking in engineering programmes, where skills are taught across the programme and where there are links and relationships formed across modules and stages. |

*(Continued)*

TABLE 6 (Continued)

| Authors | Discipline(s) in which the studies were carried out | Kinds of critical thinking instructional approaches or modes covered | Teaching strategy/ concrete instructional strategies covered | Learning materials | Findings around instructional approaches, teaching strategies, and learning materials | Conclusions from the reviews |
|---|---|---|---|---|---|---|
| Puig et al. (2019) | Different professional fields in HE institutions: | General approach, Infusion approach, Immersion approach, Mixed approach. | Self-study includes instructional techniques and learning activities that are based on the students' individual work. Dialog encompasses learning through discussion. Authentic instruction consists of presenting students with real problems, or problems that make sense to them, engaging them, and stimulating them to enquire. | Texts (articles, essays). E-learning activities. Authentic problems. | Most of the interventions carried out in all of the fields used an immersion approach, and the infusion approach was the second most common approach. | There are many commonalities among critical thinking interventions in all of the fields regarding the critical thinking aims, approaches, learning materials and teaching strategies. One of the most remarkable findings is the use of an immersion approach in all fields. This shows a tendency of encouraging the embedding of critical thinking within domain-specific fields as a way of helping students to become critical thinkers, rather than teaching critical thinking as a separate subject. |
| Payan-Carreira et al. (2019) | Health professions education | Immersion, mixed | Problem-Based Learning (PBL), | Not mentioned | Regarding the effectiveness of instructional approaches, immersion was adopted in the majority of the studies analyzed (over 80%), and reported significant improvements of both general and specific gains. In this review, it was not easy to extract clear evidence on the most effective learning strategy. In general, the most effective seems to be the simulation and reflective writing, followed by concept mapping, PBL, and CBL. | This review confirmed that learning strategies that actively engage students in learning, along with longer interventions, might be preferred than traditional lectures to enhance critical thinking skills and dispositions. |

*(Continued)*

TABLE 6 (Continued)

| Authors | Discipline(s) in which the studies were carried out | Kinds of critical thinking instructional approaches or modes covered | Teaching strategy/ concrete instructional strategies covered | Learning materials | Findings around instructional approaches, teaching strategies, and learning materials | Conclusions from the reviews |
|---------|------------------|----------------|----------------|-----------|-----------|-----------|
| Tuononen et al. (2022) | No specifications | Not mentioned | Inquiry based learning methods. Scaffolding and sequential assignments. Performance-based assessment. | Not mentioned | Not mentioned | The findings relating to learning and development of critical thinking skills were contradictory, depending on the study design, methods and sample size. Based on the studies covered, it seems that the development of critical thinking is uncertain or limited. |

self-regulatory manner through sequential cognitive processes. There are nuances in what constitutes a skill, which implies a situated and evaluative implementation (Cruz et al., 2017; Tuononen et al., 2022). El Soufi and See's (2019) definition is more focused on evidence-based reasoning. Cruz et al. (2017) emphasize dispositions that point to mental and character qualities inherent in a person, which extends the definition to look beyond cognitive abilities.

Comparing these definitions, there is no complete consensus on what needs to be done in order to think critically, except that it involves higher order cognitive processes. The literature emphasizes the fact that students should move from what to learn to how to learn from a socio-constructivist perspective (Andreucci-Annunziata, 2012, 2016). This means that students must be able to make sense of the task they are doing, because at this level of complex thinking it is not enough to follow instructions or perform tasks: critical thinking necessarily implies students' ability to evaluate.

Since the information in Table 4, the question would be how to approach critical thinking, considering two related aspects: one has to do with the training of cognitive tasks in an instructional setting; the other requires aspects more linked to the affective/emotional being, a comprehensive quality that is trained according to the idiosyncrasy and background of each person. The five selected papers do not provide a common answer on how to do this. Critical thinking is associated with formal education in certain fields, such as engineering, language teaching, etc. This means that it is generally approached from specific problem situations and generalized to broader aspects where competences are demonstrated.

The review by El Soufi and See (2019) highlights specific teaching methods that enable critical thinking to be exercised. However, when looking for an answer, they suggest studies with larger populations and add that not all studies agree on a common definition of critical thinking so that different aspects of the process could be measured. Ahern et al. (2019) add that studies should be longer and integrate critical thinking into the curriculum, which would make it possible

to evaluate a period of training. They question the assessment of critical thinking in the absence of a more consensual definition of the term. Finally, they suggest that stakeholders interested in demonstrating or assessing critical thinking, such as employers, should be involved.

