

EVALUACIÓN DE LA COMPETENCIA EN PENSAMIENTO CRÍTICO A TRAVÉS DE ESTRATEGIAS DE APRENDIZAJE ACTIVO: UNA REVISIÓN SISTEMÁTICA DE LA LITERATURA

ASSESSING CRITICAL THINKING COMPETENCE THROUGH ACTIVE LEARNING STRATEGIES: A SYSTEMATIC LITERATURE REVIEW

Autores: ¹Patricio David Mena Sevilla, ²Carlos Julio Castro Angos, ³José Manuel Jalil Hover y ⁴Miguel Ángel Herrera Pavo.

¹ORCID ID: <https://orcid.org/0009-0003-2723-2178>

²ORCID ID: <https://orcid.org/0009-0001-2854-5032>

³ORCID ID: <https://orcid.org/0009-0008-7521-8561>

⁴ORCID ID: <https://orcid.org/0000-0002-0321-7235>

¹E-mail de contacto: patricio.mena@uasb.edu.ec

²E-mail de contacto: carlos.castro@uasb.edu.ec

³E-mail de contacto: joey_jalil@hotmail.com

⁴E-mail de contacto: miguel.herrera.p@uasb.edu.ec

Afiliación: ^{1*}Pontificia Universidad Católica del Ecuador, (Ecuador). ^{2*3*4*}Universidad Andina Simón Bolívar, (Ecuador).

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¹Magíster en Ciencias de la Educación. Especialista en Salud y Seguridad Ocupacional con mención en Salud Ocupacional. Docente de la Pontificia Universidad Católica del Ecuador, (Ecuador).

²Magíster en Educación. Magíster en Derecho Penal. Magíster en Derecho Constitucional. Especialista en Derecho Constitucional.

³Licenciado en Educación y Enseñanza de Inglés como segunda lengua. Máster en Tecnología Educativa y Máster en Psicopedagogía.

⁴Psicopedagogo, Tecno-antropólogo y Doctor en Sociedad de la Información y el Conocimiento. Actualmente, Docente titular y director del Área de Educación de la Universidad Andina Simón Bolívar, sede Ecuador. Editor de la Revista Andina de Educación y docente colaborador en el Máster de Educación y TIC de la Universitat Oberta de Catalunya, (España).

Resumen

Este artículo examina el papel de las estrategias de aprendizaje activo en la evaluación y desarrollo de la competencia en pensamiento crítico en diversos contextos educativos, una cuestión que se ha vuelto especial y relevante tras la pandemia de COVID-19. Mediante una revisión sistemática de la literatura que sigue las directrices PRISMA 2020, se seleccionaron 33 estudios de acceso abierto publicados en los últimos tres años a partir de diversas bases de datos, utilizando términos de búsqueda en inglés y español. Los estudios seleccionados, que incluyen diseños cuantitativos, cualitativos, de métodos mixtos y cuasiexperimentales, aportan evidencia sólida de que las estrategias de aprendizaje activo, como el aula invertida, el aprendizaje basado en casos y los proyectos colaborativos, mejoran significativamente las habilidades de pensamiento crítico, al mismo tiempo que fomentan el aprendizaje socioemocional. El análisis revela una fuerte asociación positiva entre estas técnicas activas y el desarrollo del pensamiento crítico; sin embargo, solo una cantidad limitada de estudios

aborda directamente la evaluación de estas habilidades, lo que evidencia una brecha en la investigación actual. En conjunto, los hallazgos sugieren que transformar al estudiante en un actor activo de su propio aprendizaje no solo mejora su capacidad para analizar, sintetizar y evaluar información, sino que también contribuye al éxito académico y profesional. Se recomienda que futuras investigaciones incorporen perspectivas regionales diversas, especialmente de América Latina y Ecuador, para perfeccionar las estrategias de instrucción y avanzar en las prácticas de evaluación basadas en evidencia.

Palabras clave: Evaluación, Pensamiento crítico, Aprendizaje activo, Enseñanza, Aprendizaje, Competencias, Socioemocional, Currículo educativo.

Abstract

This article examines the role of active learning strategies in assessing and developing critical thinking competence in various educational contexts. This concern has become even more critical following the COVID-19 pandemic. By conducting a systematic literature review

following PRISMA 2020 guidelines, the authors selected 33 open-access studies published within the last three years from multiple databases using search terms in both English and Spanish. The selected studies, which include quantitative, qualitative, mixed-methods, and quasi-experimental designs, provide robust evidence that active learning approaches, such as flipped classrooms, case-based learning, and collaborative projects, significantly enhance critical thinking skills while fostering socio-emotional learning. The analysis reveals a strong positive association between these active techniques and the development of critical thinking; however, only a limited number of studies directly address the assessment of these skills, indicating a notable gap in the current research. The findings suggest that transforming students into active participants in their learning process improves their capacity to analyse, synthesise, and evaluate information and contributes to greater academic and professional success. The authors recommend that future research incorporate diverse regional perspectives, particularly from Latin America and Ecuador, to refine instructional strategies and advance evidence-based practices in educational assessment.

Keywords: Assessment, Critical thinking, Active learning, Teaching, Learning, Competencies, Socio-emotional, Educational curriculum.

Sumário

Este artigo investiga o papel das estratégias de aprendizagem ativa na avaliação e no desenvolvimento da competência em pensamento crítico em diversos contextos educacionais, uma questão que se tornou ainda mais relevante após a pandemia de COVID-19. Através de uma revisão sistemática da literatura, em conformidade com as diretrizes PRISMA 2020, os autores selecionaram 33 estudos de acesso aberto publicados nos últimos três anos a partir de múltiplos bancos de dados, utilizando termos de busca em inglês e espanhol. Os estudos selecionados, que abrangem desenhos quantitativos, qualitativos, de métodos mistos e quase-experimentais, fornecem evidências robustas de que

abordagens de aprendizagem ativa — como salas de aula invertidas, aprendizagem baseada em casos e projetos colaborativos — promovem melhorias significativas nas habilidades de pensamento crítico, ao mesmo tempo em que incentivam o aprendizado socioemocional. A análise demonstra uma forte associação positiva entre essas técnicas ativas e o desenvolvimento do pensamento crítico; contudo, apenas uma parcela limitada dos estudos aborda diretamente a avaliação dessas habilidades, indicando uma lacuna na pesquisa atual. Em suma, os resultados sugerem que transformar os estudantes em participantes ativos do próprio processo de aprendizagem não só aprimora sua capacidade de analisar, sintetizar e avaliar informações, mas também contribui para o sucesso acadêmico e profissional. Recomenda-se que pesquisas futuras incorporem perspectivas regionais diversas, especialmente da América Latina e do Equador, para refinar as estratégias de ensino e avançar nas práticas de avaliação baseadas em evidências.

