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Investigating critical thinking in higher education in Latin America: Acknowledging an epistemic disjuncture

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Abstract

Critical thinking (CT) in higher education (HE) has been widely investigated in Western countries. Most of the research on CT has conceived it as a higher order thinking skill with implications for learning processes. CT has also been connected with critical pedagogies, an approach that seems particularly attuned with the Latin American region. Through a systematic literature review, this article maps the scholarship on CT in HE in Latin America (LATAM). Findings point to a local character of the research on CT that heavily relies on cognitive psychology traditions. It is proposed that the scholarship on CT in LATAM is characterised by *an epistemic disjuncture* that favours theories and methodologies produced in the Global North overshadowing well-recognised traditions of critical pedagogies in the region. We conclude that research on CT in the region is missing an opportunity to develop powerful features that are especially fitting for LATAM' s geo-historic context.

Keywords: Critical pedagogies, critical thinking, Freire, Global North/Global South, Latin America, review paper

Introduction

Critical Thinking (CT) in higher education (HE) has been investigated for the last 40 years. It has gained relevance in recent years, especially in Western contexts such as the USA and Europe (Davies & Barnett, 2015; Ennis, 2015; Facione, 1990; Moore, 2011). In those contexts, higher education institutions have been increasingly called to equip professionals with CT. In a highly complex and technological world, students are expected to be critical thinkers in order to become successful

professionals (Davies, 2013, 2015) so as to respond to the demands of the knowledge economy (Mhinga, 2013) and a globalised world (Ramasamy, 2011), and to become active citizens (Barnett, 1997).

The literature on CT has paid attention to cognitive aspects of CT and learning, although there are also approaches that highlight the socio-political dimensions of teaching CT (Davies & Barnett, 2015). CT has been associated with the improvement of creativity (Spuzic, et al., 2016), learning attitudes, academic results (Ghanizadeh, 2017), meaningful learning (Culver, et al., 2019), employability (Davies, 2015; Shah, 2011), and as a lifelong skill that needs to be promoted (Green, 2015). Studies show that CT has diverse impacts on graduates' academic, professional, personal, and socio-political attributes. Other studies have focused on curriculum and the skills that graduates need to learn to meet the labour market demands (Shah, 2011) and whether CT should be taught as a part of transversal skills or if it should be taught through a disciplinary approach (Abrami, et al., 2015; Moore, 2011).

Despite extensive research, CT is a slippery concept with diverse definitions pointing to different perspectives, dimensions and implications (Davies & Barnett, 2015). Research on CT in HE has mainly revolved around the ways in which students learn CT and how it can be assessed (Green, 2015; Hitchcock, 2015). However, there is no agreement about how to incorporate CT in study programmes. As a result, not only is more research required on how to promote CT in programmes of study (Abrami, et. al, 2015), but also more scholarship on the matter of CT itself.

Studies that have analysed CT in non-western European contexts are scarce with a few studies that have taken place in Africa (Bali, 2015; Schendel, et al., 2020) and Asia (Hamzah & Shaari, 2018; Tan, 2017). In turn, it is not clear as to the extent to which CT has been investigated in HE in Latin America (LATAM) or the ways in which the many understandings of CT inform teaching practices in this region.

Through a systematic literature review of articles, this review article aims to map the scholarship around CT in HE in LATAM. The review provides an identification of conceptualisations associated with CT in LATAM, ways in which CT is investigated in the classroom and/or in the curriculum either in specific disciplines or in a more transversal way. The research methodologies deployed to investigate CT will also receive attention. Given the long-standing tradition of critical pedagogies and Freire's ideas in LATAM, this article argues that the scholarship of CT in HE in that region should emphasise a socio-political dimension. While CT skills are necessary and important to participate in the so-called information society, a CT approach that responds to the high degree of inequities in the Latin American region should strengthen the essence of Freirian critical pedagogies. According to this perspective, being critical involves a state of self-realisation and consciousness of the oppressive conditions that affect the social reality with the aim of interrupting them. The article expands on this topic and discusses implications of this review for HE in the region.

Definitions of critical thinking

CT has been addressed from different disciplinary traditions, especially psychology and philosophy (Davies & Barnett, 2015) which, in turn, have had implications in educational settings. While philosophical approaches have focused on logical argumentation psychological traditions have drawn on cognitive approaches mainly (Paul, 2011).

From a philosophical point of view, in the 1970s, there was an interest in promoting argumentation skills in the curriculum (Paul, 2011). According to this perspective, critical thinkers were able both to identify an argument and to evaluate it (Davies & Barnett, 2015). An educational implication here was the introduction of 'programs designed to develop skills of logic, reasoning, and argument' (Davies & Barnett, 2015: 7).

From a cognitive perspective CT is a 'combination of skills, attitude and knowledge' (Sternberg & Halpern, 2020: 1). Usually, CT is associated with higher order thinking skills such as evaluating, synthesising, analysing, interpreting, making inferences, and explaining (Facione, 1990). A critical thinker not only has the ability to deploy higher and complex cognitive skills, but also possess good communication skills that allow them to work effectively with others in a team to address problems (Paul & Elder, 2006).

More than five decades ago, from a cognitive developmental perspective, Perry (1970) observed students for fifteen years during their educational journey at university and recorded how students developed their CT. He provided four phases of student-teacher interaction, showing how their roles interact and change during the learning process. In the first phase, students learn pre-set 'correct' answers and provide them when asked. In a second phase, students realise that some questions might have different answers; at this stage, students start to develop hypotheses regarding the unanswered queries, thus beginning the CT process. In a third phase, students start to understand the need for theories to support their work, for which their teachers provide validity. Students develop argumentation skills, logical consistency, and use reasoning characteristic of their discipline. In the last stage, students understand how to address certain problems and develop their own worldviews in a range of domains. Students begin to view problems from different perspectives, formulate valid questions, identify suitable solutions to problems, and even develop new theories. In pedagogical situations, and according to Schendel, et al. (2020) CT can be enhanced if students build knowledge from real situations, engage actively in their learning and receive support from peers and teachers through class discussion, collaborative group work, and open- assessments.

CT also includes dispositions that involve an attitudinal dimension and a 'sense of psychological readiness of the human being to be critical' (Davies & Barnett, 2015: 13). From this perspective, CT is conceived as a set of dispositions in 'relation to the self, …to others… and to the world' (Davies & Barnett, 2015: 13). For example, CT in relation to the self involves a desire to be well-informed, tolerance to ambiguity, integrity, empathy, perseverance, and intellectual courage among others. CT in relation to others includes a respect for alternative viewpoints, open-

mindedness, appreciation of individual difference and scepticism, while CT in relation to the world involves interest, inquisitiveness and seeing both sides of an issue (Davies & Barnett, 2015: 13). However, in Davies and Barnett's words, this latter definition fails to include 'a sense of actual or potential action' (2015: 14). Accordingly, these authors propose 'the skills-plus-dispositions-plus-actions' view (Davies & Barnett, ibid), for which Barnett coined the term 'criticality' (Barnett, 2007).

Criticality involves not only cognitive skills and dispositions but also 'the individual's wider identity and participation in the world … it comprises three things: thinking, being, and acting' (Davies & Barnett, 2015: 15). These three moments are intertwined and each may be realised at ever higher levels. According to this view, CT enables higher education students to reach a level of *transformative critique* while engaging with the broader world as a citizen. Such students and graduates are *autonomously able* – unprompted by pedagogical situations – to size up situations in the world and to respond to them *agentically*.

