

Critical Thinking in a Learner Literary Corpus Thematic Extrapolations in Hemingway's *A Farewell to Arms*

DOI: <https://doi.org/10.33806/ijaes1076>

Victor Khachan and Nahla Nola Bacha
Lebanese American University, Lebanon

Received: 29.3.2025

Accepted: 14.4.2026

Published: 7.6.2026

Abstract: The teaching/learning of English literature to university EFL/ESL students has been essential to the development of their critical thinking skills. Using a corpus linguistics approach, the present study investigates the extent to which learners' critical awareness is apparent through their analysis and interpretations of the characters and themes in the novel, *A Farewell to Arms* (1929), by Ernest Hemingway. A literary learner corpus of 206 literary argumentative essays was compiled from a '20th Century American Novel' course at an English-medium university in Lebanon. The essays were quantitatively analyzed to investigate prevalent thematic trends. This study was able to draw thematic differences between Hemingway's novel and the learners' literary analytic interpretations. The main findings indicated that the learners' collocational networks strongly supported Hemingway's stylistic 'iceberg principle'- a critical thinking-based expectation Hemingway had for his readers. Most importantly, this lexical analysis revealed a clear 'genre' shift from *narration* in Hemingway's *A Farewell to Arms Corpus* to *argumentation* in the Learner Literary Corpus. Overall, this study underscores the importance of literature courses in developing students' critical thinking skills and the role corpus linguistics can play in quantifying 'critical thinking' measures in literature.

Keywords: collocational networks, critical thinking, Hemingway, 'iceberg principle', learner corpus, literature

1. Introduction

The notion of critical thinking skills is not a new concept. As far back as Socrates, Aristotle and Plato, critical thinking was viewed as a reasoning skill in questioning assumptions and beliefs. John Dewey (1933) noted the importance of critical thinking in education and referred to it as 'reflective thinking' as well as "active, persistent, and careful consideration of a belief or supposed form of knowledge in the light of grounds which support it" (p. 9). Critical thinking is highly significant in one's educational and social life, involving a social perspective in which individuals get to understand themselves and the world in which they live (Facione 1990; Cananau 2021). Furthermore, researchers emphasized that critical thinking is also central for the development of good ethical citizens in a democratic society (Barnett 1997; Brodin 2007; Paul and Elder 2019).

Critical thinking is commonly defined as 'meaning construction' through analysis, inference, evaluation, and reflective judgment (Facione 1990; Ennis 2011). The teaching of literature in English as a Foreign Language (EFL) context

requires learners to negotiate ambiguities as part of the interpretive and evaluative process (Rosenblatt 1994; Sharadgah, Sa'di and Ahmad 2019; Alsaleh 2022; Ghosn 2002). Nevertheless, learners' English proficiency and cultural distance can limit their engagement with complex literary texts, leading to superficial interpretations (Hussein and Al-Emami 2016). These challenges, in particular, have made the empirical assessment of critical thinking in learners' literary responses difficult to measure.

Despite the tendency to approach critical thinking as an observable criterion, empirical critical thinking assessment methods, unfortunately, have been lacking (Brookfield 2012; Cananau 2021). In literature courses, learners' analytical abilities are typically evaluated through essays guided by rubrics that emphasize coherence, textual evidence, and argumentative structure. While pedagogically valuable, such assessments are inherently subjective and difficult to standardize (Stapleton 2001) and fail to detect the impact of linguistic limitations on critical thinking (Floyd 2011; Dong and Chang 2023).

However, recent developments in corpus linguistics offer a means of addressing this problem. Corpus-based approaches enable the systematic analysis of learner-produced texts, revealing patterns of language use that extend beyond individual essays or instructor judgment (McEnery and Hardie 2012). Nonetheless, learner corpus research has mainly contributed to the understanding of learner language (i.e., lexico-grammatical features) rather than learners' interpretive meaning construction (i.e., critical thinking) (Granger, Gilquin and Meunier 2015; Li 2021).

As a means towards this end, this study explores major themes in the novel *A Farewell to Arms* (1929) by Ernest Hemingway and compares them with the ones highlighted in a literary learner corpus on the same novel. Notably, *A Farewell to Arms* exemplifies Hemingway's 'iceberg principle', in which much of the thematic and emotional content remains unstated and must be inferred by the reader (Hietanen 2010; Johansson 2015). That is, meaning in the novel emerges through inference and evaluation rather than explicit exposition, making it particularly suitable for examining critical thinking in learners' literary feedback (Hietanen 2010). Accordingly, using a corpus linguistics approach in the form of collocational networks of abstract concepts rather than narrative details (Brezina, McEnery and Wattam 2015; Brezina 2018) can provide a quantitative measure of critical thinking and explain further the nature of learners' critical engagement in literary analysis—a research area that remains understudied. Having said this, the following main question guides this study:

To what extent are the thematic extrapolations showcased in the learners' literary corpus indicative of learners' critical thinking skills?

2. Literature review

2.1 Critical thinking assessment

Assessing critical thinking remains a challenging task for educators and scholars alike, as it is an internal cognitive process not directly observable. Despite these challenges, numerous assessment methods have been developed and used to

measure learners' critical thinking skills in educational settings. The use of rubrics, performance tasks, classroom observations, questionnaires and interviews remain the main tools to assess critical thinking.

One common approach is the use of rubrics and performance tasks to assess learners' literary responses. Rubrics categorize critical thinking according to specific criteria such as interpretation, analysis, inference, and evaluation. Such rubric-based evaluations in literature courses help instructors pinpoint how deeply students are engaging with texts and where their analytical reasoning might be strengthened (Heyck-Williams 2017; Sharadgah, Sa'di and Ahmad 2019; Reynders et al. 2020; Sato 2022). Similarly, standardized testing instruments have also been utilized. A case in point is the *California Critical Thinking Skills Test (CCTST)*-comprising 34 multiple-choice questions on analysis, evaluation, inference, deductive and inductive reasoning (Tung and Chang 2009).

Another approach to assess critical analysis is through questionnaires and interviews. Kobylarek et al. (2022), for instance, designed a questionnaire that asks learners to rate their own critical thinking abilities across levels of Bloom's taxonomy (remembering, understanding, applying, analyzing, evaluating, creating). In the same vein, Widiastuti and Syamsi (2023) measured critical thinking by determining the level of learners' engagement in a self-assessment feedback. As to interviews, Ouhiba (2022) assessed her learner's critical thinking by using semi-structured interviews and classroom observation.