Palavras-chave: Avaliação, Pensamento crítico, Aprendizagem ativa, Ensino, Aprendizagem, Competências, Socioemocional, Currículo educacional.

Introduction

The COVID-19 pandemic profoundly impacted approximately 1.3 billion students worldwide, exposing them to stress and psychological consequences that persist today (Bonilla, 2020). This crisis highlighted the need to re-evaluate educational practices and goals, as the pandemic altered the affected psychosocial traits (Vargas et al. 2021). These changes influenced not only students but also teachers, many of whom experienced anxiety and helplessness on a global scale (University of Portland et al., 2020). Educators and policymakers have increasingly emphasised the inclusion of critical thinking as a key learning outcome, along with a growing demand for curricula incorporating social-emotional learning (SEL) (Blewitt et al., 2020). Consequently, national education guidelines

have reinforced the importance of critical thinking for both academic and non-academic success. Active collaboration strategies help students develop self-awareness, build relationships, and make informed decisions (University of Portland et al. 2020). Likewise, constructivist and active learning approaches are crucial in fostering critical thinking (Gaspe y Hathiringe, 2024).

Assessment serves a dual purpose: it measures student progress while also functioning as a tool for critical thinking by promoting self-reflection (Lakhtakia et al., 2022). Developing critical thinking requires students to analyse, synthesise, and evaluate information to reach logical conclusions (Hwang et al., 2023). Effective assessment methods, such as self-assessment and peer assessment, enhance student engagement and encourage metacognition, leading to more meaningful learning experiences (Ilhan, Poca, y Aslaner 2023). Active learning strategies further strengthen critical thinking and collaboration, improving learning outcomes. These strategies transform students from passive recipients to active participants, allowing them to develop teamwork, adaptability, and creativity (Reddy et al. 2024). Likewise, self-assessment and peer assessment allow students to develop skills related to acquired knowledge, strengthening the teaching-learning process. However, it has been shown that many academic environments do not adequately develop students' skills to analyse, organise, and articulate ideas critically, which suggests the need for teacher training and ongoing education. (Coto Tacusi 2023; Leshowitz, DiCerbo, y Symington s. f.)

Despite the recognised importance of critical thinking, teachers and students rarely assess it in the classroom (Aston 2023). Undoubtedly, assessing this competence represents a challenge in the teaching-learning process, so it

is necessary to measure progress to improve the application of strategies (Kadrija et al., 2023). Active learning techniques such as Socratic dialogue and classroom debate allow students to approach biases and develop arguments based on evidence. (Bates et al., 2024; Khan, 2020). Consequently, more research is required to understand how to apply these strategies in different educational contexts. Therefore, this research analyses the relationship between active learning techniques and the evaluation of critical thinking.

Considering the explanatory framework, the main research question (PRQ) is; what is the relationship between assessing critical thinking and active learning techniques in educational contexts? To analyse this relationship in more depth, the study determines the following supporting questions; RQ1: How effectively can teachers and students assess critical thinking skills in the classroom?; RQ2: How feasible is the development of critical thinking within current educational processes?; RQ3: Are active learning techniques essential for fostering critical thinking? Based on the research questions, the study aims to establish how active learning techniques contribute to the assessment of critical thinking and provide information about the role of these strategies in the teaching-learning process.

Material and Methods

This study is based on a systematic literature review (SLR) applying PRISMA 2020 standards (Page et al. 2021) to analyse the relationship between the assessment of active learning techniques and critical thinking assessment. An integrative bibliographic search was conducted to select primary and secondary research articles in English and Spanish. The search queries were (1) for Scopus: TITLE-ABS-KEY(“assessment” AND “critical thinking” AND “active learning”); (2) for WoS:

((“ assessment ” (Topic) AND "critical thinking" (Topic) AND "active learning" (Topic)); and (3) for Scielo: (all indexes (“assessment” AND "critical thinking" AND "active learning")) The review was conducted based on articles published in the last three years (2022-2024), a time interval chosen due to the influence that the COVID-19 pandemic had on education, particularly on the teaching-learning process, assessment practices, and the development of critical thinking. Studies were retrieved from Scopus, Web of Science, and

SciELO. The inclusion criteria considered studies published as open-access in indexed journals in Spanish and English addressing the evaluation of critical thinking competencies, the role of critical thinking in teaching-learning processes, and the implementation of active learning strategies. In contrast, those studies published in languages other than Spanish or English, non-open-access articles, duplicates, or those published outside the selected timeframe were excluded. From this search, 33 articles were selected (see Fig. 1).