Debates about CT in higher education

There are two key debates about the very concept of CT that have important implications for teaching and learning processes. The first one is whether CT is a general skill (Ennis, 2015) or is content-specific, being rather attached to different disciplines (Abrami, et al., 2015; Schendel, et al., 2020). It has been argued that CT involves generic skills that can be applied across a large variety of disciplines, such as science, history, literature, psychology, and everyday life (Tiruneh, et al., 2018). Jones, in turn, argues that CT 'occurs within the conventions, methodologies, and knowledge bases of particular disciplines and fields and within the structures that they provide' (2015: 169). Some scholars (Abrami, et al., 2015; Schendel, et al., 2020) have pointed out that CT constitutes a generic skill while also being discipline specific while Ennis (2015) point out that CT involves dispositions that will encourage students to use these skills either in general contexts or specific situations.

A second debate revolves around whether CT is context-neutral or context- specific (Tan, 2017). This debate resonates with an old discussion between universal cognitive skills being proposed by Piaget versus socio-cultural approaches drawing on Vygotsky's ideas which point that desirable learning skills are set by specific cultures. In Western cultures, the skill to reason, question and solve problems individually are well-regarded as generic skills while in collectivistic cultures (for example, in Asian countries (Hofstede, 2011) a more collective approach to solve problems (McBride, et al., 2002).

Nowadays, most studies on CT have been developed in countries in the Global North such as the USA or the UK while in Asia or Africa there are fewer studies on CT (Schendel, et al., 2020). In the Global North, CT is frequently manifested in the image of students raising questions, sharing their opinions and discussing out loud in classrooms. Yet, this representation dismisses non-western philosophies such as Confucianism, that promotes a strict sense of respect toward elders and

authority figures. In some Asian countries such as China (Tran, 2013), Singapore (Tan, 2017), or Thailand (Calero Guerrero, 2014) students are timid and may not necessarily feel comfortable raising questions openly. Yet, this would not necessarily mean that they are not capable of exerting CT. Cultural differences across countries might shape the ways in which CT is taught and learnt. Arp and Watson (2015) argue that it is harder to teach CT skills in some Asian cultures because memorisation is prevalent rather than comprehension. Meanwhile, in more individualistic societies, working in groups and collaborating to reach a common goal might be harder.

From a cultural perspective, a tension emerges when CT is conceived as a universal skill versus a vision that takes into consideration the history, local cultures and the specific attributes of HE across different countries. In the particular case of LATAM, critical pedagogies is a foundational school that relates with some of the definitions of CT, although with important differences. The next section expands on this topic and we come back to it in the discussion of the findings of this review article.

Critical thinking and critical pedagogies

Several scholars have linked CT with critical pedagogies (Burbules & Berk, 1999; Fernández-Balboa, 1993; Paul & Elder, 2006; Rahimi & Sajed, 2014). Burbules and Berk (1999) highlighted that both concepts share a concern on how to cultivate a critical predisposition to assess and judge the reliability of information and social situations, but these approaches emerge from different epistemological positions. While CT is more concerned with 'epistemic adequacy' to judge the trustworthiness of information and articulate arguments (Burbules & Berk, 1999: 47), critical pedagogies are concerned with social justice matters (Bali, 2015). According to critical pedagogies, being critical implies an understanding of the mechanisms through which dominant ideologies serve to maintain the advantages of privileged elite groups at the expense of excluding others (Burbules & Berk, 2018).

While CT and critical pedagogies could be part of the same educational project, their link is not automatic nor granted. As described by advocates and thinkers of critical pedagogies (e.g. Apple, 2011; Giroux, 1997, hooks, 1994; Ladson-Billings, 1995; McLaren 1997), critical pedagogy goes beyond being able to be a critical thinker, since it implies to assume a stance in the world that intentionally seeks to disrupt oppressing mechanisms.

In South Africa, there have been initiatives to promote critical citizenship education as a result of the tensions produced by apartheid (Costandius, et al., 2015). In this context, developing CT is seen as part of a broader educational project that aims to work for a more inclusive and anti-racist HE that promotes the values of 'tolerance, diversity, human rights, and democracy' (Costandius et al., 2015: 547).

In LATAM, critical pedagogy is an important philosophical school. The ideas of the Brazilian philosopher and educator Paulo Freire (e.g. Freire, 1968, 1992; Freire & Macedo, 1987) have shaped generations of educators in the Latin American region and elsewhere (Haymes, 2022; Torres, 2019).

In its essence, Freire´s thought posits that education should be a liberatory practice, that allows 'educandos' (students) achieve self-realisation about their position in the world and empowerment to overcome their conditions of oppression. Freire's critical pedagogy was strongly inspired by the colonial history of Brazil and the role that education has been playing in maintaining the domination of indigenous and black populations in a postcolonial Brazil during the second half of the twentieth century.

Following ideas of Karl Marx, John Dewey, Hegel, Eric Fromm, Frantz Fanon and Albert Memmi (Díaz, n.d.) and permeated by the history of other colonial countries, Freire argued that the classroom can be a place for social transformation. Being the educational curriculum a tool to legitimise the knowledges of the dominant class, Freire proposed that educators should enact a pedagogy that relies on dialogical processes that invite students to problematise what it is being taught. To do so, educators, especially those working in contexts with historically marginalised groups, need to recognise students ' prior knowledge and abandon the classic unidirectional method of teaching lectures, a method that Freire called 'banking education' . Thus, a critical pedagogy challenges the taken-for-granted hierarchical relationship between educator as the knower and 'educandos' (students) as recipients of information. It aims to generate a dialogical practice that allows students and educators to become aware of the underlying socio-political and cultural conditions that limit their freedom to disrupt it (Freire, 1968).

To sum up, critical pedagogies encompass a relationship among a) dialogical practices to problematise educational curriculum, b) a self-realisation of teachers and students of the injustices that limit their freedom, and c) an intentional search to disrupt conditions of inequality. These three elements have been quite present in the discourses about public universities in LATAM as agents of transformation (Guzmán-Valenzuela, 2016). However, over the last three decades or so, tensions between universities as transformative universities and a neoliberal and capitalist agenda have emerged in the region (see Austin & Beserra, 2022; Guzmán-Valenzuela, 2016; Guzmán-Valenzuela, et al., 2020). Like in other countries, the emphasis on training the next generation of workers for the labour market to compete in a globalised knowledge economy has taken the higher education agenda undermining the potential role of HE to question, disrupt and interrupt the mechanisms that cause inequities.

Methodology

This study consists of a systematic review of the literature on CT in HE produced by scholars affiliated to Latin American universities and published between 2012-2022. Our approach follows the set of procedures recommended by the 2020 statement of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (BMJ, 2021), also known as PRISMA (BMJ, 2021). PRISMA is a methodological approach that ensures the replicability and transparency of the review process. The updated PRISMA statement 2020 provides 27 procedures that we have followed throughout the

search and reporting process.

The process of identification of articles included a systematic search in the databases of Web of Science (WoS), Scopus, and SciELO. Both WoS and Scopus contain the largest collection of journals across disciplines and are considered the most prestigious indexations in several countries across the world (Mongeon & Paul-Hus, 2016). In turn, given that this systematic review is focused on LATAM, it was decided to include SciELO which is the most popular indexation in the region although it does not have the same academic status as WoS or Scopus (Packer, 2009).

The key terms entered into each of the respective databases included the following: 'CT' and 'higher education' or 'tertiary education' and the following twenty Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, El Salvador, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Uruguay, and Venezuela. This search process identified a total of 462 articles, of which 63 were duplicated. The selection process is illustrated in Figure 1 (below) and consisted of a series of steps.