In sum, while methods like rubrics, standardized tests, classroom observations, questionnaires and interviews remain central to critical thinking assessment in literature education, they remain descriptive and mainly qualitative and subjective. Thus, a balanced assessment approach, combining qualitative judgment with quantitative data, could provide an empirical opportunity to measure learners' critical thinking in the literature classroom. Accordingly, this study attempts to extract quantitatively thematic patterns in a learner corpus on *A Farewell to Arms* that may be indicative of a thematic drift from Hemingway's original novel.

2.2 Learner engagement with *A Farewell to Arms*

Text knowledge is crucial in assessing learners' critical thinking. Classroom discussions of *A Farewell to Arms* have engaged learners in philosophical, psychological and political explorations, tackling themes such as existentialism, gender roles, war, trauma, and sexuality (Ilyas 2019; Ibrahim 2025). The depth of triggers in *A Farewell to Arms* is highlighted clearly in Yarbaji (2019) who notes that "Through stark realism and emotional restraint, the novel reflects the deep scars left by war... love, loss, disillusionment, and fate – themes [...] that resonate with timeless questions about human resilience, meaning, and mortality" (p.339).

Hemingway's conscious narrative technique (i.e., iceberg principle) leaves much unsaid, requiring readers to infer deeper meanings beneath the surface details. *A Farewell to Arms* opens the door to a variety of interpretations that depend on readers' own viewpoints, values, and social norms. That is, the novel's narrative gaps prompt readers to be critical thinkers, filling in implications from their

personal and cultural frames of reference (Hietanen 2010; Doshan and Shuo 2014; Johansson 2015). This inherent quality makes *A Farewell to Arms* a compelling literary work to quantitatively assess critical thinking in a learner corpus.

Educators have noted that Hemingway's text *demands* a form of critical readership – students must read between the lines, question the protagonist's perspective, and contemplate ambiguous symbols or endings. As Hietanen (2010) and Doshan and Shuo (2014) have argued, the novel's narrative gaps prompt readers to be critical thinkers, filling in implications from their personal and cultural frames of reference.

Recognizing these pedagogical benefits, instructors around the world have incorporated *A Farewell to Arms* into their teaching and studied how learners respond to it. In her classroom-based study in a Swedish upper-secondary school, Johansson (2015) investigated her learners' critical thinking development through Hemingway's 'iceberg principle'. Students read and discussed selected passages to explore how Hemingway's omissions shape one's understanding of a character.

On a different front, in *Teaching Hemingway's A Farewell to Arms*, Tyler (2008) compiled a collection of essays from instructors reflecting on their experiences with the novel across secondary and post-secondary settings. These practitioners report that Hemingway's work consistently prompts lively classroom dialogue and deep analysis. Tyler's (2008) consensus in this pedagogical reflection on *A Farewell to Arms* was that learners were able to appreciate the novel's subtleties and form their own interpretations. Tyler (2008) concluded that *A Farewell to Arms* has proven to be an open-ended narrative that transforms passive into active readers through interpretation and introspection.

In this context, this study focuses on identifying the main themes in both Hemingway's novel *A Farewell to Arms* and its associated learners' literary essays to explore possible thematic extrapolation that would be indicative of the learners' critical thinking skills.

3. Method

3.1 Corpus selection and compilation

Adopting corpus linguistics as a method of analysis to measure university students' critical thinking ability as conveyed in their undergraduate literary essays, this study used the following 2 corpora: (1) Ernest Hemingway's *A Farewell to Arms* (AFTA hereafter) (88503 words) and (2) *The Learner Literary Corpus* (LLC hereafter) (114345 words). LLC is a compilation of 206 literary essays written in English by L1 Arabic undergraduate students at an English-medium university in Lebanon. The essays are literary analysis essays on Hemingway's novel *A Farewell to Arms*. LLC is part of a larger literary learner corpus from different literature courses at the university. The essay topics focused on the novel's characters and themes and were carried out in the classroom for an hour as part of the regular course tests. It is important to note that a 'thematic' limitation in sample selection may have narrowed the scope of learners' 'thematic' responses. After all, the learner literary corpus was a product of a limited number of prompts on *A Farewell to Arms*. That is, it is very unlikely that the prompts used in class to generate the literary essays

were comprehensive enough to critically frame all possible themes in *A Farewell to Arms*.

3.2 Corpus tools

Corpus linguistics has emerged as a powerful empirical tool that allows researchers to manage large corpora through the use of computational lexical analysis software, bridging qualitative and quantitative analyses to investigate linguistic concepts. Corpus linguistics tools provide clear statistical measures to explore discourse patterns through frequency patterns and collocational networks, bridging language in use and literary analysis (McIntyre and Walker 2019; Hussein and Abdul-Kadhim 2020; Makouar 2020; Čermáková and Mahlberg 2022; Bacha and Khachan 2023). Lately, corpus linguistics has also gained methodological momentum in argumentative writing as an indication of critical thinking (Ab Kadir and Abdul Wahid 2018; Hinton 2021; Tesfie 2023).

This study adopts a corpus-linguistics analytic framework using #LancsBox 5.1.1- a software package for the analysis and visualization of language data and corpora developed at Lancaster University (Brezina et al. 2021). Two #LancsBox tools were used in this study: (1) *Word* and (2) *GraphColl*. As such, the *Word* tool was used to calculate the word frequency ranking in the corpora under study whereas *GraphColl* was used to track the level of thematic extrapolation through the identification and visualization of the most frequent words/themes and their collocates (lexical associations between words in a corpus)- attempting to map thematic networks (Brezina et al. 2021).

4. Data analysis and discussion

A first step towards measuring ‘critical thinking’ was to highlight the degree to which LLC diverges from AFTA. To determine possible thematic drifts between Hemingway’s novel and learners’ interpretation of the novel, word frequency was measured to extrapolate frequent themes in both corpora.

4.1 Word frequency: AFTA

Table 1 shows the 100 most frequent words¹ in AFTA. The decision to adopt the cut-off word frequency of 100 was made to ensure the embedding of the most dealt with themes in AFTA (see Basirat and Nivre 2017). Remarkably, AFTA portrayed a noticeable unusual congregation of personal pronouns (“I” (2nd), “you” (6th), “we” (12th), “he” (13th), “they” (15th), “me” (20th), “she” (28th), ‘my’ (34th), ‘her’ (45th), ‘his (47th) (See Table 1).

