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Systematic literature review on critical thinking in higher education

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Abstract: The purpose of this paper is to conduct a comprehensive systematic literature review (SLR) on the development, assessment, and influencing factors of critical thinking in higher education. As critical thinking is widely recognized as a core competency for academic and professional success, this review aims to synthesize empirical evidence on how it is fostered across various disciplines and learning environments. The study investigates effective pedagogical strategies, assessment techniques, and the integration of digital tools, including artificial intelligence, in promoting critical thinking. Additionally, it explores how institutional policies, cultural contexts, and disciplinary differences shape students' critical thinking dispositions and learning outcomes. Using PRISMA guidelines, 50 empirical studies from 2016 to 2025 were selected across multiple databases. The review analyzed both qualitative and quantitative research on critical thinking development, assessment techniques, AI integration, pedagogical methods, and socio-cultural influences. Findings indicate that active learning, interdisciplinary instruction, and AI-enhanced tools support critical thinking development. However, over-reliance on standardized assessments and AI-generated content can hinder deep engagement. Disciplinary and cultural factors also shape critical thinking skills. Most studies used cross-sectional designs and focused on specific disciplines or regions, limiting generalizability. Future research should explore longitudinal impacts and cross-cultural comparisons. Universities should adopt blended assessment methods, invest in AI literacy, and revise curricula to foster critical thinking through interdisciplinary and student-centered learning environments.

Keywords: *Active learning, AI in education, Assessment, Pedagogy, Critical thinking, Higher Education, Student engagement.*

1. Introduction

Critical thinking is a fundamental skill in higher education, fostering students' abilities to analyse, evaluate, and synthesize information for informed decision-making. As educational paradigms evolve, there has been increasing emphasis on assessing and enhancing critical thinking skills across various disciplines [1, 2]. Research indicates that integrating critical thinking into curricula not only enhances student engagement but also equips learners with essential skills for navigating complex real-world problems [3]. This study conducts a Systematic Literature Review (SLR) to explore existing research on critical thinking in higher education, focusing on methodologies, assessment techniques, influencing factors, and implications for educational policy and practice. Specifically, this review examines how diverse pedagogical approaches, such as inquiry-based learning and collaborative projects, enhance critical thinking outcomes [4]. It also explores assessment techniques, including formative assessments and rubrics, as effective measures of students' cognitive skills [5]. Furthermore, this study investigates institutional and cultural factors influencing the development of critical thinking, recognizing that policies and practices established at the organizational level play a crucial role in fostering an environment conducive to critical engagement [6]. Ultimately, this review highlights prevailing trends

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in the assessment and teaching of critical thinking and offers insights into developing effective educational policies that promote these essential skills.

2. Background / Literature Review

The literature on critical thinking in higher education spans multiple domains, including psychology, education, technology, and social sciences. Researchers have explored various aspects of critical thinking, focusing on assessment methods, pedagogical interventions, and the role of technology in cognitive development [7]. One major area of study involves the assessment of critical thinking skills using standardized tests such as the California Critical Thinking Skills Test (CCTST) and the Watson-Glaser Critical Thinking Appraisal [8]. These tools help measure students' abilities to analyze, evaluate, and reason logically. However, scholars argue that standardized tests may not fully capture the complexity of critical thinking in diverse learning environments, particularly in contexts that require creative problem-solving and interdisciplinary thinking [9].

Another significant focus is the impact of digital learning technologies and AI-driven tools on students' critical thinking abilities. Studies have investigated how platforms such as ChatGPT and AI-based learning systems can enhance students' analytical reasoning by providing instant feedback, exposure to multiple perspectives, and interactive learning experiences [10]. While AI has shown potential in supporting cognitive development, concerns about over-reliance on AI-generated content and the accuracy of AI feedback remain key challenges in its adoption for educational purposes [11]. Educational interventions, such as case studies, active learning, debate-based learning, and precision teaching, have also been examined for their effectiveness in fostering critical analysis and problem-solving skills [12]. Case-based learning encourages students to apply theoretical knowledge to real-world situations, while debate-based learning enhances argumentation skills and cognitive flexibility [13]. Precision teaching methods, which focus on data-driven instructional techniques, have been shown to improve students' critical thinking fluency over time [5].

Additionally, cultural, and demographic factors play a role in shaping students' critical thinking dispositions. Studies have explored how gender, educational background, parental education, and academic discipline influence students' engagement with critical thinking tasks [14]. For instance, some research indicates that students in social sciences tend to demonstrate stronger critical thinking dispositions compared to those in STEM fields, where problem-solving approaches may prioritize structured methodologies over open-ended inquiry [15]. Several systematic reviews and meta-analyses suggest that constructivist learning theories, active engagement, and technology-enhanced learning environments significantly contribute to the development of higher-order thinking skills [16, 17]. However, challenges such as assessment bias, reliance on rote learning, and issues related to AI dependency remain. Addressing these challenges requires a multi-faceted approach that integrates innovative teaching strategies, blended assessment methods, and responsible AI integration in higher education [6].