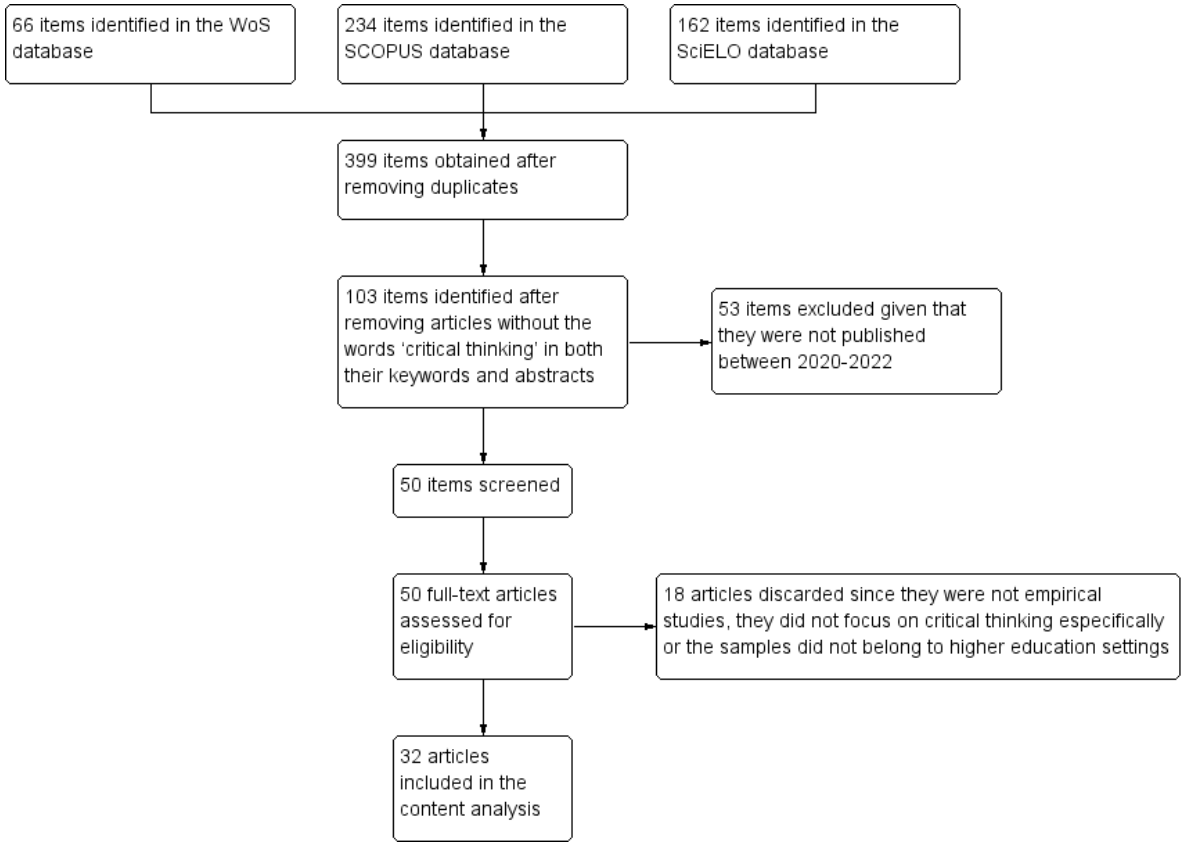

Figure 1. Flow diagram following the PRISMA template

First, articles whose focus and object of study was CT in higher education institutions in LATAM were selected. Second, articles whose abstracts and keywords included the term 'critical thinking' were identified. Third, argumentative, review, and purely theoretical articles were removed; that is,

just empirical articles were selected. Fourth, given the high number of articles published between 2020 and 2022 (see Figure 3), all of them (32 articles) were thematically analysed (Braun & Clarke, 2006). The thematic analysis was conducted by three members of the team. In the first stage, two members of the team read 10 papers while the third member read 12. In light of these readings each member identified the main research goal of each article, the methodology used to investigate CT, the sample characteristics and the main theoretical approaches deployed. In a second stage of the thematic analysis, the team members interchanged the readings of the articles to triangulate the analysis and make changes or add nuances if necessary. And, finally, in a third stage, the team members interchanged again the articles so as to consolidate the analysis. Each article was read twice at least by two members of the team.

Descriptive analysis

Most articles were written in Spanish (47%), followed by English (39%) and Portuguese (14%). Figure 2 shows that almost half of the articles on CT are indexed in Scopus (182 articles), followed by those indexed in SciELO (151 documents) and finally by those indexed in WoS (66).

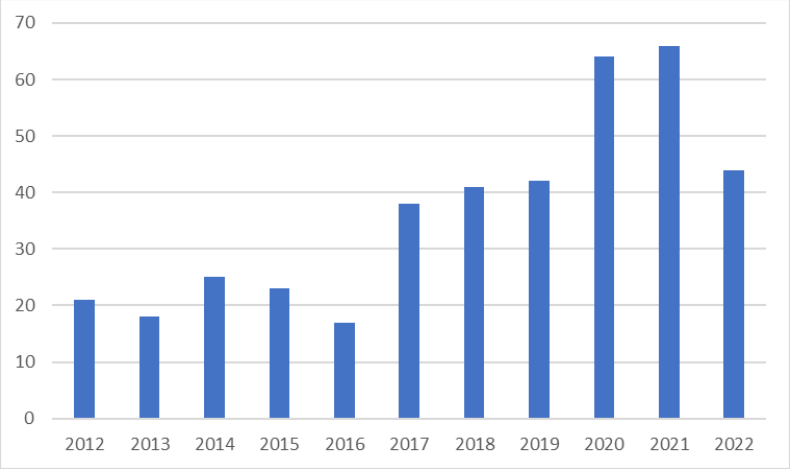

Figure 2. Year of publication of the articles

Figure 2 illustrates the evolution of articles on CT over the years. Year 2021 was the year with the largest number of published papers while 2016 was the year with the fewest publications. Broadly, the number of articles addressing CT increased over the last six years (2016 onwards). This trend shows that CT is a recently new research topic in HE in LATAM.

Figure 3 shows the evolution of articles published between 2012 and 2022 per indexation. Overall, most CT articles have been published in the Scopus indexation, followed by SciELO in 2021 and 2020. This trend is associated with Scopus having a significant proportion of social science Journals while SciELO is an initiative launched by Brazilian agencies, in which an important number of Latin American journals are hosted.

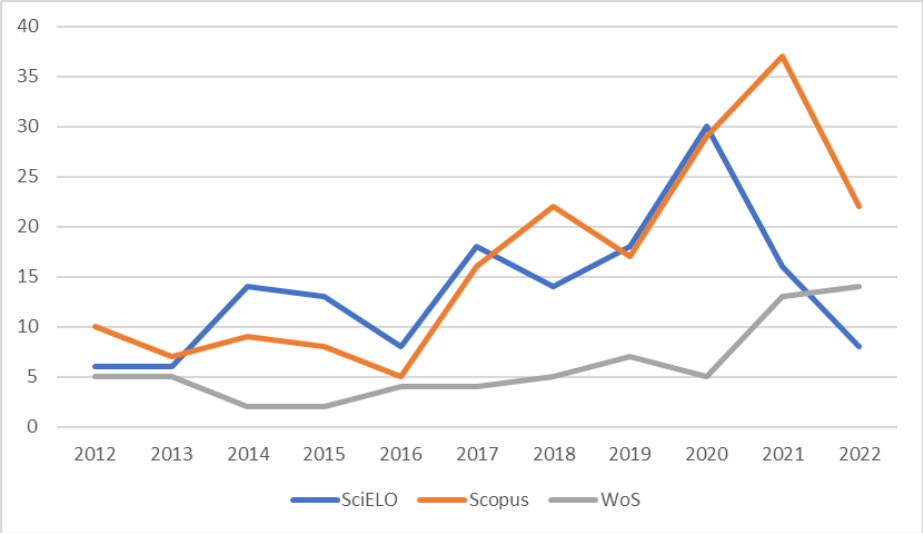

Figure 3. Year of publication of the articles by indexation

As is apparent in figure 4, more than 60% of the articles are collaborative articles (authored by more than one author). Most of them were written by authors affiliated to a university within the same country in LATAM (domestic collaboration), followed by articles authored by scholars affiliated to universities in different countries (international collaboration).

