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Revista Lengua y Cultura

Biannual Publication, Vol. 7, No. 13 (2025) 1-8

ISSN: 2683-2321

Mexican Pre-Service English Teachers' Higher Order Thinking and Critical Thinking Skills

Habilidades de pensamiento de orden superior y pensamiento crítico de profesores mexicanos de inglés en formación

Oscar M. Narváez-Trejo [a], Gabriela G. Estada-Sánchez [b], Patricia Núñez-Mercado [c]

Abstract:

Today, educators worldwide are prompted to foster Higher Order Thinking Skills HOTS in the classroom, as equipping students with 21st-century competencies is considered essential. Recent studies have analysed the implementation and promotion of HOTS; however, studies focusing on HOTS in Mexico are still scarce, especially those among EFL teacher education programmes. Therefore, this study aims to contribute to the current existing body of knowledge by identifying Pre-Service English Teachers (PSET) levels of HOTS as a result of their schooling. To do so, 107 PSET were surveyed with the Critical Thinking Attitudes Scale (Hirayama & Kusumi, 2004). Results suggest that while PSET demonstrate a strong foundation in their HOTS and critical thinking skills, it is necessary to conduct further research using other methods to corroborate them. This study provides valuable insights into the cognitive strengths among the PSET participants and encourages further investigation regarding the teaching practices in this institution, which could give an account of the benefits of the integration of HOTS into teacher education programs, fostering in this way future generations of reflective, independent thinkers.

Keywords:

Critical thinking, English as a Foreign Language (EFL), Higher-order thinking skills, Pre-service teachers

Resumen:

Hoy en día, se espera que los educadores de todo el mundo fomenten las habilidades de pensamiento de orden superior (HOTS, por sus siglas en inglés) en el aula, ya que formar a los estudiantes con las competencias del siglo XXI se considera esencial. Estudios recientes han analizado la implementación y promoción de estas HOTS; sin embargo, en México estos estudios aún son escasos, especialmente entre los programas de formación de profesores de inglés como lengua extranjera (EFL, por sus siglas en inglés). Por lo tanto, este estudio tiene como objetivo contribuir al actual cuerpo de conocimiento existente mediante la identificación de los niveles de HOTS de los profesores de inglés en formación (PSET, por sus siglas en inglés) como resultado de sus estudios universitarios. Para ello, se encuestó a 107 PSET con la Escala de Actitudes de Pensamiento Crítico (Hirayama & Kusumi, 2004). Los resultados sugieren que, si bien los PSET demuestran una base sólida en sus HOTS y habilidades de pensamiento crítico, es necesario llevar a cabo más investigaciones utilizando otros métodos para corroborarlos. Este estudio proporciona conocimientos valiosos sobre las fortalezas cognitivas entre los participantes del PSET y anima a seguir investigando sobre las prácticas docentes en esta institución, lo que podría dar cuenta de los beneficios de la integración de las HOTS en los programas de formación de profesores, fomentando así futuras generaciones de pensadores reflexivos e independientes.

[a] Oscar M. Narváez-Trejo, Universidad Veracruzana | Facultad de Idiomas | Xalapa-Veracruz| México, https://orcid.org/0000-0003-3259-2787, Email: onarvaez@uv.mx

[b] Gabriela G. Estrada-Sánchez, Universidad Veracruzana | Facultad de Idiomas | Xalapa-Veracruz| México, https://orcid.org/0009-0001-3185-7248, Email: gestrada@uv.mx

[c] Autor de Correspondencia, Patricia Núñez-Mercado, Universidad Veracruzana | Facultad de Idiomas | Xalapa-Veracruz| México, https://orcid.org/0000-0002-5963-3887, Email: pnunezl@uv.mx

Fecha de recepción: 18/02/2025, Fecha de aceptación: 18/08/2025, Fecha de publicación: 05/05/2025

DOI: https://doi.org/10.29057/lc.v7i13.14543

***Palabras Clave**:*

Pensamiento crítico, Inglés como lengua extranjera, habilidades de pensamiento de orden superior, profesores en formación

Introduction

Research in the field of HOTS has reached the consensus that the cultivation of critical thinking, regarded as the attainment of high cognitive development, is imperative for attaining academic success in higher education institutions, making it a fundamental ability that students and global citizens ought to nurture (Kaur et al., 2020). Therefore, the cultivation and pursuit of critical thinking have emerged as crucial competencies within the realm of education (Widiatmo et al., 2019), and the growing necessity to address intricate challenges in an interdependent global context has heightened the significance of these so-called twenty-first-century skills in all education levels (Jerome et al., 2017; Organisation for Economic Cooperation and Development [OECD], 2019; Yeung, 2015).