Unquestionably, AFTA’s most frequent words revealed the prevalence of personal pronouns. Hence, the systematic presence of personal pronouns within the 28 most frequent words in AFTA is indicative of the ‘narrative’ genre that Hemingway’s novel *A Farewell to Arms* falls under. Interestingly, the high frequency of the pronouns ‘I’, ‘you’, ‘we’, and ‘she’ (2nd, 6th, 12th and 28th, respectively) uncovered proximal relationships displayed by the major characters in *A Farewell to Arms*. These relationships are clearly interwoven by the narrator (‘I’) in a plot that involves heavily another major character (i.e., ‘you’) that turns

out to be a ‘she’ who the narrator is involved with in a way that logically leads to the prominence of the pronoun ‘we’.

Table 1. Prevalence of personal pronouns across the 100 most frequent words in AFTA

Personal Pronouns	Frequency Ranking	Occurrences
The	1 st	6198
I	2 nd	3358
You	6 th	1800
Said	10 th	1225
We	12 th	921
He	13 th	857
They	15 th	667
Me	20 th	610
She	28 th	454
Her	45 th	306
Catherine	49 th	281
Him	58 th	254
Yours	84 th	163

In the same vein, ‘said’ and ‘Catherine’ came as the 10th and 49th most frequent words in AFTA, respectively. This strikingly peculiar high frequency of ‘said’ can be explained as a genre-based characteristic in AFTA. The occurrences of ‘said’ (1225 times) imply the interactive and engaging nature of the plot in *A Farewell to Arms*, where Hemingway allows his characters to voice their opinions and emotions as well as feelings. As to ‘Catherine’, its relatively high frequency (49th; 281 occurrences) suggests clearly the unique role Catherine plays in *A Farewell to Arms*. Despite Catherine’s frequency prominence, her role in the novel remains secondary/complimentary to the narrator’s. That is, the personal pronoun ‘I’ (2nd most frequent; 3358 occurrences) was mostly a representation of the narrator’s role/intervention (as protagonist) in the story and its centrality in the evolution of the plot in *A Farewell to Arms*.

4.2 Word frequency: LLC

Moving to the Learner Literary Corpus (LLC) word frequency, Table 2 indicates a clear drift from AFTA’s dominance of pronouns. In contrast, words such as ‘Henry’, ‘Catherine’, ‘war’, and ‘love’ occupied high frequency positions in the top 20 most frequent wordlist. LLC’s 100 most frequent words also displayed ‘life’ (28th), ‘Rinaldi (33rd)’, ‘death’ (64th), and most notably, ‘hope’ (76th), ‘Fredrick’ (98th), and ‘escape’ (100th).

Table 2. Most frequent 'thematic' words in LLC

Word	Frequency ranking	Occurrences
He	7 th	2599
Henry	10 th	1817
His	11 th	1684
Her	12 th	1474
Catherine	14 th	1337
War	15 th	1313
She	16 th	1270
Love	17 th	1246
Him	23 rd	819
Life	28 th	541
Rinaldi	33 rd	512
They	37 th	417
Their	42 nd	370
I	45 th	297
You	47 th	276
We	53 rd	268
Death	64 th	246
Hope	76 th	212
Them	97 th	178
Escape	100 th	175

In comparison to AFTA, LLC portrayed different frequency patterns of the 100 most frequent words. The absence of pronoun dominance is an aspect of this difference between AFTA and LLC. The absence of 'I', 'you', and 'we' from the top 12 most frequent word list and their substitution with 'he', 'his', 'her' and 'she' (7th, 11th, 12th and 16th, respectively) in LLC indicates a clear 'genre' shift- from 'narrative' to 'argumentation'. This shift in the prevalence of pronouns from 1st personal to 3rd personal pronouns signaled discourse divergence. In contrast to AFTA, students' use of 3rd personal pronouns in LLC was in reference to the characters in the novel they were discussing/interpreting. In other words, 3rd personal pronouns in LLC were used within an argumentative framework to elaborate on the students' perception of the characters in *A Farewell to Arms*. As to the relatively high frequency of 'I' (45th; 297 occurrences) and 'you' (47th; 276 occurrences) in LCC, this high frequency was due to the students' preference to use 'direct quotations' from *A Farewell to Arms* (mainly in relation to the use of 'you'). On the other hand, 'I' was only a path for students to express their personal opinions as in the following examples: "I believe that...." and "I think that...."

The 100 most frequent word list in LLC highlighted the dominance of 'thematic' words such as 'life' (28th), 'death' (64th), 'hope' (76th) and 'escape' (100th), a major shift from AFTA. Apparently, students interpreted the novel in ways that foregrounded thematic possibilities infrequent in AFTA. Markedly, it can

be assumed that the students' interpretations of *A Farewell to Arms* did, in fact, fulfil Hemingway's 'iceberg principle'.

Overall, determining the patterns of the 100 most frequent words in AFTA and LLC listed above was an important step to frame a possible list of words that could have 'thematic' weight (i.e., conceptual significance). While word frequency measures establish which words are salient and recurrent, they do not capture how these frequent words are textually related. Collocational network analysis, by contrast, foregrounds patterns of co-selection, revealing how words cluster together to construct thematic meaning across contexts. In the following section, we lay out the collocational relationships of the selected most frequent words in both AFTA and LLC.

4.3 Collocational networks in AFTA

As we have already established the prevalence of pronoun frequency in AFTA, it is essential now to look into their collocational networks to validate their 'narrative' functional nature and to gain more insights into their 'thematic' potential. Using *#LancsBox GraphColl* tool (Brezina et al. 2021), the 10 strongest² collocates of the pronouns topping the 100 most frequent word list in AFTA were calculated (see Table 3).

To measure the strength of the collocates, the *Cubic Mutual Information* (MI3) statistical measure was used. It is important to note that MI3 was adopted due to its 'sensitivity' to *frequent yet exclusive* collocations, a situation that fits well the high frequency of pronouns in AFTA (Brezina 2018).

Noticeably, the collocational relationships highlighted in Table 3 consolidated the importance of pronouns in storytelling (i.e., narrative). The pronouns' strongest collocates meshed well-defined relationships between the characters and their role in weaving the interactive nature of storytelling (Okamura 2009). The involvement of the author as narrator was noticeable in all the pronouns' collocational networks (see Table 3). To illustrate, the personal pronoun 'I' collocated strongly with all pronouns, underlining that the narrator (author and protagonist) is at the center of events from beginning to end. This collocational relationship between the personal pronoun 'I' and the other most frequent pronouns³ in AFTA led to a deeper understanding of Hemingway's character conceptualization. It is clear that Hemingway emphasized his centrality as author (narrator and protagonist) in relation to all other characters in the novel- by employing the 'oblique first-person narration' (Owens-Murphy 2009).