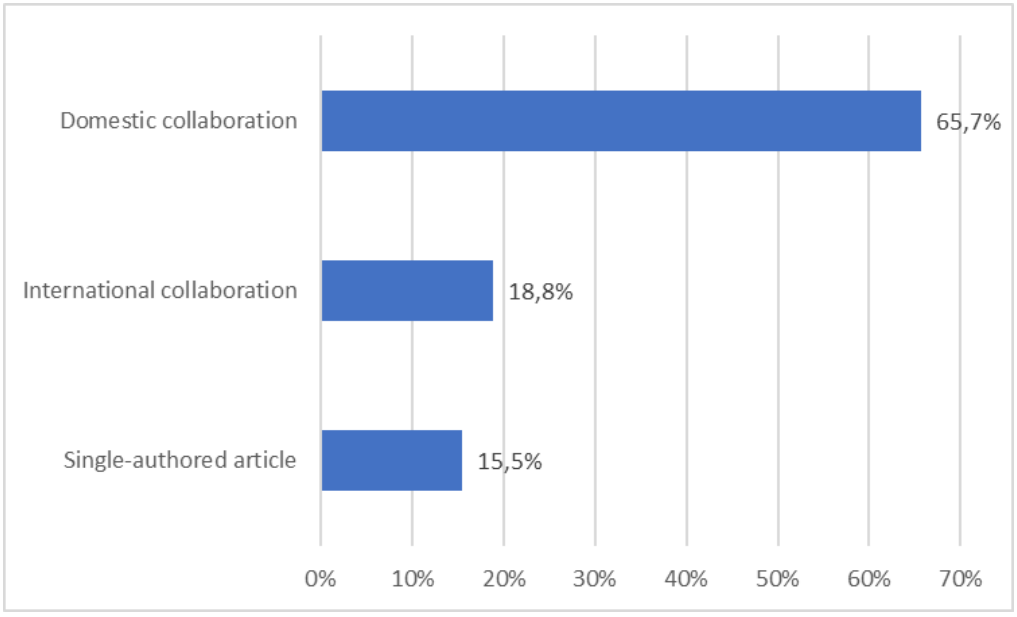

Figure 4. Type of authorship of the articles

Table 1 shows international collaboration and the country affiliation of the articles' first author. It shows that Spain leads the co-authorship of articles on CT followed by both Mexico and

the USA.

Table 1. Collaborative articles by country of the first author

Leadership (first author) in collaborative articles	Articles
España	17
México	12
USA	
Brazil	9
Ecuador	6
Colombia	5
Portugal	3
Chile	
Rumania	2
Venezuela	
Chile	1
Argentina	
Australia	
Perú	
Total	**75**

Spain is the country in which collaboration among scholars in LATAM is most evident (29 articles). This collaboration is unsurprising, given that the use of Spanish is common across these countries. This trend is followed by the USA (17 articles) and Brazil (9 articles). In the case of the USA, studies (Guzmán-Valenzuela et al., 2023 show that, in the social sciences, there is a significant level of collaboration between authors affiliated to a Latin American university and to a university in the USA.

Content analysis

The 32 articles identified for the content analysis showed trends regarding the type of research conducted about CT, the disciplines and samples involved, the type of research methodology and the main theoretical approaches used to investigate CT. Most of these are case studies (either of specific courses, programmes, universities, or countries), situated in undergraduate programmes (26), in *both* undergraduate and postgraduate programmes (2) and in a doctoral programme (1). Most of these courses are in the social sciences (13) and STEM disciplines (11). The appendix shows the main characteristics of these articles in relation to their research methodology and theoretical references.

The analysis identified five groups of articles: (i) studies about specific pedagogical

interventions to promote CT and the assessment of the effectiveness of such interventions; (ii) studies about whole courses across different disciplines aiming to promote CT; (iii) studies containing the analysis of the curriculum and the ways in which it promotes CT; (iv) studies that correlated CT with other skills; and (v) studies about the use or validation of tests to measure CT. In the following, more details about these types of studies are described.

The first 12 articles describe pedagogical interventions aiming to develop CT among students. Six of the studies took place in STEMM (science, technology, engineering, mathematics and medicine) disciplines and three in teacher education programmes. Most of these studies consisted of pre-experiments or quasi-experiments with both a control group and an experimental group. Usually, the experimental group of students was exposed to a pedagogical intervention that promoted active and collaborative learning.

For example, article 1 provides an account of pedagogical interventions in two courses in biology (one at an undergraduate level and another at a postgraduate level), with one of them using research-based learning, that is, a type of methodology that promotes students' abilities in conducting their own research and solving research problems so as to promote their learning. Another example is presented by paper 10 that describes a pedagogical intervention promoting active learning among engineering students. Underpinning these papers is the idea that CT can be enhanced through active learning and a direct involvement of the students in their learning.

Typically, studies involving an intervention were quantitative and included the measurement of CT (pre-post intervention) through *ad hoc* questionnaires to measure the development of CT among other skills (e.g., creativity). Several studies included questionnaires to measure students' perceptions or satisfaction about their learning.

Second, six articles (13-18) revolve around specific courses across diverse disciplines (philosophy, engineering, and education) aimed at promoting CT. In these articles, it is assumed that CT will be promoted in these courses. For example, two papers describe the use of active learning methodologies (paper 17 draws on project-based learning and article 16 describes the promotion of argumentation through academic writing in philosophy). A wide variety of research methods was evident. While some studies use *ad hoc* questionnaires to measure CT in the wake of the learning experiences, others describe the use of specific tasks (argumentation through writing or solving of mathematical problems) to measure the development of CT indirectly. One qualitative study reports on a pedagogical initiative actually led by four engineering students (across four projects in Colombia) (article 17). Interviews, surveys, and observation grids were used to examine the development of CT among students and their teachers.

Third, two studies (19-20) examine the ways in which CT is contained and promoted through the curriculum, namely in philosophy at a Colombian university (article 19) and in educational projects in accountancy at a university in Cuba (article 20). Both studies performed a document analysis to identify ways in which CT is promoted through the inclusion of components in the

specified curriculum.

Fourth, six studies (21-26) report on quantitative research in which CT and other skills are measured and correlated. For example, articles 21 and 23 positively correlates CT and cooperative learning; article 22 correlates CT with academic performance and self-efficacy; article 24 positively correlates CT with interpersonal skills, and article 26 relates CT with a research disposition. Interestingly, article 25 positively correlates CT and active learning, both measured through an encephalogram[1]. These studies took place across a variety of programmes (economics, business, mathematics, and psychology).

Fifth, six studies (27-32) quantitatively measure CT among students either by using/adapting a previously validated test on CT or by creating and validating a new test. These studies take place across different disciplines such as engineering, literature, history, sciences, social work, and linguistics among others. In addition, 28 of the 32 analysed studies define CT by relying mainly on CT conceptualisations and instruments that emerged outside of the Latin American region, drawing primarily on the work of the USA-based scholars Peter Facione, Robert Ennis, Richard Paul, and Linda Elder. For instance, Vidal and colleagues (2021), in a study of engineering students in Chile, adopted a pedagogical intervention using a model known as CDIO (Conceive — Design — Implement — Operate), created by the Massachusetts Institute of Technology. With CDIO, students are expected to work collaboratively and provide feedback to each other at different stages of the project. The justification of using this model goes back to Facione´s definition of CT, who highlights the importance of activating the use of CT through activities.

Drawing on a wider range of authors, the article by Aznar and Laiton (2017) highlights the role of CT as higher-order cognitive capacity, which involves skills associated with the understanding of a phenomenon, identification of reliable information sources, logical reasoning, and capacity to solve problems. This conceptualisation of CT supposes a gradual developmental process, which starts with the disposition of students in critically analysing and understanding phenomena. The same authors discuss the best instruments to measure their intervention, which has a strong component of problem-solving. All the instruments mentioned were developed outside the Latin American region (the California Critical Thinking Test; the Cornell CT test; Watson-Glaser CT test; the International Critical thinking test; the Ennis – Weir Critical Thinking Essay Test; and the PENCRISAL test from the University of Salamanca

A cross-examination of the 32 articles shows that the work of the Colombian scholar Sonia Bentarcourth-Zambrano and the Chilean scholar Christian Miranda are cited in some of the analysed papers. Both scholars have adapted the Tasks in Critical Thinking (TCT), originally developed by the transnational company Educational Testing Service. However, their conceptualisation of CT follows that of some of the dominant authors in the field (e.g. Facione, 2007; Paul & Elder, 2006).