3. Methodology

Critical thinking is widely recognized as a crucial competency for higher education students, yet there remains a lack of clarity regarding the most effective strategies for its assessment, development, and enhancement across diverse academic contexts. This systematic literature review (SLR) aims to synthesize existing research to address this gap and provide insights into best practices for fostering critical thinking in higher education.As this review does not involve human or animal subjects, research protocol registration was not required before undertaking the study. The systematic review and meta-analysis were conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor and transparency.The purpose of this SLR is to explore, assess, and summarize the determinants influencing critical thinking in higher education. Specifically, this review seeks to address the following research question:

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- How is critical thinking assessed, developed, and influenced in higher education contexts?

To answer this question, the review focuses on the following key areas:

Contextual factors play a significant role in shaping critical thinking development in higher education. Institutional policies that prioritize active learning, interdisciplinary collaboration, and student-centred pedagogies contribute to fostering critical thinking skills [18]. Teaching methodologies, including problem-based learning, debate formats, and inquiry-driven instruction, further influence how students engage in analytical reasoning [19]. Additionally, digital learning tools such as AI-based tutors, online discussion forums, and gamification strategies have been shown to support critical thinking development by providing interactive and adaptive learning experiences [20]. Faculty engagement is also critical, as instructors who integrate reflective questioning, real-world case studies, and metacognitive strategies can significantly enhance students' critical thinking abilities [2]. The assessment of critical thinking in higher education relies on a variety of standardized and alternative frameworks. Traditional cognitive assessments such as the California Critical Thinking Skills Test (CCTST) and Watson-Glaser Critical Thinking Appraisal (WGCTA) are widely used to measure students' analytical, evaluative, and inferential reasoning abilities [1]. However, alternative assessment methods, including discourse analysis of student interactions, reflective writing assignments, and project-based evaluations, provide deeper insights into students' ability to apply critical thinking in real-world scenarios. The effectiveness of these assessment techniques varies across disciplines, highlighting the need for contextually relevant evaluation strategies [6].

Cognitive, emotional, and social influences significantly impact students' critical thinking dispositions. Self-efficacy, or students' belief in their ability to engage in analytical reasoning, plays a key role in their willingness to question assumptions and explore multiple perspectives [21]. Motivation, both intrinsic and extrinsic, also affects students' engagement in critical thinking tasks [22]. Collaboration with peers fosters dialogue and exposure to diverse viewpoints, which enhances reasoning skills. Furthermore, cultural perspectives shape how students approach problem-solving and argumentation, indicating that critical thinking development must be adapted to diverse educational and social contexts [23].

To improve critical thinking outcomes in higher education, evidence-based recommendations must be provided for educational policymakers, instructors, and curriculum developers. Institutions should incorporate critical thinking instruction into curricula through explicit skill-building exercises and interdisciplinary coursework [3]. Faculty development programs should train educators in strategies that promote analytical reasoning and reflective learning. Assessment practices should balance traditional testing with performance-based evaluations that measure real-world application of critical thinking. Additionally, universities should invest in technological innovations and collaborative learning environments to support students' cognitive development. These recommendations aim to create a comprehensive framework for fostering critical thinking skills in higher education [17].

3.1. Data Collection and Analysis Procedure

The selection criteria for this systematic literature review (SLR) involved identifying relevant studies from multiple academic databases, including ERIC, PsycINFO, JSTOR, SpringerLink, Taylor & Francis Online, Wiley Online Library, and Google Scholar. Articles were selected based on their alignment with the research focus on critical thinking in higher education. The inclusion criteria emphasized peer-reviewed journal articles, empirical studies, and conference proceedings published between 2016 and 2025, ensuring up-to-date insights. The inclusion of Ahern, et al. [24] in the review, despite the 2016–2025 scope, is justified because it provides a foundational Critical Thinking Model that remains relevant in higher education research. The study highlights disciplinary differences in CT instruction, particularly between engineering and humanities, an issue still debated in recent literature. If later studies build upon, reference, or fail to address this gap adequately, its inclusion ensures a comprehensive theoretical foundation. Additionally, its findings may have influenced educational policies and assessment frameworks, making it a key reference for understanding the evolution of

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critical thinking pedagogy. Exclusion criteria eliminated book chapters, editorials, non-English articles, SLRs, and studies with vague methodologies.

3.2. Databases and Their Relevance

Figure 1 visually represents the distribution of selected studies across various academic databases, highlighting the primary sources used for this Systematic Literature Review (SLR). A significant portion of the literature was retrieved from ERIC, PsycINFO, and JSTOR, reflecting their strong relevance in educational and psychological research. SpringerLink, Taylor & Francis Online, and Wiley Online Library also contributed extensively, emphasizing their role in providing peer-reviewed articles on teaching methodologies, cognitive development, and learning sciences. Additionally, Google Scholar played a crucial role in broadening the search scope by indexing a wide range of scholarly books, articles, and reports across multiple disciplines. The distribution depicted in the graph underscores the multidisciplinary approach taken in this review, ensuring a comprehensive and diverse analysis of critical thinking in higher education.