In reference to the 'said' collocates, 'I' (collocational frequency: 842; stats: 23.59) was 2.7 times that of the 3rd and 4th strongest collocates 'he' (collocational frequency: 312; stats: 21.26) and 'you' (collocational frequency: 339⁴; stats: 20.55), and approximately 6 folds that of 'Catherine' (collocational frequency: 136; stats: 19.28) and 'she' (collocational frequency: 156 times; stats: 19.18). The statistical strength of the collocate 'I' with the node 'said' in comparison with all other collocates, was indicative of not only the centrality of the 'I' (narrator, author and protagonist) but also its conversational 'supremacy' in *A Farewell to Arms*. The

collocational mapping of ‘said’ was valuable in clarifying who, among the characters, was the most vocal.

Table 3. The strongest collocates of the pronouns topping the 100 most frequent word list in AFTA

Word	Frequency ranking	Collocational Strength ⁵
I	2 nd	The; 2- said; 3- to; 4- and; 5- you; 6- it; 7- was; 8- a; 9- don’t; 10- not
You	6 th	I ; 2- to; 3- do; 4- are; 5- said; 6- the; 7- don’t; 8- will; 9- me; 10- want
Said	10 th	1- I ; 2- the; 3- he; 4- you; 5- to; 6- Catherine; 7- she; 8- a; 9- it; 10- go
We	12 th	the; 2- and; 3- were; 4- to; 5- in; 6- a; 7- said; 8- I ; 9- went; 10- could
He	13 th	said; 2- the; 3- was; 4- his; 5- I ; 6- a; 7- and; 8- to; 9- you; 10- me
They	15 th	The; 2- were; 3- and; 4- to; 5- said; 6- are; 7- me; 8- I ; 9- if; 10- in
me	20 th	you; 2- to; 3- I ; 4- tell; 5- the; 6- and; 7- he; 8- give; 9- they; 10- it
she	28 th	1-said; 2- her; 3- die; 4- and; 5- was; 6- the; 7- I ; 8- to; 9- me; 10- a
My	34 th	1-and; 2- I ; 3- the; 4- hand; 5- in; 6- on; 7- put; 8- with; 9- took; 10- to
Her	45 th	1-and; 2- I ; 3- she; 4- kissed; 5- hair; 6- the; 7- hand; 8- face; 9- please; 10- to
His	47 th	1-he; 2- and; 3- the; 4- head; 5- face; 6- shook; 7- was; 8- with; 9- I ; 10- cap
Catherine	49 th	1- said; 2- I ; 3- the; 4- and; 5- to; 6- was; 7- she; 8- a; 9- it; 10- very
Him	58 th	I ; 2- the- 3- he; 4- and; 5- to; 6- you; 7- at; 8- with; 9- told; 10- said
Your	84 th	1-you; 2- friend; 3- take; 4- I ; 5- to; 6- and; 7- your- 8- leg; 9- is; 10- head

Turning to the collocational network for ‘Catherine’, its strongest collocate was ‘said’ (collocational frequency: 136; stats: 19.29) whereas its 2nd strongest collocate was ‘I’ (collocational frequency 118 times; stats: 17.22). In the 7th places came ‘she’ (37; stats: 15.09). Needless to say, ‘Catherine’ is a major character that *A Farewell to Arms* is centered on. In addition, Catherine’s 2nd strongest correlate ‘I’ pointed out to the possibility that Hemingway opted to give Catherine an interactive role, a leeway to speak her mind, or most probably a channel for him to speak through her. All in all, the collocational networks for both ‘said’ and

‘Catherine’ were in favor of portraying Catherine as an outspoken character in *A Farewell to Arms*, an observation that did not align completely with Lockridge’s (2013) conclusion that Catherine was “the most brilliant single embodiment of Hemingway’s narrative technique of omission” (p. 177).

4.4 Collocational networks in LLC

In the previous section, the collocational networks in AFTA indicated clearly Hemingway’s dual presence as narrator and protagonist. Evidently, these results consolidated the dominance of pronouns frequency discussed in section 4.1. In contrast, the collocational networks for the 100 most frequent words in LLC, using the *Cubic Mutual Information* (MI3) statistical measure did not imply any thematically-loaded collocates. Table 4 highlights this absence of a strong thematic potential as an indication of learners’ critical thinking.

Table 4. Words topping the 100 most frequent word list in LLC, using MI3 calculations

Word	Frequency ranking and Occurrences	Collocational Strength
Henry	10 th ; 1817	1-the; 2- and; 3- to; 4- of; 5- in; 6- Catherine; 7- is; 8- that; 9- a; 10- she
Catherine	14 th ; 1337	1-and; 2- the; 3- to; 4- Henry; 5- Barkley; 6- he; 7- in; 8- love; 9- is; 10- of
Rinaldi	33 rd ; 512	1-the; 2-and; 3-is; 4-a; 5-to; 6-of; 7-in; 8-Henry; 9-his; 10-was
War	15 th ; 1313	1- the; 2- of; 3- and; 4- to; 5- in; 6- is; 7- he; 8- a; 9- his; 10- that
Love	17 th ; 1246	1-and; 2- the; 3- in; 4- of; 5- to; 6- Catherine; 7- is; 8- Henry; 9- with; 10- his
Life	28 th ; 541	1-of; 2- in; 3- a; 4- and; 5- the; 6- his; 7- to; 8- is; 9-that; 10- he;
Death	64 th ; 246	1-the; 2-of; 3-and; 4-her; 5-in; 6-after; 7- was; 8-to; 9-is; 10- he
Hope	76 th ; 212	1-is; 2-there; 3-and; 4-in; 5-of; 6-the; 7- life; 8-that; 9-to; 10-no
Escape	100 th ; 175	1-Reality; 2- from; 3-to; 4-and; 5-the; 6- an; 7-war; 8-only; 9- of; 10- way

Hoping to target possibly stronger collocational relationships in LLC, it was important to shed light on the *exclusivity yet infrequency* of the collocates. Thus, the shift from the *Cubic Mutual Information* (MI3) to the *Mutual Information* (MI) statistical measure was warranted (Brezina 2018). In this context, to investigate possible thematic extrapolations in the learner corpus, the high frequency thematic words occurred in LLC, namely ‘war’, ‘love’, ‘life’, ‘death’, ‘hope’, and ‘escape’ were discussed (see Table 2).