[1] An Encephalogram, also known as EEG, is a medical exam that captures the electrical activity in the brain using small and metal discs (electrodes) attached to the scalp.

Finally, only two of the articles (Sandoval, et al. and Canese de Estigarribía) mention Freirian critical pedagogy to highlight how CT could open the way to possibilities of worldly transformation. Sandoval and colleagues, like Canese de Estigarribía, provide an extended explanation of how critical thinking is a pedagogical condition of world transformation. Indeed, they offer a genealogy of CT, citing the philosophies of Kant, Marx, and the Frankfurt Critical Theory School. Sandoval and colleagues, in a study to foster CT among Chilean undergraduate students, point to the work of Freire as one of the theorists that inspired their LASRED pedagogy as a didactic unit to promote CT through the use of emerging technologies. LASRED (by its acronym in Spanish) stands for reading, analysing, synthesising, solving problems, evaluating, and decision-making. Sandoval and associates indicate that Freire´s socio-critical pedagogy places emphasis on relationships between praxis, reflection, and action to transform the world, a pedagogic philosophy that was foundational in inspiring change in HE. However, the authors are explicit in mentioning that LASRED conceptual basis is heavily influenced by a constructivist learning approach that highlights the active students' involvement in their learning and the role of the teacher in mediating such learning and also by a connectivist approach that conceives learning as being part of a connected community and in which technology and social media play an important role.

In turn, Canese de Estigarribía, in a study on the development of CT skills among philosophy students in a Paraguayan university, briefly mentions the work of Freire to indicate his influence in HE across LATAM. However, this article does not connect its main research aim with Freire' s theories and it is rather concerned with measuring the association of CT with cognitive (interpretation, classification, analysis, evaluation, intellectual empathy, transformative vision and problem solving) through a dedicated test.

Discussion and conclusion

This study contributes to the broad field of studies on CT in HE from two perspectives: i) It analysed the definitions and methodologies used to characterise and measure CT in LATAM; and ii) it uncovered certain underlying patterns of knowledge production about CT in that region.

It has been found that CT, as an object of study in HE, has gained traction in LATAM, especially since 2017 and notably in the last three years (2019 onwards). This scholarship has been published mainly in Spanish, followed by English. Most of it is contained in both SciELO and SCOPUS journals which is not surprising considering that SciELO articles are mainly in Spanish while SCOPUS articles tend to be published in English mainly. These features, together with the fact that most of the articles identified here were co-authored by scholars affiliated to a university within the same Latin American country (i.e., were domestic collaborative articles), and that most of the studies examined through the content analysis were of small-scale initiatives in specific courses and/or programmes and in particular universities, speak to the *local character of the scholarship on CT in LATAM*.

Conceptually, and as evident in the content analysis, CT is seen mainly as a higher-order

cognitive capacity whose development implies a developmental phase of acquiring certain skills (Facione, 1990; Paul & Elder, 2006; Perry, 1970). Many of the skills examined and promoted in the analysed studies include those of seeking an understanding of phenomena, reflection, argumentation, deductive and inductive reasoning, solving problems, and making judgements. Therefore, these studies point to CT as a high-order cognitive skill and are inspired by classic cognitive psychology theories.

Missing in these Latin American studies, therefore, is a broader conceptualisation of CT that involves the formation of modes of *being critical*, that is, the possession of dispositions to engage critically with the world as citizens and professionals (Barnett, 1997; Davies & Barnett, 2015; Schendel, et al., 2020). These wider aspects are not readily present in the scholarship on CT in LATAM rendering it quite narrow in its conceptual range. This limitation in Latin American scholarship on CT might be due to CT having been operationalised predominantly through tests and questionnaires, requiring the measurement of specific traits and dimensions of student learning that are readily observable.

Furthermore, and surprisingly, it was found that the scholarship of CT in LATAM has not been sufficiently permeated by the principles of critical pedagogy. Although in two articles Freire and other authors from the Frankfurt school are mentioned, in neither of them critical pedagogies have a key role in shaping teaching and learning processes. Freire' s ideas here play a rather inspirational role that not necessarily materialise in pedagogical processes aiming to disrupt injustice and inequities matters.

Through the examination of the scholarship on CT, we have found what we would term an epistemic *disjuncture* in knowledge production on CT in LATAM that unfolds both theoretically and methodologically. *Theoretically,* the ways in which CT is investigated in LATAM rely heavily on theories and conceptualisations emerging from outside LATAM, especially, the USA. This dynamic in the knowledge production on CT in LATAM reflects what some scholars have termed a coloniality of knowledge (see Quijano, 2000; Grosfoguel, 2007). The idea of a coloniality of knowledge foregrounds the power and visibility of the epistemologies produced by the Global North, a phenomenon that is supported by material, geopolitical and symbolic conditions that can be traced back from colonial times. This dynamic would explain that despite the strong tradition of critical pedagogies (Torres, 2019) in the Latin American region, most of the articles have omitted these issues. Paulo Freire's critical pedagogy (1968; 1992) – with its concepts of praxis and conscientisation and a critique of the 'banking' idea of knowledge acquisition are not addressed in the dominant conceptualisations of CT in LATAM.

And *methodologically,* we are witnessing – in the scholarship of CT in LATAM, an undue importation of instruments from the Global North through the use of instruments produced to measure CT in the USA mainly, followed by instruments developed in the UK and Spain. While most of the time, in these studies, the authors adapted the tests and questionnaires to concrete higher education Latin American contexts through statistical techniques, they rarely signalled the cultural

limitations in the use of such instruments. The mistaken assumption is that these imported instruments can readily be transferred, unproblematically, to Latin American HE contexts, despite the obvious differences between the LATAM context and the contexts in which these instruments were originally produced. Implicit here is the idea that CT is a unitary concept made up of a universal set of particular skills that are context-free and that can be measured in a context-free form. Moreover, research on CT conducted in Latin American universities involve mostly low-scale case studies that do not allow generalisations and, as a result, research outcomes are, in any event, rather context-specific. However, very little is said about those specificities.

We further conclude that Latin American scholarship' s conceptualisation of CT, and its instruments in measuring this phenomenon in the Latin American region, is missing an opportunity to develop features that are especially fitting for LATAM' s geo-historic context; in particular, approaches that are connected with the long-standing tradition of critical pedagogies. Future research in HE in LATAM could also helpfully examine the omnipresence of neoliberal discourses, not least in their promoting an unduly economic interpretation of CT.