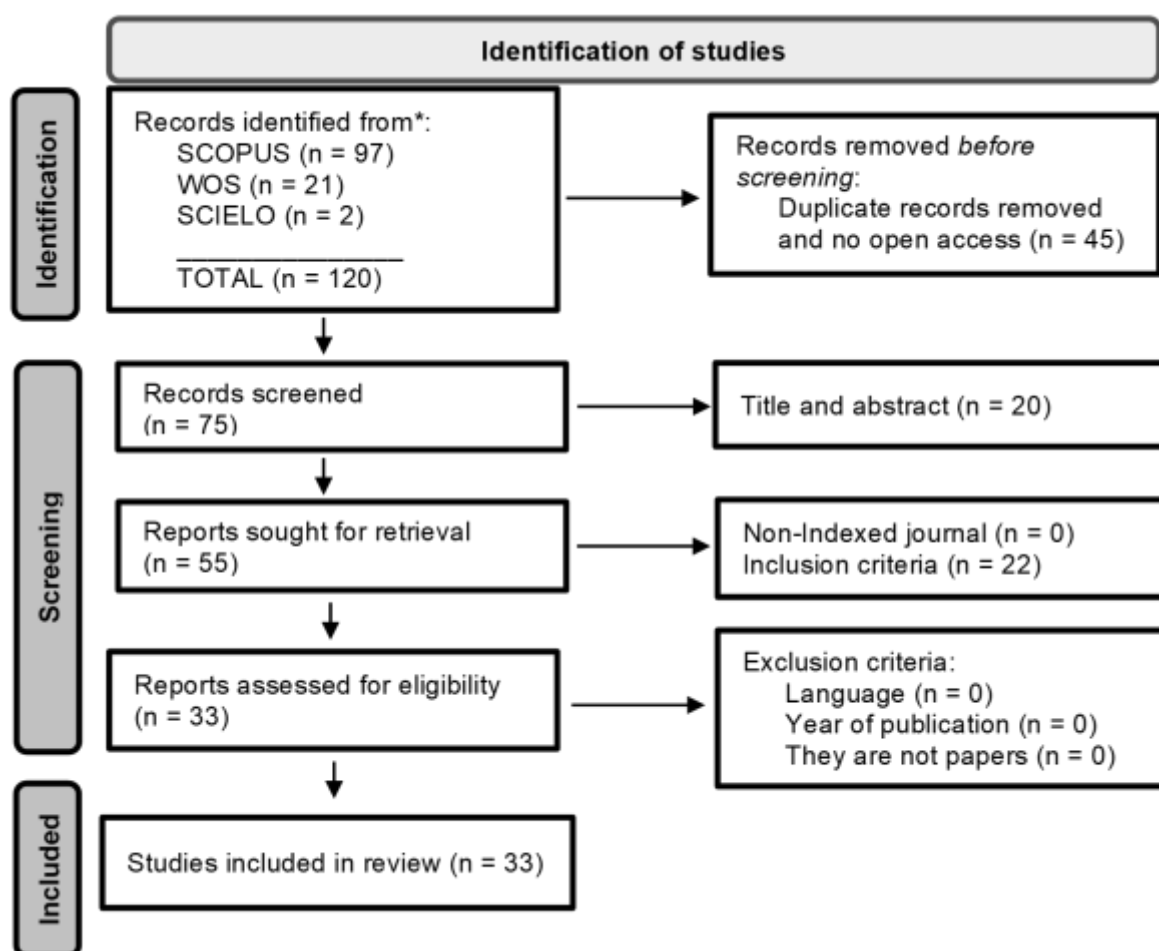


Figure 1. PRISMA 2020 flow diagram

To ensure methodological rigour and minimise bias, the research team used the 2022 Johns Hopkins Health System/Johns Hopkins School of Nursing tool (Hopkins John s. f.) to evaluate the thirty-three selected articles. This tool

categorises studies based on levels of evidence and quality. Levels of evidence range from Level I, which represents the highest quality evidence typically derived from randomised controlled trials, to Level III, which includes

descriptive, observational, and qualitative studies. Quality ratings are assigned by evaluating criteria such as study design, sample size, methodological transparency, and the consistency of findings; grades A, B, and C denote high, moderate, and low quality, respectively. The research team classified the articles based on the criteria established in the tool to ensure rigour and reliability according to the levels of evidence. Coding was performed systematically to organise and relate the findings to the research questions. This rigorous evaluation provided robust information, ensuring that only studies that meet appropriate standards contribute to the overall conclusions.

An individual code was assigned for the articles, beginning with the letter "P" followed by an identification number. The research question code followed (RQ1, RQ2, or RQ3). Finally, the study's methodological approach code included quantitative (Qt), qualitative (QI), mixed methods (MMA), or quasi-experimental (Qe).

Results and Discussion

The results are presented in two separate illustrations. The first provides a visualisation of 33 selected articles, the research methods, levels of evidence, and quality classification. The second illustration describes the themes, dimensions, and factors related to the three research questions: assessment, critical thinking, and active learning techniques, which are used to improve educational practice.

Characteristics of the selected studies

The data analysis included the 33 selected articles, which strongly represent Active Learning (RQ3), with 52% (17 articles) addressing innovative strategies such as flipped classrooms, case-based learning, problem-solving, and collaborative skills development. This dominance suggests a pedagogical shift toward learner-centred approaches to

cultivating practical and transferable competencies. Critical Thinking (RQ2) accounts for 39% (13 articles), highlighting the growing recognition of analytical reasoning, argumentation, and metacognitive awareness as essential skills for academic and professional success. Meanwhile, Assessment (RQ1) accounts for 9% (3 articles), indicating a minor but notable focus on refining assessment methods to measure deeper learning outcomes and self-regulated learning. Regarding research methods, quantitative designs account for 52% of articles, mixed methods 27%, quasi-experimental studies 12%, and qualitative studies 9%.

The distribution of levels of evidence further contextualises these trends. The predominance of level III studies (85%, 28 articles), comprising quantitative (QT), qualitative (QI), and mixed methods (MMA) approaches, underscores a reliance on observational and descriptive research rather than experimental designs. While level III studies provide valuable insights into classroom practices and student perceptions, they are limited in establishing causal relationships, which may restrict their applicability to broader educational settings. Level II studies (12%, four articles), primarily quasi-experimental (Qe), represent efforts to validate interventions more rigorously. However, their relatively low percentage suggests that empirical testing of instructional strategies remains an area of growth. Notably, here were no Level I studies (RCTs), highlighting the lack of gold-standard evidence in this field. Quality analysis reveals that 58% (19 articles) received an A (high quality) grade, demonstrating clear methodologies, sufficient sample sizes, and well-defined conclusions. These studies, particularly in Active Techniques (RQ3), effectively integrate practical applications with defined outcomes. 39% (13 articles) received a B grade (good

quality), often due to minor methodological limitations, smaller sample sizes, or restricted generalizability. Only 3% (1 article) received a C grade (low quality), indicating that most studies in this review maintain acceptable standards of rigour and reliability. However, the prevalence of Level III evidence among high-quality articles suggests the need to advance research designs toward Level I and II to strengthen the field's empirical base.

Active Learning (RQ3) dominance aligns with contemporary trends prioritising interactive, hands-on, technology-enhanced learning models. These studies often employ mixed

methods approaches (MMA, 27%) to capture both quantitative results and qualitative perspectives, reflecting an effort to balance statistical rigour with narrative depth. In contrast, critical thinking studies (RQ2), while abundant, most often rely on quantitative (QT, 52%) and quasi-experimental (Qe, 12%) designs, demonstrating attempts to assess skill development in structured settings. Evaluation (RQ1), despite its limited representation, includes high-quality mixed-methods research (MMA), suggesting a focus on exploratory frameworks rather than established measurement tools.