Table 5. The collocates for ‘war’, ‘love’, ‘life’, ‘death’, ‘hope’ and ‘escape’, using MI statistical measure

Word	Collocational Strength (MI scores above 5)
War (MI)	1-territory; 2- rationality; 3- evil; 4- outlook; 5- horrors; 6- illustration; 7- involvement; 8- drop; 9- enter; 10- amidst; entered; atrocities; survive; toll; brutality; managed; necessary; joined; let’s; chaos; devastation; dropped; concerning; dangerous; effects; killing; seriousness; concept; cope; am; movies; differently; figure; viewed; volunteered; during; its period; inevitable; Italy; whereas; middle; represented; effect; theme; affected; world; worse; view; realized; wound; destruction; henry; soldier
Love (MI)	1-declares; 2- fell; 3- fall; 4- falls; 5- pure; 6- falling; 7- grew; 8- nor; 9- superficial; 10- pretend; 11- lust; 12- honest; 13- don’t; 14- truth; 15- affair; 16- true; 17- illness; 18- claimed; 19- starting; 20- based; 21- additionally; 22- henry; 23- aspect; 24- real; 25- perception; 26- seriously; 27- claims; 28- lie; 29- between; 30- deeply; 31- peace; 32- believing; 33- ms.; 34- attitude; 35- argue
Life (MI)	1-risks; 2-daily; 3-general; 4-strange; 5- full; 6-pleasures; 7- value; 8- personal; 9- ended; 10-meaning; better; enjoy; new; your; fighting; uses; hope; part; view; why; order; meaningless; itself; experience; simple; showed
Death (MI)	1-blood; 2-foreshadowing; 3- witnessing; 4- escaping; 5- bed; 6- till; 7- symbol; 8- stop; 9- fear; 10- tragic; ends; rain; lover; fiancé; after; loss; due; such; doesn’t
Hope (MI)	1-window; 2- create; 3- topic; 4- symbol; 5- lies; 6- there; 7- better; 8- give; 9- within; 10- meaningless; lose; light; found; ones; new; no; little; strong; hope; find; life; lost; any
Escape (MI)	1-Reality; 2-destiny; 3-tragedy; 4-tries; 5-superficial; 6-trying; 7- from; 8-order; 9-cannot; 10-Switzerland; Rinaldi’s; an; only; way; together; them; were; there

The strongest collocates mapped for the learners’ thematic extrapolations in Table 5 pinpointed to a meaningful thematic transformation. Table 5 highlighted a thematic framework related to each of the themes and implied the learners’ ‘critical thinking’ abilities and capabilities. The number of the strongest collocates is not the same for all themes. MI scores of 3 and above could be considered as a ‘significant’ strength threshold for collocates (Hunston 2002 cited in Baker 2016). For a more comprehensive thematic extraction, this study adopted a MI score of 5 as its ‘significant’ strength threshold. Table 5 displayed the collocates for ‘war’, ‘love’, ‘life’, ‘death’, ‘hope’ and ‘escape’, using MI statistical measure.

In the case of ‘war’, in contrast to the MI3-calculated collocational networks, the MI-based calculations led to a network of strong collocates portraying ‘war’ as ‘evil’ and a messenger of ‘horrors’, ‘brutality’, ‘atrocities’, ‘killing’, ‘chaos’ and ‘devastation’. Again, this finding reinforces Hemingway’s iceberg principle and the learners’ ability to think critically through employing reading and inferential skills (Hakes 2008). Learners were able to open a window into Hemingway’s literal messages in relation to the real world (McNaught and Lam 2014; Hussein and

Abdul-kadhim 2020; Masood, Shafi and Darwesh 2020). To illustrate further, Figure 1 provides a visual representation of the MI collocational network for 'war'.

Figure 1 indicated the collocational strength⁶, expressed in terms of the length of the line between the network collocates. In a way, the shorter the line between the center of the figure (here war) and its network collocates is, the stronger the collocational relationship will be. The visual representations of the collocational networks for the themes in LLC were calibrated with the collocates of MI scores of 5 and above (as reported in Table 5). Noticeably, the 'war' collocates exposed the learners' thematic extrapolation in ways that conceptually defined war beyond Hemingway's description in *A Farewell to Arms*.

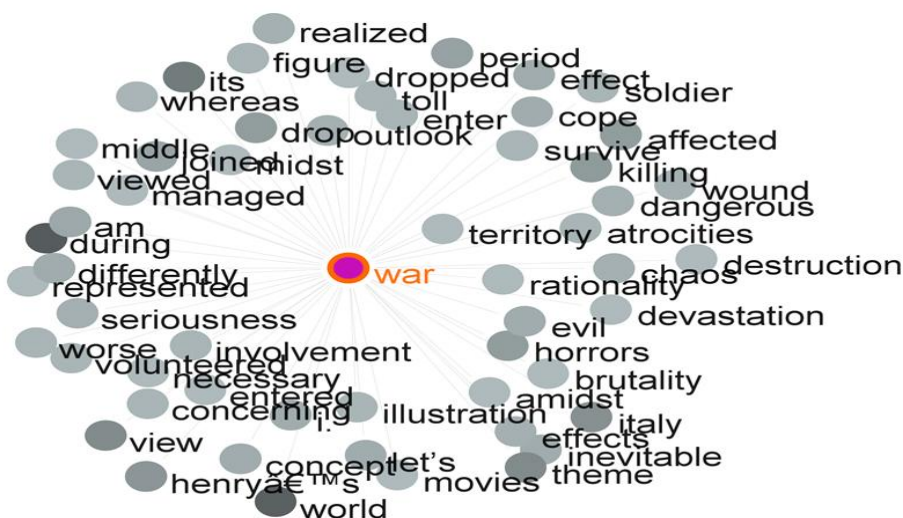


Figure 1. Visual mapping of the 'war' collocates in LLC- as produced by *GraphColl* in *LancsBox* (Brezina et al. 2021)

Figure 2 mapped visually the 35 strongest collocates for 'love' (MI scores 5 and above). This visual representation showed that students' perception of 'love' as interpreted in *A Farewell to Arms* involved a variety of quality ranging from 'true', 'pure', 'real' and 'honest' to 'superficial', 'lust[ful]', and 'lie'.

On the other hand, ‘death’ was associated with ‘foreshadowing’, ‘witnessing’, ‘fear’, ‘loss’, ‘tragic’, ‘blood’, ‘bed’, ‘lover’ and ‘escaping’ (see Figure 4).