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Appendix 1: Thematic analysis of selected 32 articles

Article, year, and country affiliation	Methodology and sample	Theories and measurement of CT
1. Active learning tools improve the learning outcomes, scientific attitude, and critical thinking in higher education: Experiences in an online course during the COVID-19 pandemic. Rossi et al. 2021, Brazil.	**Quantitative**: Case study. Quasi-experimental design. Interventions and then questionnaires (pre and post). First experience: Undergraduate online course (12 hours) in biology (cell culture). Course inspired by active learning (active learning strategies). Second experience: online course on infectious diseases. Teaching methodology: research-based learning. **Sample**: Science undergraduate and postgraduate students from one university in Brazil.	**Conceptualizations associated with CT:** Active learning. The assumption is that active learning improves critical thinking (Michael, 2006). **Measurement:** Evaluation of the academic performance and then questionnaires with multiple-choice and open-ended questions.
2. Impact of Interactivity and Active Collaborative Learning on Students' Critical Thinking in Higher Education. González-Cacho & Abbas. 2022, Mexico.	**Quantitative**: Case study. Non-experimental design. Intervention involving active and collaborative learning using social media. Correlation and post surveys with questions about interactivity, collaborative learning and CT. **Sample**: 273 architecture and engineering undergraduate students from one university in Mexico.	**Conceptualizations associated with CT:** Relationship of social media-based activities to critical thinking. Inter-activity and active collaborative learning are built into the activities and positively impact critical thinking development. **Measurement**: Online questionnaire.
3. The use of video essays and podcasts to enhance creativity and critical thinking in engineering. Caratozzolo et. al. 2022, Mexico.	**Quantitative**: Case study. Experimental design. Pre and post tests on cognitive maturity and creativity and other transversal abilities. Experimental group: experiences using video essays, podcasts, world café plus online activities like debates, panels, workshops, etc. Students' opinions. Engineering courses on creativity in criticality. **Sample**: 323 undergraduate students of engineering programs from one university in Mexico.	**Conceptualizations associated with CT:** Creative thinking, divergent thinking and other traits. Taxonomies of creativity, Kirton' s cognitive style, models of creativity (creativity in criticality), metacognition. **Measurement**.: Articulation ability tests. and modified VALUE rubrics from the Association of American Colleges and Universities (AAC&U).

4. Effect of a critical thinking program on pedagogy students' representation bias. Ossa-Cornejo et al. 2020, Chile-Spain.	**Quantitative**: Impact evaluation of the intervention to the CT program (PENCRIT) through pre and post-test (Saiz, 2017). Quasi-experimental design. **Sample**: 95 undergraduate students of pedagogy in natural sciences and mathematics from two Chilean universities.	**Conceptualizations associated with CT:** CT is a skill that allows analysing and evaluating the available information based on questions and hypotheses that reveal its coherence, validity, and probability of occurrence (Marin y Halpern, 2011; Miranda, 2003; Tung y Chang, 2009). **Measurement**: Impact of the "critical thinking program for scientific reasoning (PENCRIT-RC) (PENCRIT-RC)" .
5. Promoting pedagogy students' scientific skills through critical thinking programme. Ossa-Cornejo et al. 2022, Chile-Spain.	**Quantitative**: PENCRIT-RC programmed through a workshop of 14 weeks. with an infusion design. Active and collaborative methodology. Promotion of 2 skills. Inquiry and probabilistic reasoning. Then tests. Quasi-experimental design. **Sample**: 95 undergraduate students of pedagogy in natural sciences and mathematics from two Chilean universities.	**Conceptualizations associated with CT:** The critical thinking program for scientific reasoning (PENCRIT-RC) was created ad- hoc for this study and is based on the idea that critical thinking is a skill that allows a person to analyse and evaluate the available information, using arguments and hypotheses that reveal coherence, value and probability of occurrence of the arguments. **Measurement**: The first instrument was one factor of the Critical Thinking Task (CTT) test prepared by Miranda (2003), who adapted and translated the instrument into Spanish from the test of the Educational Testing Service of the United States (Erwin & Sebrell, 2003). The second instrument was a selection of probabilistic thinking items from Lawson's scientific reasoning scale.
6. Virtual education in the critical thinking of university students. Valencia. 2021, Peru.	**Quantitative**: Case study. Quasi-experimental design. Intervention with an experimental group exposed to virtual education to determine its influence on the CT and measure it through pre and post-tests. **Sample:** 68 undergraduate students of first cycle of the faculties of architecture and urbanism and communication and administration sciences attending at a private university in Peru.	**Conceptualizations associated with CT:** Theories related to the critical thinking variables are based on sociocultural and cognitive theory and the theoretical basis of Facione (2007). Vygotsky's (1997) sociocultural approach is also used. **Measurement**: Rubric created ad-hoc by the research team.

7. Chemical Laboratory on Context: Input for Development of Critical Thinking Skills. Rodríguez-Cepeda et al. 2020, Colombia.	**Quantitative:** Case study. Pre-experimental design. Intervention and measurement of CT. Intervention to promote the development of CT skills by posing problem situations in the context of food chemistry and then measuring them with an instrument. **Sample**: 32 undergraduate students of the degree in chemistry of the National Pedagogical University, Colombia.	**Conceptualizations associated with CT:** Essential cognitive skills of CT proposed by Facione (2007). **Measurement**: Questionnaire previously validated by experts consisting of six open questions that assess the degree of development of interpretation and argumentation skills.
8. University Pedagogy Based on Generic Competencies to Develop Critical Thinking Skills in Students of the National University of San Martín. López-Novoa et al. 2020, Peru.	**Quantitative:** Case study. Quasi-experimental design. CT measurement intervention (generic skills). Intervention with students to promote generic competences. Measurement with pre and post-tests its influence on the development of CT skills. **Sample:** 180 undergraduate students from one university in Argentina.	**Conceptualizations associated with CT:** Six core skills for critical thinking by Giancarlo and Facione (2001): Analysis, inference, interpretation, evaluation, explanation and self-regulation. **Measurement:** Questionnaire. It does not indicate how the questionnaire was developed or validated.
9. Perception of first year commercial engineering students on critical thinking and teamwork competencies. Soria-Barreto & Cleveland-Slimming. 2020, Chile.	**Quantitative:** Case study. Non-experimental design. Intervention with use of active learning methodologies. Questionnaires to measure students' perceptions, satisfaction and evaluation of the development of competences of critical thinking and collaborative work. **Sample**: 113 undergraduate students of an engineering degree at one university in Chile.	**Conceptualizations associated with CT:** Definitions of CT of Facione (1990) and Abrami (2008) CT definitions. **Measurement:** Two questionnaires developed by the research team to measure: 1) self-perception of CT competencies and 2) student satisfaction about the pedagogical strategies used.
10. Development of Soft Skills in Engineering Education through Cross-Evaluation. 2021, Chile.	**Quantitative**: Case study. Intervention with active-collaborative learning. Then, questionnaires and rubric to evaluate CT through feedback. Pre-experimental design. **Sample**: 52 first year undergraduate students of engineering in one university in Chile.	**Conceptualizations associated with CT:** Definition of CT of Tung & Chang, 2009; Yang 2012. Activation of CT (Facione, Facione and Giancarlo, 2000; Saiz and Rivas, 2008; Valenzuela and Nieto, 2008). **Measurement:** Rubric developed by the research team adapted from Larrain (2015) to measure how students provided feedback that considered four aspects: self-evaluation, peer evaluation, teacher evaluation and external evaluation. Likert scale.

11. Critical Thinking and Strategic Competence Acquisition in Translation Students. Vidal-Sepúlveda et al. 2020, Peru.	**Quantitative**: Case study. Quasi-experimental design. Design with pre-test and post-test with non-equivalent groups (non-randomized). Intervention to stimulate CT conceived as higher order cognitive operations such as analysis, inference, interpretation, evaluation and self-assessment. Design with pre-test and post-test with non-equivalent groups (non-randomized). **Sample**: Undergraduate students of translation in one university in Peru.	**Conceptualizations associated with CT:** Definition of CT from Elder and Paul (1994). **Measurement:** Test has three parts corresponding to three dimensions: problem solving, translation evaluation, and translation self-assessment.
12. The effectiveness of computer-based simulations for numerical methods in engineering. Tudón-Martínez et al. 2020, Mexico.	**Mixed design:** Case study. Quasi-experimental quantitative design with a qualitative component. Intervention to assess the impact of active learning self-regulated activities developed through virtual learning environments and supported by computer simulations for the instruction of numerical methods. **Sample**: 13 undergraduate engineering students in one university in Mexico.	**Conceptualizations associated with CT:** Relationship between active learning and CT. **Measurement**: CT is promoted through a technological approach based on Virtual Learning environments and supported by computer simulations.
13. Teacher education and critical thinking: Systematising theoretical perspectives and formative experiences in Latin America. Fandiño Parra et al. 2021, Colombia.	**Qualitative**: Documentary review of 265 academic papers and theses, plus 137 qualitative surveys on critical thinking, educational perspectives and experiences. **Sample**: For the second stage of the research, the qualitative surveys were applied to 137 teachers from 3 Latin American countries (with a mixed group of participants whose academic levels were undergraduate, specialisation, master' s degree, Ph.D. degree and other)	**Conceptualizations associated with CT:** CT definitions of Scriven & Paul (2015), Sternberg (1986), Enis (2001) and Facione (2007). **Measurement**: Documentary review of 265 academic papers and theses, and the implementation of 137 qualitative surveys on critical thinking educational perspectives and experiences.
14. Different ordering of the first topics on the Philosophy and Society I syllabus. Hernández. 2021, Cuba.	**Quantitative:** Case study. Non-experimental design. Documentary analysis of the program and of the available literature. Questionnaire applied to a group of students, unintentionally selected, about the favourite subjects and contents of the program. Descriptive analysis.	**Conceptualizations associated with CT:** Definition of CT of Educational Technology CT (2020) and Mackay Castro, Franco Cortázar and Villacis Pérez (2018). **Measurement**: Questionnaire designed by the research team.