Table 1. *Selected studies. Evidence Level – Quality Level. Coding.*

Title	Central topic	Evidence level	Quality level	Code
Assessment as Learning in Medical Education: Feasibility.	This article investigates the "Assessment as Learning" (AaL) concept in medical education, emphasising student-centred approaches to self-regulated learning and evaluation frameworks.	III (Mixed-Methods Approach)	A (Clear methodology, sufficient sample size, and consistent findings)	P1 - RQ1 - MMA
Based Case-Based Learning and Flipped Classroom Methods to Improve Critical Thinking	This study investigates integrating case-based learning (CBL) and flipped classroom (FC) methods to enhance active learning and critical thinking among international physiology students. It demonstrates improved enthusiasm, problem-solving skills, and application of theoretical knowledge.	III (Quantitative)	A (Well-designed intervention with clear impact)	P2 - RQ3 - Qt
Behavioural Assessment of Soft Skills Development in Pre-Medical Biology Courses	This work evaluates a structured course to enhance soft skills for pre-medical students. It incorporates active learning, collaborative work, and patient simulations. The focus is on integrating assessment methods to evaluate behavioural and critical thinking competencies.	III (Quantitative)	B (Adequate methodology, but lacks deeper statistical robustness)	P3-RQ1-Qt
Beyond the Passive Absorption: Engaging Students in Critical Reading of Scientific Articles	This work proposes an active learning framework combining argumentation, peer review, and task-oriented reading to develop science students' critical reading and reasoning skills. It highlights the need for explicit opportunities to strengthen these abilities through structured activities.	III (Qualitative)	B (Clear themes but some limitations in generalizability)	P4-RQ2-Ql P4-RQ1-Q1
Cultivating Critical Thinking Skills: A Pedagogical Study in a Business Statistics Course	This study examines teaching strategies, including Socratic dialogue and active learning, to foster critical thinking in business statistics. It highlights gaps in educational practices and emphasises faculty training for teaching critical thinking.	III (Quantitative)	A (Solid methodology and reliable statistical analysis)	P5-RQ2-Qt P5-RQ1-Qt
Developing Analytical and Observational Skills in Undergraduate Engineering Students	The research focuses on enhancing analytical and observational skills using poster presentations and peer reviews in engineering education. It evaluates the method's effectiveness through surveys and metrics such as creativity, conceptual understanding, and critical thinking development.	III (Quantitative)	A (Precise metrics and evaluation criteria)	P6-RQ3-Qt
Effect of Team-Based Learning on Classroom Engagement, Critical Thinking Dispositions, and Academic Performance in Nursing Students	A quasi-experimental study that evaluates the impact of team-based learning (TBL) on engagement, critical thinking, and academic achievement in nursing students. This study's results demonstrate higher engagement, enhanced critical thinking, and improved test scores compared to traditional teaching.	II (Quasi-Experimental)	A (Robust design with well-defined experimental groups)	P7-RQ2-Qe
Empowering Students through Active Learning in Educational Big Data Analysis	This work explores active learning approaches to improve students' data analysis and critical thinking skills. Tasks integrate data-driven projects, peer evaluations, and reflections to enhance analytical and problem-solving abilities.	III (Mixed-Methods Approach)	A (Combines practical implementation with data analysis)	P8-RQ3-MMA
Enhancing Authentic Assessment in Large-Class Design Education Through Authentic Project-Based Learning	The study investigates how authentic project-based learning can improve assessment methods, critical thinking, and engagement in large design education classes and highlights strategies for developing effective evaluation systems.	III (Mixed-Methods Approach)	A (Well-structured, detailed analysis and relevant findings)	P9-RQ1-MMA
Escape Rooms in Pharmacy Education: More Than Just a Game	The research explores escape rooms as a game-based learning strategy to promote critical thinking, teamwork, and decision-making in pharmacy education. Results show high engagement and effectiveness in reinforcing course content.	III (Quantitative)	A (Engaging and measurable learning outcomes)	P10-RQ3-Qt P10-RQ1-Qt
Flipped Classroom: Perception of Early Childhood Education Students	This work examines students' perceptions of the flipped classroom model in early childhood education programs. It evaluates motivation, comprehension, autonomy, and competence acquisition. Results highlight enhanced creativity and cross-disciplinary competencies, reinforcing flipped classrooms as effective pedagogical tools.	III (Quantitative)	B (Good methodology but lacks deeper impact evaluation)	P11-RQ3-Qt
I Do, I Understand: Engaging Campus and Distance Students through Active Learning	The study integrates asynchronous and synchronous distance learning approaches with active learning strategies to engage students. It highlights critical thinking development through videos, fieldwork, and collaborative tasks.	III (Mixed-Methods Approach)	A (Clear structure and hybrid teaching assessment)	P12-RQ3-MMA
Impact of Case-Based Learning Strategy Implementation on Clinical	This work evaluates the effects of case-based learning (CBL) on motivation, critical thinking, and professional competencies. A quasi-experimental study showed statistically significant improvements in learning outcomes.	II (Quasi-Experimental)	B (Good design but lacks long-term outcome evaluation)	P13-RQ2-Qe