According to the OECD (2019), the promotion of critical thinking, creativity, tolerance, and rationality is crucial for fostering both individual and social well-being within the context of an increasingly interconnected global landscape, characterised by complexity, globalisation, and digitalization. In the same vein, scholars have claimed that learners who employ HOTS often do better in education than those who do not (Wilson & Narasuman, 2020). That is why the implementation of HOTS is particularly essential in the teaching-learning activities (Cancino & Capredoni, 2020), and it is therefore essential to innovate the curriculum to fit the current professional 21st-century skills (Vu et al., 2020). Hence, nurturing these skills should be seen as a fundamental objective for higher education institutions.

Consequently, HOTS have been incorporated as a learning objective in Thailand, Russia, Brazil, and Mexico (Li & Wegerif, 2014) as well as in England, Hong Kong, Malaysia, and China (Li, 2016). As a result, Mexican higher education institutions have implemented instructional models that aim to foster critical and creative thinking among students. These models prioritize the *utilization* of teaching methods rooted in HOTS within the classroom setting or including specific courses for such purpose. For instance, the university in which this study was conducted implemented across all of its academic programmes a compulsory course named Critical Thinking for Problem Solution.

Resulting of this growing recognition of the significance of students' HOTS development in the educational arena, this trend has extended to the domain of language acquisition (Johansson, 2020) and hence has become prominent within the field of English Language Teaching (ELT) (Antonio et al., 2021). Research within EFL instructional settings has revealed that collaboration between university students is a fundamental component in cultivating HOTS (Paul, 1992; Paul & Elder, 2006), which translates into the students' learning outcomes enhancement when their cognitive processes incorporate an extensive exchange of perspectives or reference frameworks through activities prioritising inquiry (Tsui, 1999). Hence, it comes as no surprise that the national curriculum worldwide has led scholars, educators, and administrators in the field of ELT to include HOTS into their respective domains.

However, the implementation of HOTS has encountered several obstacles and complexities. One primary issue pertains to the attitudes and views held by certain educators. The classes taught by these professors are typically structured in a teacher-centred style, which tends to restrict opportunities for autonomous study or inquiry-based learning (Hughes, 2014). Consequently, investigating pre-service teachers' actual cognitive development in terms of HOTS is essential to assess whether the curriculum and teaching strategies have been successful in promoting these abilities. This is precisely the aim of the present study, and once this has been established, it might serve as a basis for further correlational studies to identify its influence on pre-service teachers' linguistic advancement.

Literature Review

Defining HOTS has proven to be challenging due to their multifaceted nature, encompassing intricate cognitive processes such as reasoning and judgement, alongside various mental and emotional dispositions like intellectual empathy, fair-mindedness, and persistence (Heffington, 2019). Schulz and FitzPatrick (2016) have observed that various terms, including good, metacognitive, productive, creative, thoughtful, complex, deep, and logical thinking, have been employed interchangeably, leading to increased ambiguity and confusion. However, the American Philosophical Association (as cited in Schulz & FitzPatrick, 2016) defines critical thinking as comprising interpretation, analysis, evaluation, inference, and explanation – processes involving the most complex aspects of Critical Thinking Skills (CTS) and closely aligning with the core concept of HOTS.

According to Heffington (2019), psychologists have posited that the cultivation of proficient reasoning skills necessitates an educational approach that is rooted in the principles of experimentation, research, trial and error, and adherence to structured methodologies. Therefore, it is imperative to acknowledge that thinking abilities are not

solely classified according to discrete cognitive domains, but also according to advancing cognitive processes or degrees.