	Sample: 15 first-year medical undergraduate students from one university in Cuba.	
15. Perspectives and challenges of critical thinking: Level of development in undergraduate students. Gonzales Llontop & Otero Gonzales. 2021, Peru.	**Quantitative:** Case study. Non-experimental design. Questionnaire to determine the level of development of critical thinking skills in undergraduate students. Descriptive analysis. **Sample:** 35 foreign language undergraduate students from one university in Peru.	**Conceptualizations associated with CT:** CT definitions of Ennis (1992), Ennis & Paul, (2003), Facione (2007), Limpan (1998), Díaz-Barriga, (2001) and Paul & Elder (2003). **Measurement:** Questionnaire developed by the researchers drawing from the literature with Lickert scale. Four dimensions: information analysis; infer the implications; alternative solutions, argue a position.
16. Towards an evaluation of pedagogical reflection from academic writing. Schnitzler-Sommerfeld & Núñez-Lagos. 2021, Chile.	**Qualitative:** Case study. Development of a rubric to evaluate written skills of CT among students in pedagogy programs. **Quantitative:** Non-experimental design, Descriptive and correlational analyses of CT written skills through a rubric, designed by the research team. **Sample**: 265 texts belonging to undergraduate students recently admitted to a private university and enrolled in six pedagogy programs: Pedagogy in Basic and Secondary Physical Education, Sports and Recreation (n = 89), Basic and Secondary English Pedagogy (n= 48), Differential Education Pedagogy (n = 46), Musical Arts Pedagogy (n = 35), Psychopedagogy (n= 24), Early Childhood Education Pedagogy (n= 23) in one university in Chile.	**Conceptualizations associated with CT:** Relationship between pedagogical reflection and CT (García & Barrientos, 2009; Martin & White, 2003). **Measurement:** Researchers developed a rubric based on seven categories to analyse reflexive texts written by students.
17. Project method to build knowledge in expertise, communication, and critical thinking related to the environment. Perico-Granados et al. 2021, Colombia.	**Qualitative**: Case study. Evaluation of the effectiveness of the project method approach in developing professional expertise, communication skills, and CT. Observations, interviews, grids, and workshops were collected for four years in projects that involved local communities. **Sample**: Four university teachers and their students (12 in total) in a civil engineering programme at one university in Colombia.	**Conceptualizations associated with CT:** Mentions the work of Plate (2011) citing John Dewey (reflexive thinking) and Madrid Hincapié (2018). **Measurement:** The participation in the project improved communication and teamwork skills, which will contribute to their critical thinking.

18. Critical thinking skills for diagnosis process application from the perspective of nursing students and professors. Riegel & Crossetti. 2020, Brazil.	**Qualitative:** Case study. 4 focus groups to identify CT skills needed in the professional career of nursing. An external observer is invited to take field notes. **Sample**: Five undergraduate nursing students and four nurse professors from one university in Brazil.	**Conceptualizations associated with CT:** Holistic critical thinking (Facione & Facione, 2009). **Measurement:** It is not measured directly. The CT skills necessary to apply the diagnostic process to clinical practice are measured.
19. A Study on Existing Perspectives about Philosophical Didactics. Giraldo Botero, et. al. 2021, Colombia.	**Qualitative**: Documentary analysis of five philosophy programs to identify the theoretical perspectives underpinning the didactics of philosophy. Analysis of their relevance within teacher training programs in philosophy. **Sample**: Philosophy programs of 5 high quality accredited universities for the year 2018 in Colombia.	**Conceptualizations associated with CT:** Not clear. It focuses on the didactics of philosophy. **Measurement:** It is not measured.
20. Training for professional judgement in accounting education. Ospina Delgado & Giraldo Villano. 2020, Colombia.	**Qualitative:** Documentary analysis and analytical perspective of Public Accounting's Educational Projects (PEP) to analyse the approach to professional judgement and critical thinking in the educational proposals of high-quality public accounting programmes. **Sample**: 14 educational project programmes from 14 high quality accredited universities for the year 2018 in Colombia.	**Conceptualizations associated with CT:** CT definition of Altuve (2010) and Relationship of CT with vocational or professional education (Cruz, 2007). **Measurement:** It is not measured.
21. Cooperative learning enhances critical thinking in Peruvian economics university students. Saenz Rodríguez et al. 2021, Peru-Colombia.	**Quantitative:** Case study. Non-experimental design. Survey correlating CT & cooperative learning. Descriptive and correlational analysis. **Sample:** 283 undergraduate students in accounting and economics from one university in Peru.	**Conceptualizations associated with CT:** Not clear. It alludes to the cooperative learning of Islam societies in the introduction, but the sample is focused on Perú. **Measurement:** An adaptation of the questionnaire on Individual Generic competencies. It includes interpretation & analysis, evaluation and inference and explanation and self-regulation (Jucevičienė & Vizgirdaitė, 2012; Sánchez et al., 2016; Silva Nieves et al., 2020).
22. Disposición al pensamiento crítico en estudiantes universitarios	**Quantitative:** Case study. Non-experimental design. Instrument to measure the correlation between CT and academic performance.	**Conceptualizations associated with CT**: List of CT definitions.

(Disposition to critical thinking in university students). Padilla et al. 2022, Peru.	**Sample**: 217 undergraduate students in international business school in one university in Peru.	**Measurement**: Zaldívar (2010) CT test, which includes 20 items divided into three areas: acknowledgement of assumptions, evaluation of judgements, and interpretations.
23. From preconceptions to concept: The basis of a didactic model designed to promote the development of critical thinking. Sandoval et al. 2022, Colombia.	**Quantitative:** Non-experimental design. Surveys with questions about interactivity, collaborative learning and CT. LASRED model. Descriptive and correlational analyses. **Sample**: They do not specify where the experts were from to evaluate the instrument or the students with whom they piloted it.	**Conceptualizations associated with CT**: Delphi group research. Sociocultural approach' s relationship between reading, writing and thinking (Vygotski, 1978, 1985; Olson, 1998). Socio-critical point of view of Freire (1971). **Measurement**: Design and validation of measurement tools for a didactic model.
24. Interpersonal values and critical thinking in students of a university in Lima. Flores Morales & Huamani, 2021, Peru.	**Quantitative**: Case study. Non-experimental design. Transactional and correlational design. Two questionnaires applied: CT test (Zaldívar, 2010) and Interpersonal Values instrument (Gordon, 1977). The hypothesis tested was that at greater levels of interpersonal values, there is a greater level of CT **Sample**: 115 first year undergraduate students from one university in Peru.	**Conceptualizations associated with CT**: Relationship between CT and values (Richard y Elder, 2005). Zaldívar (2010) and Facione definition of CT (2007). **Measurement**: Zaldívar test (2010), with 20 items that questions how individuals perceive their position in specific situations, scale of 6 point (e.g. I question the reliability of opinions that most people accept; My judgements go beyond particular impressions and opinions).
25. Looking for experimental evidence of critical thinking through EEG. González-Hernández et al. 2021, Mexico.	**Quantitative:** Case study. Quasi-experimental design. A video of 3:29 duration was presented to both treatment and control group with information of a Problem-Based Learning (PBL) challenge that uses doughnuts as its central theme. A distractor was introduced in the treatment group. Participants were watching the video while they were connected to an encephalogram to measure their brain activity. The expectation was that the treatment group would have a change in their brain waves when they identified the distracting piece in the video.	**Conceptualizations associated with CT**: Ennis definitions of CT (1987). **Measurement**: CT as a construct can be measured using brain waves from a portable electroencephalogram (EEG) during a problem-based learning (PBL) exercise.