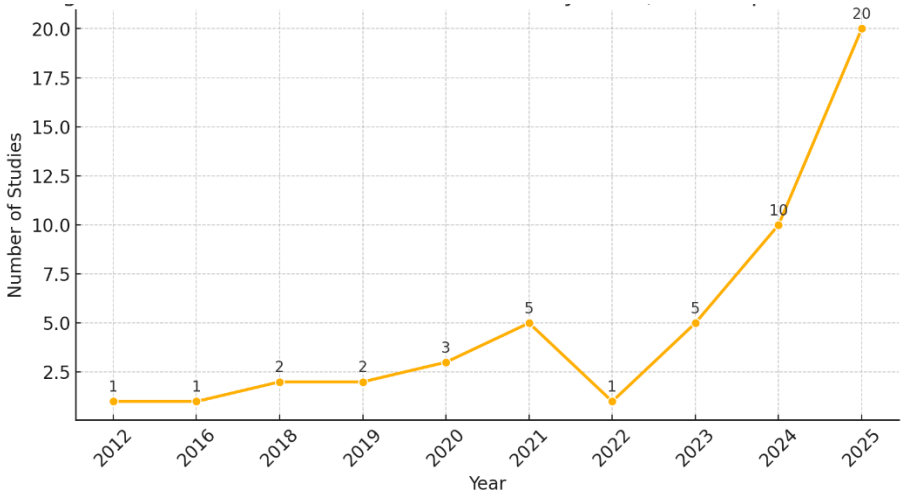

Figure 1.
Distribution of studies according to the year.

The distribution of research design types across the 50 studies as shown in Figure 2 reveals a strong preference for quantitative research, which appears most frequently, followed by experimental, mixed-methods, and qualitative approaches. Quantitative studies dominate, suggesting a heavy reliance on statistical data and structured methodologies to assess critical thinking in education. Experimental and quasi-experimental designs are also widely used, reflecting efforts to measure interventions' effects on critical thinking skills. Mixed-methods research, which integrates both qualitative and quantitative approaches, shows a balanced attempt to capture both measurable outcomes and deeper insights into learning processes. Meanwhile, qualitative studies, though fewer in number, emphasize in-depth analysis through interviews, thematic analysis, and ethnographic techniques. This distribution suggests that while objective, data-driven approaches are prevalent, there is a growing recognition of the need for more holistic, context-rich explorations of critical thinking development.

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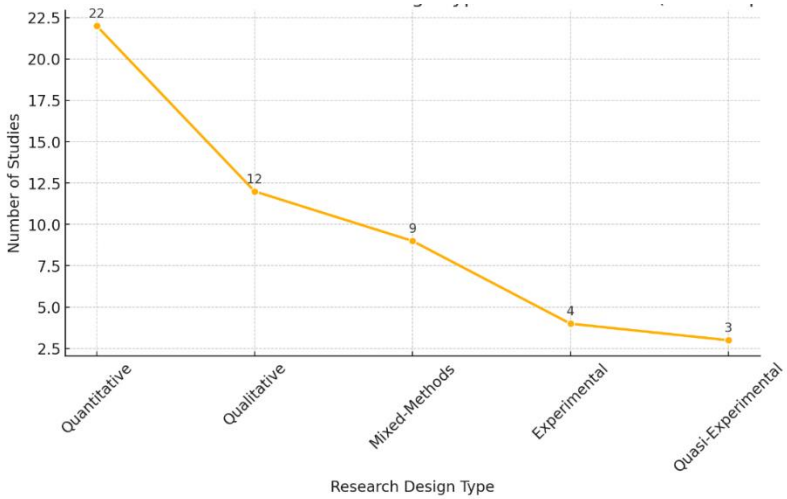

Figure 2.
Distribution of research design types across the studies.

3.3. Risk of Bias Assessment

Each study included in the review was evaluated for potential bias using the Cochrane risk of bias tool, which considers factors such as selection bias, performance bias, detection bias, attrition bias, and reporting bias [25]. The assessment was conducted independently by five researchers, and their findings were consolidated into a detailed summary table. Given that this review does not focus on medical or strictly scientific research, the risk of bias assessment primarily emphasized the instruments used and the sample size of each study.

3.4. Certainty Assessment

The GRADE (Grading of Recommendations, Assessment, Development, and Evaluations) approach was employed to systematically evaluate the quality of evidence for each reported outcome. This method provided a structured framework for assessing the reliability of findings based on the comparison criteria [26]. A summary of the methodologies and keywords used in the reviewed articles is provided in the accompanying table.

3.5. Ethics Statement

As the review is based solely on previously published data, ethical approval was not required for this analysis.