Practice Students in Physiotherapy				
Incorporating Visualization Tools and Active Learning Approaches for Programming Courses	This paper discusses integrating visualisation tools and active learning methods to teach programming. It enhances logical thinking, debugging, and programming skills, addressing gaps in traditional methods.	III (Quantitative)	B (Useful framework but limited scalability)	P14-RQ3-Qt
Innovative Self-Directed Clinical Case Exercise (SPLICE): Fostering Critical Thinking in Medical Education	The study introduces the SPLICE model, which combines self-directed learning and clinical case analysis to develop critical thinking and communication skills. Results from intervention and control groups highlight SPLICE's effectiveness.	III (Quantitative)	A (Clear data presentation and reproducibility)	P15-RQ2-Qt
Integration of Visual Thinking Strategies in Undergraduate Health Assessment Courses	This work explores the feasibility of using visual thinking strategies (VTS) to enhance critical thinking and interpersonal skills in nursing education. Combines in-person and online sessions with visual analysis techniques.	III (Mixed-Methods Approach)	A (Clear methodology and focus on critical thinking)	P16-RQ2-MMA
Investigating the Transformative Effects of Active Learning Approaches in Engineering Education	This research evaluates active learning methodologies, such as peer instruction, project-based learning, and simulations, to enhance engagement and critical thinking. Results support active learning to improve problem-solving and lifelong learning habits.	III (Mixed-Methods Approach)	A (Balanced methods and strong results)	P17-RQ3-MMA
Learning by Doing Using the Life Cycle Assessment Tool: Collaboration with Industries	The paper uses Life Cycle Assessment (LCA) to examine experiential learning through industry projects. Focuses on developing analytical and transferable skills for engineering students in collaborative industry contexts.	III (Quantitative)	A (Industry-based learning approach with measurable results)	P18-RQ3-Qt
Learning by Storytelling and Critiquing: Enhancing Information Literacy and Critical Thinking	This work explores digital storytelling combined with peer evaluation to promote critical thinking, information literacy, and self-efficacy among students. A quasi-experimental study found significant improvement in learning outcomes.	II (Quasi-Experimental)	B (Good insights but slightly limited sample size)	P19-RQ2-Qe P19-RQ1-Qe
Microteaching and Peer Assessment in Mathematics Teaching Practice	This study uses micro-teaching and peer assessment to enhance critical thinking, self-reflection, and pedagogical skills in future mathematics teachers. Highlights improvements in cognitive, affective, and psychomotor domains.	III (Qualitative)	B (Reflective insights but small sample size)	P20-RQ2-QI
Modern Ways of Learning as a Means of Enhancing Cognitive Activity	This paper analyses the effectiveness of interactive learning methods such as group work, case studies, and self-assessments to boost cognitive activity. The study evaluates the impact of these approaches on interdisciplinary collaboration and critical thinking development.	III (Mixed-Methods Approach)	A (Creative approach and application)	P21-RQ3-MMA P21-RQ1-MMA
Perceptions of Medical Students on Active Learning Strategies in Embryology	This study evaluates active learning strategies, including DIY modelling, reciprocal peer tutoring, and case discussions, to improve understanding and critical thinking in embryology. Findings show enhanced comprehension and problem-solving skills.	III (Quantitative)	B (Engaging method but lacks longitudinal analysis)	P22-RQ3-Qt
Problem-Based Learning in a Flipped Classroom: Effects on Pain Management Courses	This quasi-experimental study compares flipped classrooms using problem-based learning with traditional methods in nursing programs. The results reveal higher academic performance and critical thinking in flipped groups.	II (Quasi-Experimental)	A (Experimental rigour and results)	P23-RQ3-Qe
Purposeful Field Trips: Enhancing Experiential Learning and Higher-Order Thinking	This work investigates the impact of experiential learning through structured field trips on higher-order thinking skills and knowledge transferability. The results emphasise the importance of pre-trip activities for reinforcing learning outcomes.	III (Mixed-Methods Approach)	A (Practical activities with measurable effects)	P24-RQ3-MMA
Students' Performance and Perceptions of Mock Trials as Teaching Tools	This research assesses the use of mock trials to teach legal and ethical issues in pharmacy education. Findings demonstrate increased engagement, critical analysis, and teamwork among students.	III (Quantitative)	B (Reasonable statistical approach but lacks qualitative insights)	P25-RQ2-Qt
Students' Assessment of Learning in Psychology Using Process-Oriented Guided Inquiry Learning (POGIL)	This paper examines the impact of POGIL in psychology education on active learning and critical thinking. Results show significant improvement in process skills, motivation, and conceptual understanding.	III (Quantitative)	B (Sound methodology but needs broader sampling)	P26-RQ3-Qt
Teaching and Assessing Critical Thinking with Educational Technology in Higher Education	This work focuses on integrating educational technology to teach and assess critical thinking in higher education. The study highlights the role of online platforms and digital tools in fostering analytical skills.	III (Mixed-Methods Approach)	A (Strong design and clear application of methods)	P27-RQ2-MMA
Teaching Dynamics to Enhance Critical Thinking and Knowledge Sharing in Mathematics Education	This study explores active learning strategies, collaborative problem-solving, and technology integration to develop critical thinking in undergraduate mathematics courses. It reports improvements in engagement, self-assessment, and peer feedback.	III (Mixed-Methods Approach)	A (Blends theory and practice effectively)	P28-RQ3-MMA
The Impact of Critical Thinking on Learning Outcomes Assessment in Primary Schools	This work investigates how critical thinking strategies influence primary education assessment methods and learning outcomes. It finds that critical thinking techniques strengthen academic performance and motivation in classrooms.	III (Quantitative)	A (Statistical rigor and well-defined scope)	P29-RQ2-Qt
The Use of Video Essays and Podcasts to Enhance Creativity and Critical Thinking in Engineering Education	This paper explores the integration of video essays and podcasts as tools to develop creativity and critical thinking in engineering programs. Results highlight improved articulation, originality, and problem-solving skills.	A (Creative approach with measurable outcomes)	A (Creative approach with measurable outcomes)	P30-RQ2-Qt P30-RQ1-Qt
Unlocking Learner Potential: Using Escape Rooms for Critical Thinking and Risk Assessment Training	This work reviews the implementation of educational escape rooms as active learning tools to enhance critical thinking and risk assessment in genetics counselling education. Students engage in problem-solving and teamwork while applying knowledge to clinical scenarios.	III (Mixed-Methods Approach)	A (Clear execution, engaging activities, and strong data)	P31-RQ2-MMA
Using Case-Based Learning to Enhance Students' Performance in Mechanical Engineering Undergraduate Programs	This study investigates the impact of case-based learning (CBL) on conceptual understanding, student engagement, and knowledge application in mechanical engineering. It demonstrates higher performance and motivation among students exposed to CBL than traditional lectures.	III (Quantitative)	A (Strong case application and results)	P32-RQ3-Qt
Why Is This Hard? Exploring Factors Affecting Critical Thinking in Higher Education	This work examines psychological and sociological barriers to critical thinking among higher-education international students. It employs workshops and qualitative analysis to highlight improved awareness of biases, argument construction, and independent thinking.	III (Qualitative)	B (Thematic depth but limited generalizability)	P33-RQ2-QI

Fuente: elaboración propia

These findings underscore the need for higher-level evidence (Level I) through randomised controlled trials (RCTs) to validate the efficacy of active techniques and critical thinking interventions. Furthermore, expanding the scope of evaluation studies (RQ1) is crucial to developing robust evaluation frameworks that capture long-term impacts on student learning.