Implementation of HOTS in Mexico

When the Mexican Ministry of Public Education issued the curriculum from the Kindergarten to High school level (Secretaría de Educación Pública, 2017), HOTS were included in the section regarding expected learning outcomes, offering examples of thinking skills that the students have to develop during their basic education (González-López et al., 2020). The thinking skills to be acquired in English classes in elementary school are expressed in terms of interpreting, understanding, and sharing, describing, comparing, and giving and recording information, which are part of the thinking skills in Bloom's taxonomy, and are meant to be implemented into the Mexican Education system right from the beginning of basic school education.

González-López et al. (2020) aimed to identify the level of skills developed before joining the program of the new educational model proposed by the Mexican Ministry of Public Education. The diagnosis comprised the following components: i) an examination of 20 exercises to measure the level of development of each skill under study; ii) a rubric to evaluate the children's responses; and iii) a table to record the results of each skill. The study revealed that students showed some development in their thinking skills (observation, comparison, classification, ordering, inferences, memory, and storytelling), linguistic skills (they write their name without surnames, communicate emotions, tell short stories, and oral language stands out), and informative skills (there are no notions of concepts that intervene). The authors conclude that this opens an opportunity to develop instructional strategies specifically tailored to support the development of foundational, mathematical, linguistic, and informational thinking skills.

Therefore, even though not explicitly present in all public education syllabi, the importance of HOTS development as part of the students' preparation for their future lives has been embraced by Mexican educational authorities. This has led to the implementation of HOTS in all levels of education and is hoped that the result of this implementation will be visible in the long term. Given the current relevance of HOTS, incorporating them into the teaching and learning of EFL has also become a demand.

Students' HOTS and CTS levels

A growing body of research has examined the critical thinking skills (CTS) among students in diverse educational and linguistic contexts. Mohammadi & Golandouz (2017) conducted a comparative analysis of the CTS of EFL learners and Humanities students, revealing no substantial variation in performance. Both groups, however, were found to require CTS enhancement, underscoring a common educational gap. Rezaee and Mubarak's (2018) study with 150 Iraqi EFL university students found CTS levels ranging from average to below average, with a statistically significant correlation between CTS and English proficiency.

Saputi et al. (2018) examined specific CTS dimensions among 297 senior high school students, finding well-developed skills in evaluation and self-regulation, while other skills, such as interpretation, analysis, and explanation, remained underdeveloped. This finding suggests that targeted improvement in specific critical thinking dimensions could be beneficial. A parallel study by Tengku (2022) classified high school students' CTS as "sufficient" overall, with notable strength in advanced clarification. Permana et al. (2019) explored the relationship between CTS and variables such as academic abilities, concept mastery, and analytical skills among 112 undergraduate students. Their analysis revealed that analytical skills contributed most significantly to CTS, followed by academic ability and concept mastery, suggesting that these predictive skills could support CTS development.

Further insights are provided by Zhou and Lin (2019), who identified high CTS levels among English and Japanese university students, with English majors excelling particularly in analytical and inferential skills, while Japanese students showed strength in evaluation skills. Notably, English students demonstrated stronger CTS overall. Lianqing et al. (2020) found similar results, with British university students scoring higher on CTS measures than their Chinese counterparts, although Chinese students performed better on the questionnaire when it was presented in their native language.

In Vietnam, Nguyen and Nguyen (2020) assessed the CTS of EFL university students and their potential relationship with argumentative writing ability. Although CTS were high, no statistically significant correlation emerged between CTS and writing performance, suggesting that instructional methods might be supporting cognitive development in other ways. Din (2020) similarly highlighted a discrepancy between students' positive attitudes towards CTS and their practical ability to apply it, particularly in critical reading.

Lastly, recent studies among high school students and pre-service teacher populations provide additional insights. Sofiyana and Sholihah (2022) found that pre-service teachers' CTS were categorically underdeveloped across programs, while Fitriani et al. (2022) reported that Indonesian high school students scored low in fundamental CTS areas such as explanation and assumption formulation. Together, these findings

underscore the need for curricular and pedagogical strategies that foster CTS effectively across educational contexts.