4 Results

4.1. Study Selection

The review gave a total of 350 articles in the initial search which was done systematically. For the final screening, out of the 250 articles which were assessed based on the titles and abstracts, 50 articles as displayed in Table 1 were considered for the systematic review. The following is a flowchart of the selection process that has been described above:

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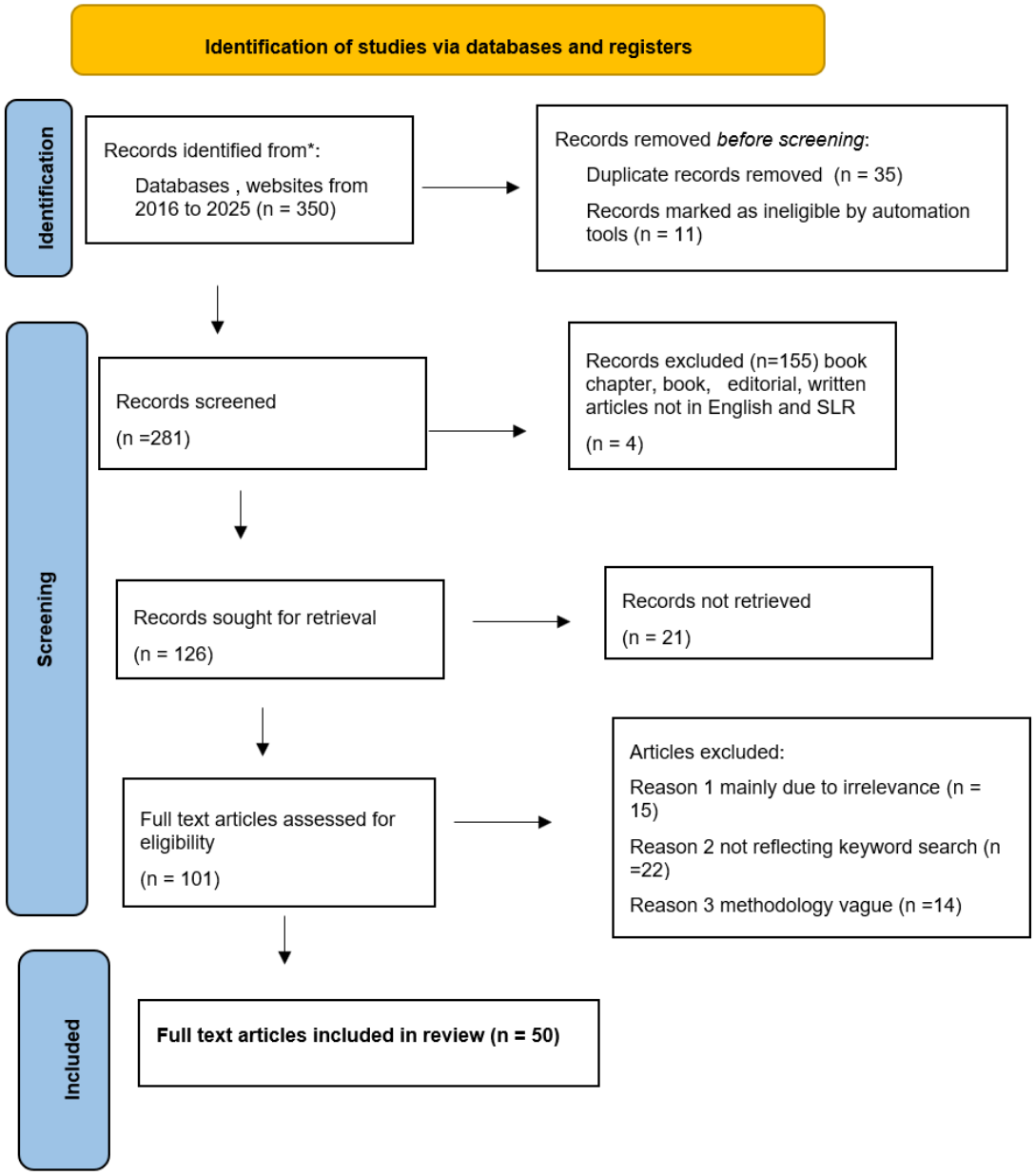

Figure 3.
PRISMA Flow Diagram of Study Selection.

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Table 1.
Distribution of articles reviewed.