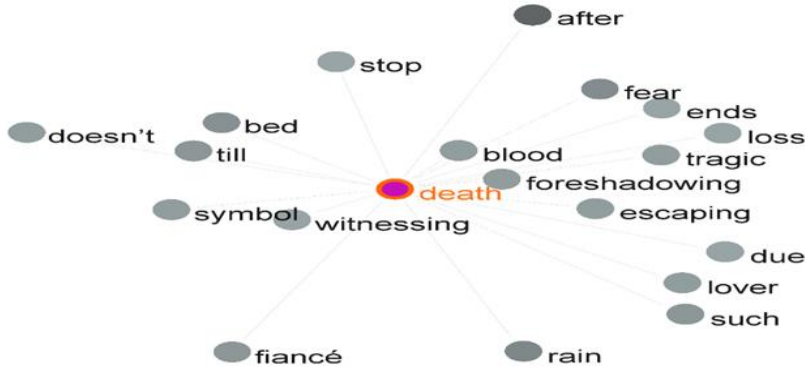


Figure 4. Visual mapping of the ‘death’ collocates in LLC- as produced by *GraphColl* in *LancsBox* (Brezina et al. 2021)

In fact, the collocational network for ‘death’ did not extract thematic possibilities, in contrast to ‘war’, ‘love’ and ‘life’ (see Figures 1-3). Apart from the 2nd strongest collocate ‘foreshadowing’, the aggregation of the ‘death’ collocates presented a rather more ‘descriptive’ insight into the novel than a ‘critical’ interpretation. ‘Blood’, ‘lover’, ‘loss’, and ‘fiancé’ were more like reminders of the narrative in *A Farewell to Arms*.

Similarly, ‘hope’ collocates did not map a clear thematic extrapolation (see Figure 5). Still, one strong collocate of ‘hope’ is ‘life’- as already discussed under ‘life’ (see Figure 3). Interestingly, across all the themes highlighted in Table 5, ‘hope’ and ‘life’ are the only two themes that collocate strongly.



Figure 5. Visual mapping of the ‘hope’ collocates in LLC- as produced by *GraphColl* tool in *LancsBox* (Brezina et al. 2021)

To explore further this collocational relationship between ‘life’ and ‘hope’, a 2nd order as coined in Berzina (2018) network for ‘life’ and ‘hope’ was mapped (see Figure 6).



Figure 6. 2nd order visual collocational network for ‘life’ and ‘hope’, as produced by *GraphColl* in *LancsBox* (Brezina et al. 2021)

A remarkable shared collocate between ‘life’ and ‘hope’ was ‘give’. Learners’ ability to draw this connection between ‘life’ and ‘hope’ underlined a ‘critical thinking’ approach. Whether ‘life’ gives ‘hope’ or ‘hope’ gives [‘meaning’] to ‘life’ is a clear analytic inference that the learners made from reading *A Farewell to Arms*. On another note, the shared collocational relationship between ‘life’ and ‘hope’ elevates Hemingway’s trust in the readers’ interpretations of his novels to a new level.

Last but not least, the ‘escape’ collocates imply a possible thematic extrapolation as shown in Figure 7. The meshing of ‘escape’ collocates exposed an interpretation of ‘escape’ as a theme along a continuum of (1) ‘reality’ and ‘superficial[ity]’, and (2) ‘destiny’ and ‘tragedy’.



Figure 7. Visual mapping of the ‘escape’ collocates in LLC- as produced by *GraphColl* in *LancsBox* (Brezina et al. 2021)

Learners in LLC were able to prove again their ability to think critically and to push the thematic envelope set by Hemingway to a level that fused ‘destiny’ and ‘reality’ in both *A Farewell to Arms* and the learners’ socio-cultural experiences, fermented in values and norms.

4. Conclusion

The corpus linguistics approach that this study adopted is an attempt to offer an alternative to the qualitative (e.g., descriptive) approaches that ‘literature’ instructors resort to while assessing the relevance of their courses in the development of the learners’ ‘critical thinking’ abilities and performance. Despite its quantitative framework, this study leads to trends of thematic extrapolations the learners extracted from their reading of *A Farewell to Arms*. The lexical analysis of the *Learner Literary Corpus* (LLC) vis-à-vis the *A Farewell to Arms Corpus* (AFTA) reveals a clear ‘genre’ shift from ‘narration’ to ‘argumentation’. The transformation of personal pronouns prominence in AFTA to real characters (e.g., Henry and Catherine) in LLC was one dimension of this genre transition. That is, the 100 most frequent words in LLC engaged a set of themes ranging from love, war and life to death and hope- transcending the prevalence of pronouns in AFTA.

Adding to its word frequency findings, this study’s reliance on the collocational relationships of the learners’ extracted themes have exposed another layer of ‘critical analysis’. It is safe to say here that the statistical measures involved to expose the collocational relationships of frequent themes were by no means to be approximated using descriptive/qualitative approaches (i.e., intuitive approaches). In fact, collocational mapping is achieved through “rigorous inferential statistical” measures to determine the collocational relationships in discourse (Brezina, McEnery and Wattam 2015; Xiao 2015: 108) - a lexical possibility that is only made possible with the advance of computational technology.

In addition to its measured ‘critical thinking’ findings, this study provides ample support in favor of Hemingway’s ‘iceberg principle’. The collocational networks for the most frequent words (i.e., themes) in LLC expose the learners’ ability to interpret *A Farewell to Arms* in thematic dimensions that were suspected to be drawn by Hemingway (as in the case of the 2nd order collocational network for ‘hope’ and ‘life’).

Nevertheless, the context of this study limits the generalization of its findings. One obvious limitation is the size of the LLC corpus (206 essays; 114345 words). Despite the ‘meaningful’ and ‘significant’ collocational networks that were extracted from LLC, it would be essential to replicate this investigation using larger corpora- compiled from larger bodies of learners at different universities in Lebanon. For the same reason, it would be interesting to conduct similar studies in other countries in the region to have a clearer insight into the effects of socio-cultural norms on ‘critical thinking’ thematic extrapolation in literary analysis. On the pedagogical level, this study did not investigate the impact of teaching on the manifestation of ‘critical thinking’ abilities of the learners. That is, this study did

not look into the extent to which teaching had influenced the learners' 'critical thinking' analysis. The instructor's interpretation input dealt with the themes of love and war, but to what degree her/his input matched the learners' analysis remained unanswered.

Although these limitations impacted the generalization of the findings in this study, this study provides a solid quantitative platform to investigate lexical relationships in discourse in order to measure learners' 'critical thinking' performance. Accordingly, more studies across different study fields in Humanities and Social Sciences are encouraged to use the tested methodology in this study. Reaching a confidence level of measuring learners' 'critical thinking' as expressed in their writing has been undoubtedly a tedious task for instructors worldwide. Thus, this study adds a quantitative weight to the significance of literature courses in the development of the learner's 'critical thinking' scope and abilities.