Payan-Carreira et al. (2019) also discuss the difficulties in studying critical thinking, arguing that no consistent results are obtained from studies using the same teaching strategies. Nor are conclusive results obtained from different strategies. Puig et al. (2019) state that the conceptualization of critical thinking as both a set of skills and a set of dispositions lacks more specific information on how and to what extent learning strategies enhance critical thinking skills and dispositions.

There are several unresolved issues. There is still no consensus on what is meant by critical thinking. On the one hand, reference is made to formal teaching factors provided by universities, which recommend different strategies to acquire the necessary cognitive skills. On the other hand, there is recognition of defined dispositions, which are attributed to action tendencies, personality traits and positive qualities of individuals. Although the authors agree on the existence of both, studies on strategies for training during higher education prevail and the discussion on individual factors of students would appear in disposition or aspects of it. From the selected reviews, it can be seen that the definition of critical thinking obtained by the Delphi project (Facione, 2011) is still valid, although this project was carried out three decades ago. It is worth noting that in the current discussion of critical thinking, the high cognitive skills are most often mentioned, more often than the dispositions, which raises a question. Is this because dispositions are more difficult to study or measure than skills?

It is recognized that critical thinking or reasoning requires dispositions; however, the relationship between dispositions and skills is not yet clear in light of these recent reviews. That is, critical thinking can be developed in students whose dispositions in terms of personal attributions favor this process (Cruz et al., 2017; Wechsler et al., 2018). A possible question that arises is whether critical thinking skills are

developed from motivational, attitudinal and other dispositions. From the perspective of individual development, there would be environmental conditions and people's emotional world that favor the acquisition of critical thinking.

Another relevant finding of our analysis is that several of the reviews emphasize the need for methodologically sound studies to advance knowledge about critical thinking in general and how to teach it. For example, Tuononen et al. (2022) found that active learning occurs in learning environments. However, they found conflicting results regarding methodological issues such as study design, methods and sample size.

One question is whether there should be more research on the dispositional aspects of successful critical thinking students, taking into account socio-cultural factors. For example, it is easier to compare individuals with similar educational opportunities (e.g., Finland), as in the study included in this systematic review (Tuononen et al., 2022), which alludes to methodological shortcomings.

If a framework definition of critical thinking training for higher education students were to be proposed, a high level of training in cognitive skills and a complex and comprehensive view of the conditions that make this possible would be paramount. These, as well as aspects of human talent, have been addressed as a condition that favours the development of critical approaches whenever pedagogical scenarios make it possible (Andreucci-Annunziata, 2012, 2016).

Looking more closely at the strategies that promote the development of critical thinking, and with a view to contributing to the construction of theory in this area, the emphasis on training in cognitive tasks in discipline-based teaching scenarios in four of the five reviews examined stands out. Focusing on the second question guiding this review, Table 6 shows that, with the exception of Tuononen et al. (2022), who do not mention this aspect, the authors agree on strategic approaches such as the general approach, the infusion approach, the immersion approach or the mixed approach, depending on the specificity of the students.

When considering the specificity of the student, it seems appropriate not to forget the specificity of the teacher. Only the study by Ahern et al. (2019) shows that, from the perspective of the educator, there is a disconnect between the theory of critical thinking and the practice of teaching critical thinking in engineering. The above seems to be relevant to the repair of teacher education beyond techniques. In other words, although some techniques have demonstrated their effectiveness, the interventions carried out in all areas, such as the immersion approach and the infusion approach (Payan-Carreira et al., 2019; Puig et al., 2019), followed by general critical thinking skills (El Soufi and See, 2019), operate in a specific interactional framework between teacher and student (Andreucci-Annunziata, 2016; Salas et al., 2021).