1.	**Ahern, et al. [24]**	**Qualitative study, Semi-structured interviews & Documentary analysis**	**Semi-structured Interviews (13 academics), Documentary analysis (curricula & student work), Critical Thinking Model**	**13 academics across disciplines, Module descriptors & student work, Purposive sampling**	**University College Dublin, Ireland**	**Engineering disciplines lack clear CT definitions. Humanities offer more explicit CT instruction. CT model developed.**
2.	Almulla [27].	Quantitative	Survey on motivation, cooperativity, peer engagement, smart classroom environment	297 students	King Faisal University, Saudi Arabia	Critical thinking and creativity positively influenced academic performance
3.	Aston [28].	Qualitative	Student interviews, self-assessment reflections, Active learning workshops	23 postgraduate students	University of Sheffield, UK	Workshops increased CT awareness and bias recognition
4.	Azkarate-Iturbe, et al. [29]	Quantitative	National Survey of Student Engagement (NSSE), Cooperative Mindset Scale (CMS), Critical Thinking Disposition Scale (CTDS)	1580 undergraduates	Spain	Identified high, moderate, and low engagement groups; social sciences students more engaged
5.	Calma and Davies [30].	Quantitative study, Systematic Essay Evaluation	Corpus of 152 graduate essays, Critical Thinking Operationalisation Framework (CTOF), Paragraph Analysis (3,279 coded paragraphs)	152 masterlevel business student essays, Systematic corpus analysis	Australia (Research-intensive business school)	Essays scored high in structuring & reasoning but lacked inferential evaluation. Suggests better CT assessment rubrics.
6.	Cao, et al. [31]	Quantitative	15-item self-designed questionnaire	476 university students	67 universities, China	High awareness of ChatGPT, concerns about academic integrity
7.	Chen and Chang [32]	Quasi-experimental	Creative Problem-Solving Questionnaire (CPSQ), Pre-test & post-test assessments	69 postgraduate students	Private university, Thailand	Project-based learning improved problem-solving and critical thinking
8.	Darwin, et al. [33]	Qualitative case study, Thematic analysis	Semi-structured interviews (7 EFL students), AI tools exploration	7 master's students, Two Indonesian universities, Purposive sampling	Indonesia (Two universities)	Students see AI as helpful in research but worry about over-reliance, bias, and loss of independent thinking.
9.	De la Puente, et al. [34].	Quantitative	Pre-test and post-test assessments, ChatGPT-based debate sessions	95 undergraduate students	Universidad del Norte, Colombia	ChatGPT improved argumentation and critical thinking more than traditional debates
10.	Dissen [35].	Quantitative	California Critical Thinking Skills Test (CCTST), California Critical Thinking Disposition Inventory (CCTDI)	140 senior-level undergraduate students	Stockton University, USA	Lower critical thinking skills compared to national population, weakest numeracy skills, GPA weakly correlated
11.	Essien, et al. [36].	Mixed	Pre-test & post-test CT	107 postgraduate	UK business	AI improved basic CT but had

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			assessments, AI Use Survey, Thematic Analysis	students	schools	limited impact on higher-order thinking
12.	Parra, et al. [37].	Qualitative	Systematic review of teacher education & critical thinking	Not specified	Latin America	CT development in teacher training is inconsistent
13.	Gadot and Tsybulsky [38].	Mixed	Digital curation log analysis, Reflective reports, Semi-structured interviews	107 participants	Israel	Developed a taxonomy of digital curation fostering critical thinking
14.	Gandimathi and Zarei [39].	Qualitative	Semi-structured interviews, Open-ended questionnaire, Essay writing task	30 postgraduate ESL students	UNITAR International University, Malaysia	CT improved language proficiency
15.	D'Northwood and Rattray [40].	Qualitative study, Thematic analysis	Semi-structured Interviews (21 business school academics)	21 Business school academics, Purposeful sampling	Russell Group University, UK	Academics conceptualize CT through argumentation, dispositions, and originality. Originality is debated as part of CT.
16.	Haghparast, et al. [41].	Quantitative	Watson-Glaser Critical Thinking Appraisal-UK (WGCTA-UK), Information Seeking Process (ISP) model-based survey	45 postgraduate students	University of Malaya, Malaysia	71% scored below average in critical thinking, strongest in assumption recognition, weakest in inference
17.	Han, et al. [42]	Quantitative	Technology Acceptance Model (TAM) Survey, Learner Engagement Scale, Chinese Critical Thinking Scale	1026 Chinese college EFL students	Multiple universities, China	Positive correlations between technology acceptance, engagement, and critical thinking
18.	Lijie, et al. [43]	Quantitative	Social Media Usage Questionnaire, Learning to Learn Competence Scale, Critical Thinking Scale	301 university students	University of the Basque Country, Spain	Evaluating information sources on social media correlated with critical thinking
19.	Lijie, et al. [43]	Quantitative	AI Literacy Scale (AIL), Technology Acceptance Model (TAM), Motivation Scale (MO), Critical Thinking Disposition (CTD) Scale	483 university students	Multiple universities, Malaysia	AI literacy significantly influenced critical thinking disposition
20.	Hounsell [44].	Conceptual	Systematic review of feedback models	Not empirical	International (UK, US, Australia, Europe)	Effective feedback must align with CT & professional application
21.	Jabali, et al. [45].	Mixed	Survey with 173 faculty members, In-depth interviews with 7 academic staff	173 faculty + 7 staff	Palestinian universities	Grades hinder critical thinking, faculty cite lack of resources as barrier
22.	Kabwete, et al. [46].	Mixed-methods study, Constructivist	Questionnaire (N=108), Semi-structured interviews (N=22),	130 mature female students, Four	Rwanda (Four universities)	Higher education helped women improve problem-solving, social