While the aggregate trends provide a broad overview of the methodological landscape across the selected studies, the following section delves deeper into the specific dimensions and factors that underpin these findings. This detailed thematic analysis reveals

the nuances of how assessment, critical thinking, and active learning interact within educational contexts.

Detailed thematic analysis of dimensions and factors

This section presents the findings according to the study's three research questions on Assessment (RQ1), Critical Thinking (RQ2), and Active Learning (RQ3). Each topic is explored through different dimensions and factors from the reviewed literature, illustrating how these areas intersect to shape educational practices (see Fig. 2).

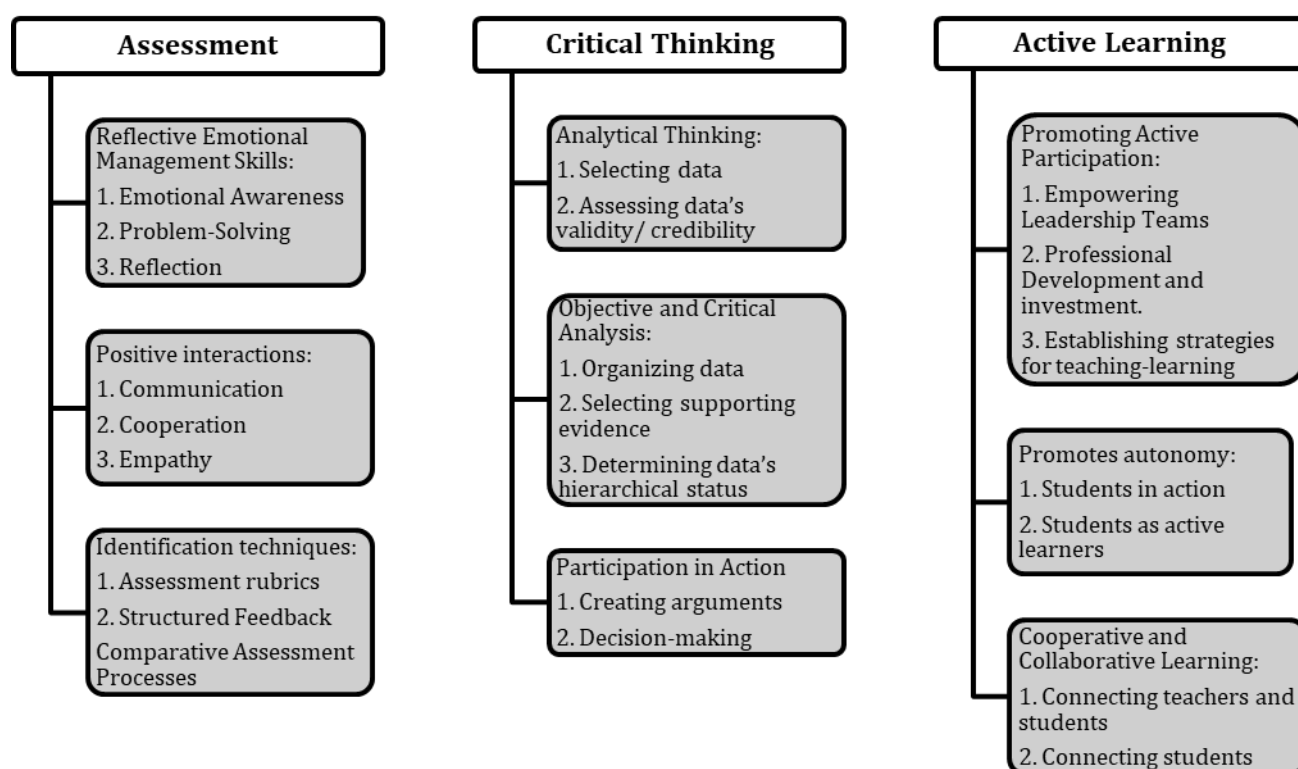


Figure 2. Dimensions and factors by RQ 1-3

Assessment

The central topic of RQ1 is evaluation, which fosters essential skills such as reflection, decision-making, collaborative work, and critical thinking. One key dimension identified is reflective emotional management, encompassing factors like Emotional

Awareness. This skill is particularly developed in collaborative contexts, as students must understand and manage their emotions and those of others. Self-assessment enables students to gauge their acquired knowledge and determine its relevance to their learning process (Kryucheva y Tolstoukhova 2023). In parallel,

peer assessment plays a critical role by allowing students to analyse evaluation criteria and incorporate feedback from their peers, thereby promoting the development of critical thinking skills (Hwang et al., 2023). Indeed, feedback is paramount in problem-solving, as (Ilhan et al., 2023) noted. Another dimension relates directly to the basic elements of critical thinking, analysing, self-regulating, interpreting, inferring, explaining, and evaluating. Reflection, as a component of the teaching-learning process, further develops critical thinking skills (Kryucheva y Tolstoukhova, 2023). The reviewed studies consistently indicate that guided peer assessment, achieved through the analysis of assessment criteria, reinforces critical thinking (Hwang et al., 2023). The cooperation factor, which emphasises individual and collaborative skills such as teamwork, is also integral to the evaluation process. Interactive methods, such as debate, foster critical thinking and empathy and promote tolerance by respecting diverse criteria (Kryucheva y Tolstoukhova 2023).

Evaluation techniques also yield several important factors. For instance, evaluation rubrics serve as clear, prior, and explanatory guides for students, ensuring they understand the evaluation process. (Caratozzolo et al., 2022) assert that analysing learning development indicators is essential to promoting competencies. (Hwang et al., 2023) highlight that using these rubrics allows students to verify their peers' work from the teacher's perspective. Structured feedback is crucial as a subsequent factor; (Archila et al., 2024) emphasise that peer assessment must be student-centred, requiring teachers to facilitate effective feedback. Moreover, the study by (Indriati et al., 2024) confirms that productive feedback significantly enhances students' work and supports the development of critical thinking. Finally, comparative processes in

evaluation further enrich this dimension by enabling students to benchmark their performance against established standards.