Methodology

To examine the empirical evidence on the development of CTS/HOTS among a sample of Mexican Pre-service English Teachers (PSET), the present study used a quantitative approach. Quantitative research is defined as a systematic investigation of phenomena through the collection of numerical data, followed by the application of rigorous statistical analysis methods (Wellington, 2015). This approach is based on verifiable data that can be measured objectively, allowing for a more reliable and unbiased analysis. By utilizing quantitative techniques, data analysis can be conducted in a systematic and structured manner.

The application of comparative analysis and basic statistical methods in this study serves as a mechanism to present empirical data in an impartial manner and uncover any underlying patterns or trends. To assess the cognitive development of PSET, a quantitative exploratory technique was employed, involving the administration of an online questionnaire. This approach allowed for the collection of numerical data that was then analysed using basic descriptive statistics, providing a more objective and systematic understanding of the phenomenon under study. A quantitative methodology ensures the reliability and validity of the findings, contributing to the overall rigor of the research.

Data collection

To measure PSET's higher-order thinking skills levels, the study employed the Critical Thinking Attitudes Scale (Hirayama & Kusumi, 2004) as used by Akatsuka (2019). The scale comprises 33 items aimed to assess the diverse HOTS often possessed by participants, evaluating various facets of cognitive capabilities in four dimensions: awareness of logical thinking (the ability to approach complex issues in a logical manner), inquiry mind (the willingness to learn from various sources), objectivity (the openness to consider others' ideas and opinions), and valuing evidence (Akatsuka, 2019). To cater to the participants' linguistic needs, the survey was translated into Spanish, given that it is their mother tongue. The process of data collection took place in the term August-December 2023.

Participants answered the 33 items on a Likert scale ranging from 10 (strongly agree) to 1 (strongly disagree). To facilitate data analysis for this paper, the values were further grouped into three ranks: High (values 8-10), Medium (values 5-7), and Low (values 1-4). This subdivision allows for a more nuanced interpretation of the attitudes towards HOTS.

The scale was digitalized using Google Forms and sent electronically to all participants, facilitating the data collection process. Responses were compiled into an Excel database, and descriptive statistics were employed to analyse the data. The results were entered in tables, distributing responses across three ranks: Low, Medium, and High. The results were then expressed in percentages to facilitate interpretation and comparison. Participants were 107 PSET enrolled in the first, third, and fifth semesters of a BA Degree in English Language, which aims to form future teachers of English in Southeast Mexico.

Results and discussion

In the logical thinking awareness category, the items elicit responses that reflect participants' perceptions of their cognitive processes related to logical reasoning. Findings show that most participants are in the medium and high ranks, as can be seen in Table 1.

Table 1. Logical Thinking Awareness

Item	Low	Medium	High
I am good at orderly thinking about complex problems.	19	56	32
I am good at summarizing my ideas and thoughts.	15	45	47
I am confident in thinking things correctly.	15	45	47
I can give persuasive explanations.	12	52	43
I can concentrate on things when I tackle a problem.	26	47	34
I can continue to tackle a problem even if it is complex.	16	39	52
I am the person who thinks things logically.	6	36	65
I can explore a topic carefully.	10	51	45
I can give suggestions constructively.	9	33	65
I get confused when I think about a complex problem.	23	43	41
My weakness is that I easily get distracted.	9	30	68
I do not have the headspace for others when I think about something.	35	39	33

These results suggest that the PSET perceive themselves as possessing a heightened level of self-awareness regarding their logical approach to various situations, ideas, and thoughts. Two elements had remarkably similar high results: summarising ideas and thoughts, with 42.1% in the medium rank and 43.9% in the high rank, and confidence in thinking things correctly, with 43% in the medium and 43.9% in the high rank. Moreover, only 5.6% of PSETs reported having problems with 'being a person who thinks logically', consistently showing a very positive perception of their logical thinking skills. These findings seem to contradict previous results indicating that logical reasoning is often underdeveloped in teacher education programs (Din, 2020), and that PSET recognize the relevance of logical reasoning but may lack the proficiency to apply it efficiently in complex situations (Mohammadi and Golandouz, 2017).