This interactional framework seems to be relevant for further research. It is within this framework that the teaching-learning process takes place. In turn, this teaching-learning process, of which the development of critical thinking becomes a fundamental part, is inserted into a defined institutional educational and strategic project with guiding guidelines. The guidelines for the process of restructuring and strategic planning of universities in the world, and especially in Latin America, have emphasized the review of the integration of the respective institutional educational projects into the general academic task. This has implications not only for the objectives of academic quality, but also for a rigorous analysis of the curricular models

postulated in institutional educational projects. In this sense, the approaches that pay attention to critical thinking because of and in the process of development, focus on the students and enable them to insert themselves in the framework of the challenges imposed by global citizenship, the strengthening of academic skills (cognitive, affective and/or bonding) and life skills, sustainable development, the inclusion of diverse perspectives and openness to internationalization (Delors et al., 1996; Sabzalieva et al., 2021). According to Molina et al. (2018), an educational model in a university setting expresses "synthetic visions of theories or pedagogical approaches that guide specialists and teachers from the development and analysis of study programmes to the systematization of the teaching-learning process in university classrooms" (p. 153). It is this last process that is particularly highlighted in this review.

## 5. Conclusion

Not surprisingly, since critical thinking is the foundation of integral education in complex times, there has been much research and study on this topic. The recent bibliometric analysis of critical thinking (Pagán Castaño et al., 2022) allowed us to support a review of reviews with current and updated data. Our review shows that dispositions and skills are key concepts in the promotion of critical thinking, and Giancarlo and Facione (2001) point out that the disposition to think critically is conceptually different from having the skills to think critically. Although all the authors reviewed agree in recognizing the importance and influence of dispositions in the area of critical thinking, there has been more research on skills than on dispositions. When turning to the aspect of teaching strategies for critical thinking, there was no consensus on how this should be done. In fact, the common recommendation to conduct further research on how to teach critical thinking raises the question of whether it is possible to teach this disposition or skill at all.

Further concerns arise about the conditions under which critical thinking can be developed in contexts that do not sufficiently validate it, or in higher education institutions that do not explicitly define it in their policies, although they require it in academic outcomes, and vice versa. The strategies derived from the methodologies reviewed do not fully respond to the development of critical thinking because they focus almost exclusively on the evaluation of outcomes rather than on the process of constructing this type of thinking and its applicability. It would be helpful to update paradigms in this area that support both study and teaching practice. A possible alternative is to consider complex paradigms (Delors et al., 1996; Elfert, 2015) that support life skills in this 21st century and are concerned with placing students at the center of their learning process, in close contact with their interactional dialog environment (family members, teachers and classmates), which challenges them and proposes joint problem solving.

In the context of educational transformation, which is the purpose of this type of study, the elements to be considered are (1) the institutional educational project (mission, vision, objectives), (2) the institutional strategic plan (strategic quality objectives in the areas of teaching, management, research and links with the environment), (3) the study plan (degree programmes, undergraduate and postgraduate programmes and their respective curricula), and (4) the

teaching-learning process. At this last level, which is also the first (the micro-genesis of educational transformations), the development of critical thinking is considered key in two senses: as training in cognitive tasks (instructional scenario) and as "training" in affective-relational attitudinal skills (expressive scenario). It is clear, in the opinion of the authors of this review, that this second approach is the one that requires further study and constitutes a line of research to be deepened and strengthened in future research. The conclusive analysis presented is consistent with the potential of complexity theory to address the challenges, at the micro- and macro-genetic levels, in establishing a new field of research in higher education from the perspective of educational psychology, and to provide possible solutions for the implementation of complex and creative thinking as a developmental goal for students and a strategic goal for higher education institutions. (Davis and Sumara, 2014; Scott et al., 2018; Harmat and Herbert, 2020).

On the other hand, the main limitation of this review is that there is not enough information to explore the different weight of the methodologies implemented for the development of cognitive, affective-attitudinal, creativity, talent and academic performance skills in higher education in academic programmes. Likewise, given the origin of the systematic reviews found and analyzed in this study, there is no information on the application of critical thinking conceptualizations and teaching practices in Latin America (Beneitone and Yarosh, 2015), which constitutes a challenge and line of research for a working team such as ours.

## Author contributions

PA-A: original idea and institutional link. PA-A, AR, SC, and MR: conceptualization and writing—original draft preparation. AM and AV-M: methodology. AM and AR: formal analysis. PA-A, AM, and AV-M: writing—review and editing. PA-A: funding acquisition. PA-A:

proofreading and final editing. All authors have read and agreed to the published version of the manuscript.

## Funding

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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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.2023.1141686/full#supplementary-material

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