Critical thinking

Critical thinking is fostered in collaborative educational environments where learning is measured by comparing students' development against established standards. (Dori y Lavi 2023) suggest that enhancing students' critical and reflective capacities is essential, while (Kryucheva y Tolstoukhova, 2023) note that peer exchanges prompt reflection and learning from one another's work. In addressing RQ2, several dimensions were identified. The first dimension, analytical thinking, encompasses data selection, a skill that leverages critical thinking to support problem-solving by identifying relevant information to build robust arguments (Bargiela et al., 2022; Sanad et al., 2023). Additionally, assessing data validity and credibility is crucial; learners must discern which sources are reliable and evidenced through appropriate support resources (Hwang et al. 2023), with these learning experiences ideally mirrored in real-world contexts (Rosenberg et al. 2024). Another key dimension is objective and critical analysis. This includes the organisation of data, which enables the sequencing of patterns and the visualisation of relationships between concepts (Choi et al. 2022), aided by organisational software for assertive analysis (Dori & Lavi 2023). Selecting supporting evidence is also vital; the rationale behind information selection should be systematic rather than arbitrary, ensuring that evidence is relevant and presented (Caratozzolo et al., 2022; Jácome et al., 2022). Moreover, categorising data strengthens arguments by establishing a hierarchical framework.

The dimension of participation in action focuses on argument creation, where statistical reasoning is used to justify claims, and

collaborative debates enhance structured logic (Bargiela et al., 2022; Dominguez, 2024). Decision-making processes integrating evidence evaluation, option comparison, and collaborative problem-solving improve adaptive reasoning (Sanad et al., 2023; Surapaneni, 2024). Together, these dimensions form a holistic framework for critical thinking, emphasising data selection, organisation, and evaluation as foundational to effective argumentation and decision-making (Bargiela et al., 2022; Jácome-Hortua et al., 2022; Muñoz et al., 2021; Rosenberg et al., 2024)

Active Learning

Structured methods and interactive tools can enhance students' ability to analyse information, justify reasoning, and tackle complex challenges in both academic and professional settings (Choi et al., 2022; Rosenberg et al., 2024). The central theme addressed by RQ3 is Active Techniques, which refocuses the teaching-learning process on the student and emphasises knowledge construction. These pedagogical strategies actively involve learners, promoting autonomy, argumentation skills, and the practical application of acquired knowledge, thereby positioning students as central agents in their educational journey (Jácome et al. 2022). The first dimension identified is the Promotion of Active Participation. This dimension underscores the importance of key areas such as the relationship between the student and teacher, the connection with the learning process, and the integration of the student into their educational environment (Sanad et al. 2023). Within this dimension, the empowerment factor of leadership teams is crucial; for example, motivation allows students to interact and critically question the educational process to optimally assimilate the material (Kryucheva y Tolstoukhova, 2023). Collaborative leadership in work teams

enhances individual autonomy and contributes to group problem-solving (Foo y Foo, 2022; Romain et al., 2024), while effective team leadership unifies criteria and facilitates coherent decision-making (Dominguez 2024). Moreover, professional development and investment, through adequate training and provision of resources, are essential to support active techniques, particularly in diverse educational contexts (Archila et al., 2024; Tsai, 2024; Yang et al., 2024).

The second dimension is the Promotion of Autonomous Behaviour. Active techniques empower students to become the primary actors in their learning, enhancing their understanding of theoretical concepts (Fuentes y Prieto, 2024). When students engage in group activities that foster the negotiation of meanings and collective knowledge creation, their adaptive reasoning and overall performance improve (Archila et al., 2024; Dominguez, 2024; Dori y Lavi, 2023). Furthermore, the role of the student as an active learner reinforces the constructivist model, encouraging the discovery of innovative solutions to educational challenges (Romain et al. 2024), which can be applied across various learning environments to reduce gaps and improve educational programs (Yang et al., 2024). The third dimension, Cooperative and Collaborative Learning, emphasises that students from diverse disciplines can exchange perspectives and knowledge, thereby reducing area-specific biases (Tsai, 2024). Key factors include establishing strong connections between teachers and students, where empathy and effective teacher-student rapport are critical (Reiser, 2023), and promoting interpersonal relationships and collaborative learning (Kore y Begum, 2022). Additionally, teacher motivation is vital in successfully implementing active techniques, directly influencing classroom interactions (Merrou et al., 2023). Critical content analysis is developed through

innovative strategies. Additionally, they reverse traditional learning orders (analyse before practising), improving student understanding (Fuentes y Prieto, 2024; Patil et al., 2022). Finally, it is essential to reinforce the effectiveness of active techniques. Teachers must connect with students to facilitate knowledge development (Rumayor et al., 2024).

The analysis of the dimensions of assessment, critical thinking, and active learning has revealed a collaborative and comprehensive approach that improves the efficiency of the learning environment. Constructivist feedback encourages better assessment, as proposed by (Ilhan et al., 2023), and group work, communication skills, and self-reflection create a self-regulated learning environment, developing critical thinking. (Kryucheva y Tolstoukhova, 2023) suggest that active learning techniques, assessment, and self-assessment are essential for teaching practices, as this is important for monitoring and continuously improving student progress. The factors and dimensions described in the review support the study's conclusion that applying collaborative learning approaches using active learning techniques improves academic performance (Sanad et al., 2023). Active learning methods have been shown to improve students' data analysis and critical thinking skills; this is key to understanding the impact of teaching methodologies on students from diverse academic backgrounds and ability levels (Tsai 2024). The evidence has helped us understand the strong and clear relationship between the development of critical thinking, active learning techniques, and effective assessment, highlighting the relevance of their application in contemporary educational practices. The results demonstrate that the development of socio-emotional competencies is significantly improved through structured

assessment practices (RQ1), facilitating and enhancing reflective feedback and supporting the development of critical thinking. Thematic analysis revealed that critical thinking is a multifaceted construct dependent on rigorous data collection, objective analysis, and collaborative assessment processes. Finally, the findings related to RQ3 confirm that active learning makes students the central axis of the educational process, promoting their autonomy and the adequate construction of knowledge. These key findings underscore the interrelated roles of assessment, critical thinking, and active learning in advancing academic performance and preparing students for real-world challenges, especially in the evolving post-COVID educational landscape.