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		approach	Thematic analysis	Rwandan universities, Purposive sampling		mobility, and confidence but posed financial and linguistic challenges.
23.	Landa-Blanco and Cortés-Ramos [47].	Quantitative	Attitudes Towards Research Scale, Epistemic Orientation Short Scale, Critical Thinking Disposition Scale	137 psychology students	Universidad Nacional AutÃ³noma de Honduras	Students with high critical thinking had better academic grades
24.	Lee, et al. [48]	Qualitative case study, Inductive thematic analysis	Semi-structured interviews (12 students), Conceptual model development	12 undergraduates, National University of Singapore, Purposive sampling	Singapore (NUS)	Students develop CT through exposure, frameworks, practice, and interdisciplinary learning.
25.	Li [49]	Mixed-methods study, Survey, Interviews, Observations	Survey (182 teachers), Focus Groups (12 teachers), Classroom Observations (3 teachers)	182 EFL Teachers (China), Convenience snowball sampling	China (Secondary Schools, Beijing)	Teachers conceptualize CT as analysis, inference, and evaluation. Classroom strategies promote CT but time constraints and exam focus hinder integration.
26.	Antrobus and West [50].	Qualitative study, Document analysis & Auto-ethnography	Document Analysis (PME course materials, blog posts, MoD policies), Auto-ethnographic reflections	PME Course materials, MoD policies, Military discussion forums, Auto-ethnography from two veteran scholars	UK Military Education (JSCSC, Shrivenham)	PME emphasizes structured reasoning over a critical spirit. Hierarchy limits open critical discussions. Officers struggle to challenge authority.
27.	Mahdi, et al. [51].	Mixed	Pre-test & post-test on CT skills, Questionnaire, Semi-structured interviews	40 students	Applied Science University, Bahrain	Case-based learning improved CT, group work was most effective
28.	Sheybani and Miri [52].	Quantitative study, Structural Equation Modeling (SEM)	Professional Identity Questionnaire [53] Critical Thinking Scale [54]	259 EFL Teachers (Iran), Convenience sampling	Iran (Language Institutes)	Professional Identity positively correlates with CT ($r=0.64$, $p<0.01$). CT significantly predicts didactical & pedagogical fields.
29.	[55].	Quantitative	Research Self-Efficacy Scale, Attitudes Toward Computers Scale, Critical Thinking Disposition Scale	197 postgraduate students	Eight universities, Turkey	CT significantly predicted research self-efficacy
30.	Orhan and Van Le [56].	Quantitative	Sosu Critical Thinking Dispositions Scale (CTDS), Multi-group Confirmatory Factor Analysis (CFA)	925 university students (480 Turkish, 445 Vietnamese)	TÃ¼rkiye, Vietnam	No significant difference in critical thinking between groups, parental education influenced Turkish students more
31.	O'Riordan, et al. [57].	Mixed	Pedagogical Content Analysis, Linguistic Analysis, Interaction Metrics	41,500 MOOC learners (sample: 1,500 comments)	FutureLearn platform	MOOCs with structured discussions fostered better critical thinking

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32.	Osborne, et al. [58].	Mixed	Survey & Thematic Analysis of Asynchronous Online Discussions (AOD)	34 postgraduate nursing students	Multi-campus university, Australia	AOD fostered engagement but assessment concerns affected discussions
33.	Virtič [59].	Quasi-experimental	Pre-test & post-test on research skills	31 students (14 undergraduates, 17 postgraduates)	University of Lille, France	Scientific literacy improved across all levels
34.	Pu and Evans [60].	Qualitative	Ethnographic Interviews, Positioning Theory Analysis	29 postgraduate students	Universities in China and the UK	Students' CT influenced by their self-positioning in academia
35.	Ronderos, et al. [61].	Comparative cross-national study, Mixed-method	Curriculum Analysis (384 documents), Interviews (9 teacher educators)	9 Teacher educators (4 Colombia, 5 Switzerland), Purposeful sampling	Colombia & Switzerland	Critical Thinking is integrated differently across national curricula. Colombia emphasizes CT at all levels, Switzerland mainly at course level. Argumentation is the most emphasized CT facet.
36.	Rossi, et al. [62].	Mixed	Pre-course, mid-course, post-course questionnaires, Multiple-choice & open-ended questions	83 students	Federal University of ParanÃ¡, Brazil	Active learning methods improved critical thinking and motivation
37.	Shamida, et al. [63].	Quantitative	Questionnaire on perceived performance, Reading test (MUET-based)	50 postgraduate students	Private university, Malaysia	Students overestimated their critical reading skills
38.	Sheikhbardsiri, et al. [64].	Quantitative	Emotional Intelligence & Learning Strategies Questionnaires	183 postgraduate students	Kerman University of Medical Sciences, Iran	Self-management linked to CT & learning strategies
39.	Smith and Drybrough [65].	Case study, Qualitative (Positioning Theory)	CT Retreat, Group Interviews (14 students), Reflexive Thematic Analysis	128 Chinese international master students, 14 in-depth interviewees, Voluntary participation	UK (School of Education, Scotland)	Students initially misunderstood CT, later repositioned as researchers/practitioners. Calls for earlier CT training.
40.	Tan, et al. [66].	Experimental	Fallacy Identification Assessments, Problem-based Training	57 university students	University in the UK	Precision teaching improved CT in online learning
41.	Tang [67].	Quasi-experimental	Watson-Glaser Critical Thinking Assessment (WGCTA)	318 university students	Peking University, Tsinghua University, Renmin University, China	Smart learning technologies improved critical thinking significantly
42.	Teo, et al. [68].	Quasi-experimental study, Mixed-methods	Visual-Based Mapping Tool, Surveys, In-class assessments, Semi-structured interviews	104 final-year undergraduates, NTU Singapore, Convenience	Singapore (NTU)	Visual-based mapping enhances problem-solving, self-regulation, and evaluative