On another note, in alignment with prior findings on self-awareness in critical thinking, the data revealed significant insights into PSET's perceived challenges. 40.2% of participants reported feeling confused when thinking about a complex problem, a finding consistent with studies suggesting that cognitive overload can impair students' ability to process and solve complex issues (Ayres & Paas, 2012). Additionally, 36.4% expressed not being able to consider others when thinking about something, supporting research indicating that high cognitive load often limits one's ability to maintain perspective or accommodate multiple viewpoints, which can be essential in critical thinking contexts (Facione, 2015; Halpern, 2014). The highest ranking item, referring to getting distracted easily (63.9%), reflects a well-documented issue in maintaining focus under cognitive load. Studies have shown that self-regulation in attention management is a core component of effective critical thinking, as susceptibility to distraction has been correlated with reduced problem-solving efficiency and cognitive endurance (Unsworth et al., 2010). Hence, despite their general positive perception, the findings of this study demonstrate the participants' recognition of their shortcomings in their critical thinking abilities. Most individuals acknowledge their limited capacity to maintain attention on a singular job without succumbing to distractions, as previously reported by Robison and Unsworth (2015), whose participants also recognized the impact of attentional drift on their critical thinking performance.

In the domain of cognitive inquiry, the replies provided by the participants exhibit minimal variation, as indicated by the predominance of high-ranking answers in Table 2.

Table 2. Inquiry mind

Item	Low	Medium	High
I want to learn many things while interacting with a variety of people.	6	36	65
I want to be a life-long learner.	22	34	51
I love to try new things.	8	31	68
I want to learn about a variety of cultures.	4	24	79
I believe that it is meaningful to learn what and how foreigners think.	1	23	83
I am interested in people who think differently from me.	9	35	63
I am the person who wants to know more about a subject/ a topic.	2	16	89
I want to know as many things as possible, whether they are useful or not.	7	37	63
I enjoy discussions with people who have different opinions.	4	43	60
I am the person who asks questions if I do not understand something.	16	38	53

The findings thus indicate that most PSET possess a heightened awareness of their significant levels of interest, curiosity, and inclination towards acquiring knowledge and exploring novel subjects. This aligns with literature that underscores curiosity as a cornerstone of CTS and HOTS (Halpern, 2014; Facione, 2015). This phenomenon has been attributed to the inherent traits and inclinations of language learners, as they exhibit a willingness to embrace and absorb knowledge from multiple cultural contexts, which fosters HOTS such as analysis, evaluation, and synthesis (Saputi et al., 2018; Tengku, 2022). One notable illustration of the recognition of these attitudes is reflected in the highest ranking item, which refers to the desire to acquire further knowledge on a particular subject or topic (83.2%). This aligns with studies indicating that curiosity-driven learning is central to developing deep, transferable knowledge (Engel, 2011).

Regarding objectivity (see Table 3), a foundational element of CTS and HOTS, most participants also exhibited a strong orientation toward a highly positive perception of their skills.

Table 3. Objectivity

Item	Low	Medium	High
I always try to judge things in a balanced manner.	6	41	60
I try to remain objective when I judge things.	4	47	56
I try to think about things from a variety of perspectives, and not only one.	5	36	66
I engage in self-reflection to determine if I have a narrow perspective.	6	29	72
I actively listen to individuals who hold opposing views.	7	29	71
I grasp things only from my personal perspective.	49	45	13
I cannot be neutral when I discuss opinions.	45	48	14

The two highest-rated items (engaging in self-reflection to determine a narrow perspective, 67.3%, and actively listening to individuals who hold opposing views, 66.4%) reflect attributes of impartiality and self-regulation. Research indicates that a willingness to reflect on one's biases and consider diverse perspectives is critical for impartial judgment and complex problem-solving (Facione, 2015).

The last two items exhibited comparable proportions in their moderate and low rankings: grasping things only from a personal perspective (45.7% and 42.2% respectively), and not being able to remain neutral when discussing personal opinions (42% and 44.9% correspondingly). This corroborates the positive self-perception of PSET regarding their objectivity in terms of openness to the opinions of others and ability to remain impartial. Once again, this challenges previous research, where PSET encountered difficulties in objectively evaluating conflicting information (Nguyen & Nguyen, 2020).

The value evidence dimension outlined in Table 4 revealed a range of responses across three items, indicating

different attitudes toward evidence evaluation in critical thinking.