Acknowledgements: The authors thank the editors and reviewers who gave informative feedback and dedicated valuable time to reviewing our manuscript.

Endnotes

¹ Tens of ‘function’ and ‘content’ words such as ‘the’ (1st; 6198 occurrences), ‘was’ (7th; 1450 occurrences), ‘that’ (18th; 644 occurrences), ‘went’ (37th; 375 occurrences), ‘asked’ (91st; 152 occurrences), and ‘other’ (97th; 144 occurrences) were dropped off the 100 most frequent word list in AFTA due to the lack of conceptual potential/weak ‘thematic’ weight.

² The decision to select the 10 strongest correlates was made to ensure that the collocates have high statistical strength (i.e., effect size)- the higher the score, the stronger the collocational relationship. By default, the 10 strongest collocates enjoy the highest statistical scores of all collocates. This statistical measure is not a hypothesis-testing measure with a *p* value (Baker 2016; Brezina 2018).

³ Happened to be topping the list of the 100 most frequent words in AFTA.

⁴ Though ‘you’ had a higher collocate frequency than ‘he’, the overall frequency of ‘you’ and ‘he’ (1800 and 857 times, respectively) impacted the statistical weight of the collocate ‘you’ (21.26) and made weaker than the collocate ‘he’ (20.55).

⁵ The words listed under ‘collocational strength’ are limited here to the 10 strongest collocates of the node word calculated using MI3- a measure that is more sensitive to frequent yet exclusive collocations (Brezina 2018). The strongest the collocate is, the higher its statistical collocational strength with the node will be.

⁶ As explained by Brezina et al. (2015), “the strength of collocation is indicated by the distance (length of line) between the node and the collocates. The closer the collocate is to the node, the stronger the association between the node and the collocate (‘magnet effect’)” (p. 22).

Victor Khachan (Associate Professor)- Corresponding Author
Lebanese American University, Lebanon
ORCID Number: 0000-0003-3636-8459
Email: vkhachan@lau.edu.lb

Nahla Nola Bacha (Professor)
Lebanese American University, Lebanon
ORCID Number: 0000-0002-1083-2818
Email: nbacha@lau.edu.lb

References

- Ab Kadir, Akshir M. and Mohd R. Abdul Wahid.** (2018). 'More than words: A corpus-based analysis of educators' conceptualisations of critical thinking'. *International Conference on Language, Culture and Society*, Kuala Lumpur, Malaysia.
- Ahmad, Hamdi.** (2019). 'Developing EFL learners' critical thinking through argumentative writing'. *Arab World English Journal*, 10(3): 45–60.
- Alsaleh, Nada J.** (2020). 'Teaching critical thinking skills: Literature review'. *The Turkish Online Journal of Educational Technology*, 19(1): 21-41.
- Bacha, Nahla N. and Victor Khachan.** (2023). 'A corpus-based lexical evaluation of L1 Arabic learners' English literary essays'. *International Journal of Arabic-English Studies*, 23(2): 415-442.
- Baker, Paul.** (2016). 'The shapes of collocations.' *International Journal of Corpus Linguistics*, 21: 139–164.
- Barnett, Ronald.** (1997). *Higher Education: A Critical Business*. Buckingham: SHRE and Open University Press.
- Basirat, Ali and Joakim Nivre.** (2017). 'Real-valued syntactic word vectors (RSV) for greedy neural dependency parsing.' In Joerg Tiedemann and Nina Tahmasebi (eds.), *Proceedings of the 21st Nordic Conference on Computational Linguistics*, 20–28. Gothenburg: Association for Computational Linguistics.
- Brezina, Vaclav.** (2018). *Statistics in Corpus Linguistics: A Practical Guide*. Cambridge: Cambridge University Press.
- Brezina, Vaclav, Matthew Timperley and Tony McEnery.** (2018). #LancsBox v.4.x [software package].
- Brezina, Vaclav, Peter Weill-Tessier and Tony McEnery.** (2021). #LancsBox v.6.x [software package].
- Brezina, Vaclav, Tony McEnery and Stephen Wattam.** (2015). 'Collocations in context: A new perspective on collocation networks'. *International Journal of Corpus Linguistics*, 20(2): 139-173.
- Brodin, Eva.** (2007) Critical thinking in scholarship: Meanings, conditions and development. Unpublished PhD Thesis, Lund University, Sweden.
- Brookfield, Stephen.** (2012). *Teaching for Critical Thinking: Tools and Techniques to Help Students Question their Assumptions*. San Francisco: Jossey-Bass.
- Cananau, Iulian.** (2021). 'Critical thinking and English literature in higher education: The theoretical models and the Swedish syllabi'. *Nordic Journal of English Studies*, 20(2): 99–128.
- Čermáková, Anna and Michaela Mahlberg.** (2022). 'Gendered body language in children's literature over time'. *Language and Literature*, 31: 11-40.
- Daoshan, Ma and Shuo Zhang.** (2014). 'A discourse study of the iceberg principle in *A Farewell to Arms*'. *Studies in Literature and Language*, 8(1): 80-84.
- Dewey, John.** (1933). *How We Think*. Boston: D. C. Heath.