	Sample: 40 undergraduate students enrolled in a course of integral calculus in engineering and business schools in one university in Mexico.	
26. Psychology students' attitudes towards research: the role of critical thinking, epistemic orientation, and satisfaction with research courses. Landa-Blanco & Cortés-Ramos. 2021, Mexico-Spain.	**Quantitative:** Case study. Non-experimental design. Cross-sectional study; four instruments were applied: a) the Attitudes Towards Research Scale-Revised (EACIN-R) (Aldana de Becerra et al., 2020); b) Epistemic Orientation Short Scale (EOSS) (Silva Palma et al., 2018); c) Critical Thinking Disposition Scale (Sosu, 2013); d) Satisfaction with University Research Courses Scale (SURCS) (created by the research team from student´s survey). Descriptive, correlation, and hierarchical regression techniques were used to measure how attitudes toward research correlate with epistemic orientation, critical thinking, and satisfaction. **Sample**: 137 psychology students taking online courses enrolled in one university in Honduras (104 undergraduates, 33 masters).	**Conceptualizations associated with CT**: CT definitions of Wallmann and Hoover (2012). Relationship between CT and scientific thinking (Shargel and Twiss, 2019). **Measurement**: Critical Thinking Disposition Scale (CTDS). It is an 11-item instrument with a five-point Likert-type response set (Sosu, 2013).
27. Development of critical thinking in doctoral students in education. Nunez Lira et al. 2020, Peru.	**Quantitative:** Case study. Non-experimental design. Cross-sectional study with the aim of measuring the critical thinking of doctoral students which allowed to establish the reliability and the analysis of the construct of the instrument used (Watson-Glaser test). **Sample**: 150 doctoral students in one university in Peru.	**Conceptualizations associated with CT**: CT definitions of Kuhn & Weinstock (2002) and Medina Peña, Medina de la Rosa, & Moreno Montañez (2017). **Measurement**: Watson-Glaser test (1980) for the evaluation of CT that presents five factors or dimensions: inference, recognition, deduction, interpretation and evaluation of arguments.
28. Creación de un instrumento de medición del pensamiento crítico a través de la matemática: Una aplicación a estudiantes de ingeniería de primer año	**Quantitative:** Case study. Non-experimental design. Creation of a test to measure CT based on mathematical competence. Measurement of reliability and validity of the test. **Sample**: Pilot instrument was applied to 75 students randomly selected in one Chilean university. Final	**Conceptualizations associated with CT**: Diverse literature on tests to measure CT. Relationship between CT and mathematics competence (Meller, 2018; Osman et al. (2015). **Measurement**: Instrument for measuring CT in mathematics developed by the research team. The type

Universitario (Creation of an instrument for measuring critical thinking through mathematics: an application to first-year university engineering students). Arancibia-Carvajal et al. 2022, Chile.	instruments applied to 371 first-year undergraduate students of engineering from the same university.	of questions included in the instrument imitate the type of questions included in the OECD PISA test.
29. Adaptación y validación del test Tareas de Pensamiento Crítico en estudiantes universitarios (Adaptation and validation of the Critical Thinking Tasks test in university students). Palma-Luengo et al. 2021, Chile.	**Quantitative:** Case study. Non-experimental design. Instrumental research design. Assessing the validity of the items introduced in the Critical Thinking Task Test (TPC) to investigate the relationship between and among the identified components, and to determine the validity and reliability of the questionnaire. Descriptive and factorial analysis. **Sample**: 161 undergraduate students from engineering in natural resources, food engineering, pedagogy in natural sciences, pedagogy in history and geography, and a general undergraduate programme in one university in Chile. University students were selected by convenience.	**Conceptualizations associated with CT**: Diverse literature on tests to measure CT. The definition of Facione (2007) is mentioned. **Measurement**: Critical Thinking Task Test (TPC) (2003), originally created by the Educational Test Service, adapted by Miranda (2003) in the Chilean context.
30. Evaluation of critical thinking in Social Work students of the Atacama Region, Chile. Betancourth-Zambrano et. al. 2020, Colombia.	**Quantitative:** Case study. Non-experimental design. Descriptive analysis. Application of the questionnaire Task of Critical Thinking test (CTC), previously adapted by Betacourth, one of the authors. **Sample**: 119 undergraduate students of social work in one university in Chile.	**Conceptualizations associated with CT**: CT definitions of Paul y Elder (2003), Facione (2007). **Measurement**: Critical Thinking Test, in its version adapted and validated for the university population in the Chilean context (Betancourth, Zambrano, Ceballos, Moreno and Aroca, 2018). It consists of 27 closed-answer statements.
31. Identification of critical thinking in second semester university students of the Caribbean University Corporation (CECAR). García et al. 2020, Colombia.	**Quantitative**: Case study. Non-experimental design. CT measurement through the test Evaluation of Critical Contextualized Thinking (EP-2C) proposed by Carrasco (2018). It consists of five variables and 26 reagents designed to measure the study variables:	**Conceptualizations associated with CT**: CT definitions of Dewey (1989), Facione (2007), Halpern (2014) and Guzmán & Sánchez (2006). **Measurement**: Carrasco EP-2C Test (2018). It was prepared from a review of the specialised literature regarding critical thinking and the educational

	analysis, interpretation, evaluation, inference and explanation. A standardised scale. **Sample:** 100 undergraduate students of the programmes of sports sciences (27), engineering (33) and bachelor' s degree in linguistics and literature (40) in one university in Colombia.	environment. He took the ideas of Facione (2007) regarding the variables that underlie critical thinking and those of Paul and Elder (2005) regarding the levels of development of critical thinking. The test is made up of 26 items designed to measure the study variables: analysis, interpretation, evaluation, inference and explanation.
32. Percepción del desarrollo de las habilidades del pensamiento crítico en la Universidad Nacional de Asunción, Paraguay (Development of perception of critical thinking skills in the Universidad Nacional de Asuncion, Paraguay) Canese de Estigarribia, 2020, Paraguay.	**Quantitative**: Case study. Non-experimental design. CT measurement through a Likert-type test with 36 indicators that measure 7 skills: interpretation, classification, analysis, evaluation, intellectual empathy, transformative vision and problem solving. **Sample:** 310 undergraduate students of philosophy, history, literature, education, communication, and psychology in one university in Paraguay.	**Conceptualizations associated with CT**: CT definitions of Ornellas (2014), Ennis (2013), Facione y Gittens (2015) and Betancourth (2015). It is mentioned that the CT was philosophically developed by two currents: Kant (2002) and Marx (1975). Paulo Freire is mentioned. **Measurement**: Likert-type test with 36 indicators that measure 7 skills associated with CT: interpretation, classification, analysis, evaluation, intellectual empathy, transformative vision and problem solving. It was previously subjected to a pilot test and validated by six experts in the area.

Note about case study: Studies whose unit of analysis corresponds to one single university or academic programme.