Table 4. Value evidence

Item	Low	Medium	High
I stick to concrete evidence when I judge something.	14	50	43
I examine a variety of facts of evidence as much as possible when I judge something.	6	49	52
I do not believe things without a doubt.	66	30	11

An overwhelming majority of participants (94.4%) claim to be able to fully engage (48.6%) or moderately engage (45.8%) in examining multiple sources of evidence. This suggests that most participants prioritize thorough evidence assessment, a cornerstone of CTS and HOTS that supports accuracy and reduces the influence of cognitive biases. Therefore, these PSET seem to have effectively developed their analytical skills, which are a central predictor of CTS (Permana et al., 2019), and suggest success in instructional practices that encourage critical evaluation and the consistent use of evidence in pre-service teacher education, underscored by Fitriani et al. (2022).

Additionally, a majority (61.7%) of PSETs do not readily accept information without questioning. This implies a cautious approach towards accepting information without scrutiny, supporting research on the importance of scepticism as a component or critical evaluation and evidence-based reasoning, and central to informed decision-making in educational contexts (Brookfield, 2017). Moreover, a significant proportion of participants (86.9%) value concrete evidence to a medium or high extent, which implies that they may consider additional aspects beyond mere proof when evaluating something. This balance enables individuals to adapt their reasoning based on context rather than rigidly adhering to objective evidence, as reported by Facione (2015).

Finally, Table 5 depicts the general PSET's perception of their CTS and HOTS categorized into high, medium, and poor rankings. This stratification facilitated the observation of distinctions within the ranks and enabled an understanding of how participants perceive their critical thinking abilities and cognitive growth.

Table 5. Results of higher, medium, and lower ranks of CT attitudes.

Categories	Ranks	Mean	SD
Inquiry mind	High	68.4	27.3
	Medium	31.7	53.2
	Low	7.9	70.1
Objectivity	High	50.28	40.1
	Medium	40.14	47.3
	Low	17.42	63.3
Awareness towards logical thinking	High	46.8	42.6
	Medium	42	46.0
	Low	16.25	64.2

Most responses fell within the higher ranks, suggesting that this group of PSET recognizes their capacity for HOTS such as analysis, synthesis, and evaluation, which are essential for effective teaching and problem solving (Halpern, 2014). Nevertheless, it is important to highlight that this simply portrays the PSET perception of their HOTS and CTS development. It is crucial to understand the additional factors by examining and assessing everyday university life circumstances. Din (2020) and Sofiyana and Sholihah (2022) recommend integrating case-based discussions and structured problem-solving activities to help PSET strengthen these critical skills; it would be interesting to observe if this type of activities occur indeed within these ELT program classrooms.

Conclusions

The objective of this study was to examine the cognitive growth of PSET in a teacher education program in Mexico. Based on the population examined, the results suggest that the participants have acquired cognitive and critical skills. Most students opted for descriptors from the upper ranks to articulate their own cognitive processes, indicating a positive self-assessment of their HOTS development. Consequently, they perceive themselves as receptive to new information, discerning in their approach to learning, and self-assured in their capacity to acquire knowledge.

The curriculum design and instructional methods employed by the faculty members seem to support PSET in enhancing both their language skills and cognitive processes. However, it would be beneficial for the program to focus on students who have not demonstrated equivalent levels of cognitive growth to better understand and address the factors contributing to possible disparities, since this study only reveals the PSET's perceptions. These findings underscore the need for teacher education programs to offer explicit, targeted support in developing the less robust areas of CTS, particularly through practical, inquiry-driven instructional strategies.

A primary limitation of the present study concerns the number of participants. With a student population of approximately 600, the sample size is relatively small. In addition, only students from the newest cohorts participated; hence, further research should investigate the cognitive development of PSET at higher levels of the degree. Another constraint pertains to the utilization of a sole questionnaire for data collection. To enhance the study's robustness, other data collection techniques could be used, such as conducting interviews with PSET or their instructors.

An additional recommendation for enhancing similar research is to employ other qualitative methods, such as classroom observation, to analyze teachers' implementation activities aimed at fostering HOTS and examining students' responses to these activities. This approach might allow for the exploration of an additional

element that could significantly influence the development of students' cognitive development.

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