- Dong, Yanning and Xin Chang.** (2023). 'Investigating EFL writers' critical thinking performance across languages'. *Thinking Skills and Creativity* 47 (4): 101232.
- Durrant, Philip and Alice Doherty.** (2010). 'Are high-frequency collocations psychologically real?' *Corpus Linguistics and Linguistic Theory* 6(2): 125-155.
- Ennis, Robert H.** (2011). 'The nature of critical thinking: An outline of critical thinking dispositions and abilities'. In Robert Sternberg and Li-Fang Zhang (eds.), *Perspectives on thinking, learning, and cognitive styles*, 1-26. New York: Routledge.
- Facione, Peter.** (1990). *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction (The Delphi Report)*. Millbrae, CA: California Academic Press.
- Floyd, Catherine B.** (2011). 'Critical thinking in EFL: Developing critical thinking in academic writing'. *ELT Journal*, 65(4): 465-474.
- Ghosn, Irma K.** (2002). 'Four good reasons to use literature in primary school ELT'. *ELT Journal*, 56 (2): 172-179.
- Granger, Sylviane, Gaëtanelle Gilquin and Fanny Meunier.** (2015). *The Cambridge Handbook of Learner Corpus Research*. Cambridge: Cambridge University Press.
- Hakes, Belinda.** (2008). *When Critical Thinking Met English Literature*. Oxford: Howtobooks.
- Hayes, William H.** (1990). Critical thinking through literature: A dialogue teaching model. Unpublished MA Thesis, University of Massachusetts, Boston.
- Hemingway, Ernest.** (1929). *A Farewell to Arms*. London: Penguin.
- Heyck-Williams, Jeff.** (2017). 'Teaching, measuring and assessing critical thinking skills'. *Next Generation Learning Challenges*. Retrieved from: <https://www.nextgenlearning.org/articles/yes-we-can-define-teach-and-assess-critical-thinking-skills>
- Hietanen, Minna.** (2010). 'Meaning, empathy and the iceberg: Reader inference in Hemingway's fiction'. *Journal of Literary Semantics*, 39(1): 27-43.
- Hinton, Matthew.** (2021). 'Corpus linguistics methods in the study of (meta)argumentation'. *Argumentation*, 35: 435-455.
- Hunston, Susan.** (2002). *Corpora in Applied Linguistics*. Cambridge: Cambridge University Press.
- Hussein, Elham and Aida Al-Emami.** (2016). 'Challenges to teaching English literature at the University of Hail'. *Arab World English Journal*, 7(4): 125-138.
- Hussein, Khalid and Ina'am Abdul-Kadhim.** (2020). 'A corpus-based stylistic identification of lexical density'. *International Journal of Psychosocial Rehabilitation*, 24(1): 6688-6702.
- Ibrahim, Mariam.** (2025). 'Teaching war, trauma and gender in Hemingway's *A Farewell to Arms*'. *Journal of Literary Education*, 8(1): 55-73.
- Ilyas, Mohammed.** (2019). 'Teaching trauma and war narratives in Hemingway'. *Journal of Literary Studies*, 35(2): 91-109.

- Johansson, Maria.** (2015). The iceberg technique in Hemingway's *A Farewell to Arms*: How it affects the character of Catherine Berkley. Unpublished BA Thesis, Halmstad University, Sweden.
- Kobylarek, Aleksander, Kamil Błaszczński, Luba Ślósarz and Martyna Madej.** (2022). 'Critical thinking questionnaire (CThQ)'. *Andragogy Adult Education and Social Marketing*, 2(2): 1-12.
<https://doi.org/10.15503/andr2022.1>
- Li, Mimi.** (2021). *Researching and Teaching Second Language Writing in the Digital Age*. Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-030-87710-1_8
- Lockridge, Ernest H.** (2013). *Keys to Hemingway*. California: CreateSpace Independent Publishing Platform.
- Makouar, Nadia.** (2020). 'Corpus linguistics and critical reading and thinking: Proposals for teaching learning sequences based on journalistic corpora in Modern Standard Arabic'. In Mohammad Alhawary (ed.), *Routledge Handbook of Arabic Second Language Acquisition*, 225-248. London: Routledge.
- Masood, Muhammad H., Shahzeb Shafi and Maqsood Darwesh.** (2020). 'Study of Shakespearean themes and characters through corpus based Voyant tools approach'. *National Conference on Education (NCE)*. National University of Modern Languages, Islamabad.
- McEnery, Tony and Andrew Hardie.** (2012). *Corpus Linguistics: Method, Theory and Practice*. Cambridge: Cambridge University Press.
- McIntyre, Dan and Brian Walker.** (2019). *Corpus Stylistics*. Edinburgh: Edinburgh University Press.
- McNaught, Carmel and Paul Lam.** (2014). 'Using Wordle as a supplementary research tool'. *The Qualitative Report*, 15(3): 630-643.
- Okamura, Akiko.** (2009). 'Use of personal pronouns in two types of monologic academic speech'. *The Economic Journal of Takasaki City University of Economics*, 52(1): 17-26
- Owens-Murphy, Katie.** (2009). 'Hemingway's pragmatism: Truth, utility, and concrete particulars in *A Farewell to Arms*'. *The Hemingway Review*, 29(1): 87-102.
- Ouhiba, Salma.** (2022). 'Investigating EFL learners' critical thinking through classroom interaction and interviews'. *International Journal of Instruction*, 15(2): 413-430.
- Paul, Richard and Linda Elder.** (2019). *The Miniature Guide to Critical Thinking: Concepts and Tools*. Maryland: Rowman and Littlefield.
- Reynders, Gil, Juliette Lantz, Suzanne Ruder, Courtney Stanford and Renée Cole.** (2020). 'Rubrics to assess critical thinking'. *International Journal of STEM Education*, 7(9): 1-15. <https://doi.org/10.1186/s40594-020-00208-5>
- Rosenblatt, Louise M.** (1994). *The Reader, the Text, the Poem: The Transactional Theory of the Literary Work*. Carbondale: Southern Illinois University Press.

- Sato, Takanori.** (2022). 'Assessing critical thinking through L2 argumentative essays: An investigation of relevant and salient criteria from raters' perspectives'. *Language Testing in Asia*, 12(9): 1-19. <https://doi.org/10.1186/s40468-022-00159-4>
- Sharadgah, Talha, Rami Sa'di and Hamdi Ahmad.** (2019). 'Promoting and assessing EFL students' critical thinking'. *Arab World English Journal*, 10 (4): 133-150.
- Stapleton, Paul.** (2001). 'Assessing critical thinking in the writing of Japanese university students'. *Written Communication*, 18(4): 506-548.
- Tesfie, Amare.** (2023). 'Effects of corpus-based instruction on students' critical thinking'. *The JALT CALL Journal*, 19(2): 197-215.
- Tung, Chi-An and Shu-Ying Chang.** (2009). 'Developing critical thinking through literature reading'. *Feng Chia Journal of Humanities and Social Sciences*, 19(1): 287-317.
- Tyler, Lisa.** (2008). *Teaching Hemingway's A Farewell to Arms*. Ohio: Kent State University Press.
- Widiastuti, Ni Kadek and Vera Syamsi.** (2023). 'Integrating literary works in an English class to improve students' critical thinking'. *Proceedings of the 20th AsiaTEFL-68th TEFLIN-5th iNELTAL Conference (ASIA TEFL 2022)*, 478-488.
- Xiao, Richard.** (2015). 'Collocation'. In Douglas Biber and Randi Reppen (eds.), *The Cambridge Handbook of English Corpus Linguistics*, 106-124. Cambridge: Cambridge University Press.
- Yarbagi, Nour.** (2019). 'War, love, and existential disillusionment in Hemingway's *A Farewell to Arms*'. *International Journal of English and Literature*, 10(3): 334-342.