As described, the research questions with their central themes, RQ1-Assessment, RQ2-Critical Thinking and RQ3-Active Learning, are related to the PQR-primary research question. (see Fig. 3).

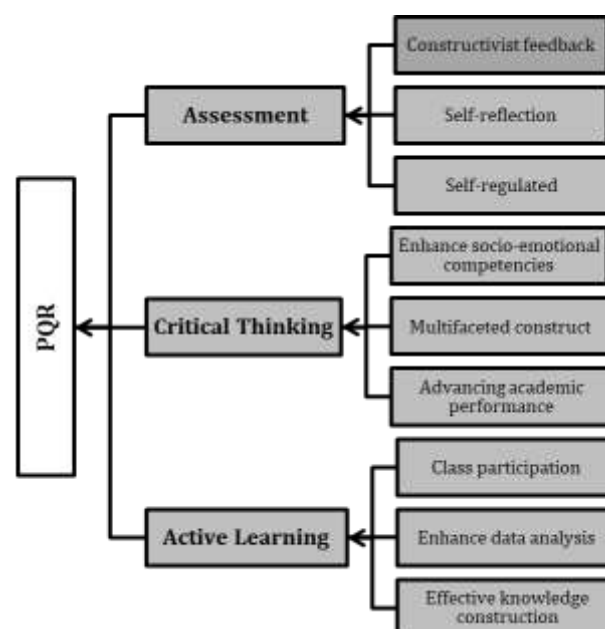


Figure 3. Relationship of RQ 1-3 with PQR

Using the insights gained from the study, findings are synthesised, helping to explore the implications of contemporary educational practices. In the following section, we reflect on

the interconnected dimensions addressed in the research questions and how the study can inform a post-COVID educational environment.

According to the results obtained for the assessment (RQ1), socio-emotional competencies are directly related to assessment practices. For example, peer assessment provides feedback to students, encouraging self-reflection on their weaknesses and empathetic exchange of ideas for continuous improvement (Ilhan et al., 2023). Structuring assessment methods helps students recognise their strengths based on collaborative learning, reflection, and exchanging ideas (Archila et al., 2024). The study revealed that addressing psychosocial factors is necessary to overcome student challenges while focusing on problem-solving (Vargas et al., 2021). The comprehensive approach fosters critical thinking, preparing students for the demands of the real world with ongoing collaborative capacity and adaptability. Critical thinking is a multidimensional construct that must be supported by applying active learning techniques and evidence-based assessments (Bonilla, 2020). Findings demonstrate that integrating structured assessment methods into educational systems improves cognitive flexibility, collaborative problem-solving, and decision-making (Blewitt et al., 2020).

The findings indicate that critical thinking (RQ2), a multifaceted process, requires analytical and reflexive dimensions. The literature emphasises that rigorous data selection, validity, and evaluation are crucial for building strong arguments (Bargiela et al., 2022). Additionally, objective and critical analysis plays a key role in systematically organising data and carefully selecting evidence, supporting and ensuring that information is appropriately presented and

relevant (Caratozzolo et al., 2022; Jácome et al., 2022). Peer and group assessment discussions are collaborative activities that reinforce these skills, facilitating reflective communication and motivating students to evaluate, compare, and justify their decisions with critical reasoning (Dominguez, 2024; Surapaneni, 2024). This holistic framework for critical thinking supports selecting, organising, and evaluating information, enhancing reasoning with adaptive decision-making to achieve academic and subsequent professional success (Rosenberg et al., 2024). In the post-COVID era, educational paradigms favour models where the student is the central focus of the educational process. Collaborative learning fosters critical thinking skills, preparing students for real-world challenges.

Regarding research question 3 (RQ3), authentic understanding occurs when students actively reorganise content, stimulating their learning (MacKenzie et al., 2024; Romain et al., 2024). Active techniques foster student participation, positioning learners as the primary agents of their knowledge construction, thereby significantly contributing to a constructivist approach. Such active participation also cultivates collaborative environments, even among students from different disciplines, facilitating the exchange of diverse paradigms and insights in interpreting curricular content (Tsai, 2024). The analysis confirms that active and collaborative work enhances learning outcomes and critical thinking skills, ultimately leading to improved academic performance, as reflected in student evaluations (Sanad et al., 2023). Furthermore, after a comprehensive literature review, several opportunities and gaps have emerged for future research. First, given that only 6% of the sources reviewed come from Latin American contexts, future studies must prioritise exploring regional approaches to active learning strategies and developing

critical thinking. Second, a focused examination of Ecuadorian educational contexts is necessary, as an Ecuadorian perspective deviates from the predominantly international source material. This highlights the need for our country to adopt knowledge-based decision-making and influence public policies and practices in education.

Conclusions

The study reveals that integrating structured assessment practices, robust critical thinking development, and active learning techniques is essential for transforming educational practices in the post-COVID era. The evidence from RQ1 shows that effective assessment, through peer and self-assessment and clear evaluation rubrics, enhances socio-emotional competencies, reflective feedback, and adaptive problem-solving. Research question 2 (RQ2) demonstrates that critical thinking is multifaceted, based on rigorous data selection, systematic organisation, and collaborative assessment, all to generate robust arguments that support informed decision-making. Research question 3 (RQ3) confirms that active learning encourages students to become central agents in the educational process, promoting their autonomy and collaborative learning supported by constructivist knowledge. The interconnected dimensions improve academic performance and motivate and prepare students to confront real-world challenges with creativity and adaptability. The implications for educational practice and policy are clear: policymakers and educators must adapt their decisions and teaching strategies based on evidence, promoting dynamism and reflection within a critical analysis framework and active participation.

Despite the valuable knowledge generated, this study has several limitations. The systematic review was limited to open-access articles

published in English and Spanish; only 6% of the sources were from Latin American contexts, with minimal focus on Ecuadorian educational settings. These factors may limit the generalizability of the findings to cultural and regional contexts. These limitations must be taken into account when conducting future research in the context of Ecuador and Latin America. Higher-level evidence, such as randomised controlled trials, should also be used to validate the effectiveness of the intervention with the application of active learning techniques and the development of critical thinking, contributing to a more comprehensive approach, evidence-based understanding of educational practices and informing policy development tailored to the needs of diverse learner populations.

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