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				sampling		reasoning.
43.	Terblanche and De Clercq [69].	Qualitative	Literature review, Interactive Qualitative Analysis (IQA), Focus groups	Accounting students	University of South Africa	Developed a critical thinking competency framework for accounting students
44.	Turner and Tyler [70].	Qualitative study, Phenomenography	TDC Critical Thinking Framework, Phenomenographic analysis of 101 student assignments	101 first-year accounting students, Australian university, Volunteer participation	Australia (Accounting program)	Accounting students struggle with CT but improve through structured interventions, questioning, and deep engagement.
45.	Veliz and Veliz-Campos [71].	Qualitative	Semi-structured interviews, Thematic Analysis	10 participants (5 postgrads, 5 educators)	Three Chilean universities	CT underemphasized in teacher education, mismatch in expectations
46.	Wali and Popal [72].	Quantitative	Survey on technology use in classrooms	30 postgraduate students	University Teknologi Mara, Malaysia	Technology enhanced engagement but reduced face-to-face interaction
47.	Weng, et al. [73].	Experimental	Deep Learning Process & Ability Questionnaires, Performance Evaluation	105 postgraduate students	Wuhan University of Science and Technology, China	Design-based learning improved deep learning and critical thinking
48.	Yang and Mohd [74].	Quantitative study, Structural Equation Modeling (SEM)	Community of Inquiry (CoI) Survey (39 items), Motivated Strategies for Learning Questionnaire (MSLQ), Structural Equation Modeling (SEM)	542 EFL university students, 13 universities in Gansu, Probability sampling	Gansu, China (EFL University Programs)	CT mediates between Social Presence (SP), Teaching Presence (TP), and Cognitive Presence (CP) in blended learning.
49.	Yin, et al. [75].	Quasi-experimental study, Pre-post-test design	Technology-Enhanced Social Learning (TSL), California Critical Thinking Disposition Inventory (CCTDI), IELTS Argumentative Writing Test	60 first-year English major students, Two natural groups (TSL vs Traditional Writing)	Hebei, China (Public University)	TSL group showed greater improvement in CT dispositions & argumentative writing. Strongest gains in open-mindedness & systematicity.
50.	Zhao, et al. [76].	Quantitative	Digital Learning Power Assessment Questionnaire, Structural Equation Modeling (SEM)	2041 university students	Provincial key university, China	Urban students performed better, sophomore/junior years critical for digital learning power

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4.2. Assessment of Critical Thinking

Assessing critical thinking in higher education often relies on standardized tools such as the California Critical Thinking Skills Test (CCTST), the Watson-Glaser Critical Thinking Appraisal (WGCTA), and the Critical Thinking Disposition Scales [1, 77]. These assessments offer a structured framework for evaluating students' analytical and reasoning abilities and are widely acknowledged in educational research. In addition to these quantitative measures, qualitative studies have employed content analysis and thematic evaluations to explore students' argumentation and cognitive processes, providing deeper insights into how critical thinking develops in different learning environments [78, 79].

Recent research highlights the significance of qualitative methods, such as reflexive thematic analysis (RTA), in capturing students' experiences and conceptualizations of critical thinking. Studies focusing on Chinese international master's students at UK universities have found that initial misunderstandings of critical thinking often lead to self-positioning as passive learners. However, structured interventions, such as critical thinking retreats, have been instrumental in helping students transition from passive learning to independent research-oriented identities (2024). These findings underscore the need for direct and early instruction in critical thinking, particularly for international students adapting to different academic expectations.

The growing use of AI-based evaluations in assessing critical thinking presents both opportunities and challenges. While AI tools can analyze large datasets and offer real-time feedback, concerns about bias and reliability remain prevalent. Recent studies have raised questions about whether these systems can accurately capture the nuances of human reasoning or if they inadvertently reinforce existing biases [80, 81]. Addressing these concerns is crucial to ensuring that AI-driven assessments complement, rather than compromise, the integrity of critical thinking evaluation in education.

4.3. Pedagogical Approaches to Enhancing Critical Thinking

To foster critical thinking among students, educators have implemented a variety of pedagogical approaches. Research indicates that group case-based learning leads to greater improvements in critical thinking than individual case studies, as it encourages collaboration and diverse perspectives [82, 83]. Similarly, active learning methodologies, including problem-based learning (PBL), debate-based learning, and peer discussions, have been shown to enhance students' reasoning abilities by promoting analytical engagement and deeper cognitive processing [84, 85].

A qualitative study focusing on positioning theory and critical thinking interventions among international students further illustrates how structured pedagogical strategies influence cognitive development. Findings suggest that students initially struggle with conceptualizing critical thinking, often equating it with criticism rather than evaluative judgment. However, by integrating structured discussions and critical reading/writing sessions, students gradually reposition themselves as independent thinkers (2024). Moreover, peer discussions, while initially challenging, were ultimately recognized as valuable for developing critical perspectives and fostering engagement in academic discourse.

Alongside these instructional strategies, the integration of digital curation and AI tools has further contributed to the development of students' argumentation skills. AI-assisted learning platforms, for instance, provide instant feedback, exposure to multiple viewpoints, and interactive learning experiences, reinforcing the benefits of active learning. However, while technology can be a powerful tool for fostering critical thinking, its misuse may undermine students' ability to think independently. Growing concerns about over-reliance on AI-generated content highlight the potential risks of excessive dependence on automated tools, which could discourage deeper cognitive engagement. Recent studies underscore the importance of balancing AI-enhanced learning with traditional cognitive approaches to ensure that technology serves as a supplement rather than a substitute for critical thinking [86, 87].

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4.4. Influencing Factors

Beyond instructional methods and technology, various contextual factors also shape the development of critical thinking skills in educational settings. While demographic aspects such as gender have not shown a significant impact, parental education has been found to influence critical thinking in specific cultural contexts, as students from households with higher educational attainment often receive more exposure to analytical discussions and problem-solving activities at an early stage [88, 89]. This suggests that socio-cultural background plays a role in shaping students' intellectual engagement and cognitive flexibility. Additionally, disciplinary background contributes to differences in critical thinking development. Research indicates that students in social sciences tend to exhibit stronger critical thinking dispositions compared to those in STEM fields [90, 91]. This difference may stem from the nature of academic training, where social sciences emphasize debate, argumentation, and multiple perspectives, whereas STEM disciplines often prioritize structured problem-solving and formulaic reasoning. However, some studies argue that incorporating interdisciplinary approaches can help bridge this gap, ensuring that students across all fields develop well-rounded critical thinking skills.

Moreover, technology acceptance plays a crucial role in fostering critical thinking abilities. Research suggests that students with higher AI literacy and engagement with smart learning tools tend to demonstrate enhanced critical thinking abilities, as digital platforms provide opportunities for deeper exploration, access to diverse viewpoints, and instant feedback mechanisms [92]. However, the effectiveness of these tools depends on how they are integrated into the learning process. If students passively consume AI-generated content without questioning or analysing it, their critical thinking skills may stagnate rather than develop. Therefore, active engagement with technology, rather than passive reliance, is key to ensuring that digital tools serve as an enhancement rather than a replacement for analytical reasoning. Taken together, these factors illustrate that critical thinking development is not solely dependent on pedagogy or technology but is also influenced by broader social, disciplinary, and technological contexts. Addressing these variables through targeted educational strategies, interdisciplinary collaboration, and responsible technology integration can help cultivate a learning environment that fosters independent, reflective, and analytical thinkers.

5. Conclusion

This Systematic Literature Review (SLR) provides valuable insights into how critical thinking is assessed, developed, and influenced in higher education. The findings highlight that a combination of active learning strategies, digital tools, and AI-based learning environments can significantly enhance students' higher-order thinking skills. These approaches encourage analytical reasoning, problem-solving, and the ability to evaluate diverse perspectives. However, despite these benefits, several challenges remain, including concerns about assessment reliability, dependence on AI, and institutional constraints. Addressing these issues is essential to ensure that critical thinking education is effectively implemented and sustained. Despite progress in fostering critical thinking, several challenges persist. One significant issue is the limitations of assessment methods; an overreliance on standardized tests may not fully capture the cognitive abilities of students [93, 94]. Institutional barriers also play a crucial role, as large class sizes, inadequate faculty training, and an assessment-driven approach to learning can hinder the promotion of critical thinking [95, 96]. Moreover, ethical and policy concerns surrounding the use of AI tools in education raise important questions about academic integrity and the potential biases inherent in AI-generated content [97]. Addressing these challenges is vital for fostering a robust environment conducive to critical thinking development.

To enhance critical thinking development, institutions should integrate active learning approaches such as case studies, debates, and problem-based learning into curricula. These methods foster student engagement and encourage deeper analytical reasoning. A blended assessment approach should be adopted, combining standardized tests with qualitative evaluations to provide a more comprehensive and accurate measurement of students' critical thinking abilities. Universities must also focus on

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enhancing AI literacy by training students to critically evaluate AI-generated content, ensuring they can differentiate between reliable and biased information. Educational policies should be revised to shift away from rote memorization and toward strategies that actively promote critical thinking across disciplines. Finally, further research should explore the long-term impact of AI and digital tools on students' cognitive development, providing valuable insights into refining and improving educational strategies. By implementing these recommendations, higher education institutions can create an environment that fosters critical thinking, encourages intellectual curiosity, and prepares students for complex problem-solving in the real world.

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