

Analyzing Sentiment and Syntactic Complexity in L2 Writing: A Computational Approach

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Received: 26 May 2024
Revised: 30 May 2024
Accepted: 31 May 2024

Jung, YeonJoo. (2024). Analyzing sentiment and syntactic complexity in L2 writing: A computational approach. *Modern English Education*, 25, 143-154.

Keywords

Korean EFL student, sentiment analysis, syntactic complexity, TAASSC
한국인 영어학습자, 감정 분석, 통사적 복잡성, TAASSC

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* This work was supported by a Junior Faculty Support Program of Pusan National University.

Abstract

This study investigated the effect of sentiment in second language (L2) writing prompts on the syntactic complexity and emotionality in essays written by English as a Foreign Language (EFL) learners. The research analyzed a dataset of 1,004 essays written by Korean adolescent students to examine the relationship between the sentiment scores of writing prompts and learner essays. The study used computational tools to measure various dimensions of syntactic complexity. The findings indicated that the sentiment of writing prompts is a significant predictor of the emotionality scores of L2 students' essays. The positive correlation suggested that more positive prompts are more likely to elicit overall more positive essays. Additionally, the study identified significant differences in baseline sentiment values between writing prompts and learner essays. Even when responding to highly negative prompts, L2 students tended to use neutral sentiment in their essays. This study demonstrated how emotional prompts can impact cognitive load, resulting in simpler syntactic structures. It also highlighted the potential risks in educational assessment due to construct-irrelevant variance. Among the indices used to measure syntactic complexity, mean length of clauses (MLC) and coordinate phrases per clause (CP/C) showed significant effects influenced by the emotionality of writing prompts and learner essays. The implications of this study are discussed.

INTRODUCTION

Writing in a second language (L2) is a multifaceted and intricate process that involves the interplay of cognitive, linguistic, and affective dimensions. Among these dimensions, sentiment and syntactic complexity are two critical factors that can profoundly influence the writing experience and the quality of L2 texts. While considerable research has focused on the cognitive and linguistic aspects of L2 writing, the interplay between affective elements, such as sentiment, and linguistic features, like syntactic complexity, remains underexplored.

Sentiment is the emotional tone or attitude expressed in language use. As sentiment plays a unique and important role in

language learning and cognitive processing (Bach & Dayan, 2017; Dewaele & Pavlenko, 2002), measuring sentiment features is helpful in understanding how emotions, feelings, and affect influence cognition and learner engagement (Crossley et al., 2017). While emotions and sentiments are related in that they both involve affective states, they are not the same constructs. Emotions are immediate, intense, and short-lived responses to stimuli, whereas sentiments are longer-lasting, more stable attitudes or evaluations, which encompass a range of emotions, from positive and negative to neutral sentiments. Emotion is considered part of the general cognitive mechanism involved in L2 acquisition (e.g., the affective filter hypothesis proposed by Krashen (1981). Understanding both emotions and sentiments is crucial in sentiment analysis, where the overall sentiment (positive or negative) toward a product, service, person, or topic is assessed based on emotional responses (Liu, 2012; Pang & Lee, 2008).

As to L2 writing, the role of sentiment is crucial for several reasons. Firstly, it can provide insights into the emotional challenges faced by L2 writers and how these challenges impact their writing performance. Secondly, by identifying the types of sentiments expressed in L2 texts, educators and researchers can develop targeted interventions to support L2 writers in managing their emotions and improving their writing skills. Lastly, exploring sentiment in L2 writing can contribute to a more comprehensive understanding of the affective dimensions of language learning, which has traditionally received less attention than cognitive and linguistic factors. Empirical research has also demonstrated a significant relationship between learners' emotional status and L2 writing performance, showing that L2 learners with better mood adaptability and stress management outperformed their peers with poor skills (Pishghadam, 2009).

Syntactic complexity refers to the range and the degree of sophistication of sentence structures that appear in language production (Ortega, 2003). It is an important indicator of L2 writing proficiency, reflecting a writer's ability to use complex and varied syntactic constructions effectively. High syntactic complexity is often associated with advanced writing skills, as it demonstrates the writer's capability to manipulate language structures to convey meaning precisely and effectively (Ortega, 2003). Conversely, low syntactic complexity may indicate a limited linguistic repertoire and reliance on simple, repetitive sentence structures. Syntactic complexity is a key factor in assessing the quality of L2 writing for several reasons. First, it provides a measurable indicator of a writer's linguistic proficiency and development. By analyzing syntactic complexity, researchers can track the progress of L2 learners and identify areas where they may need additional support. Second, syntactic complexity is closely linked to the cognitive processes involved in writing. Producing complex sentences requires higher cognitive effort and greater linguistic control, which are hallmarks of advanced writing skills. Finally, syntactic complexity contributes to the overall readability and effectiveness of a text. L2 texts with varied and complex sentence structures are generally more engaging and easier to read, which can enhance the communicative impact of the writing (Crossley et al., 2022).

Emotional factors were found to affect learners' cognitive distribution across different linguistic aspects involved in L2 writing, such as lexical and morphosyntactic vs. pragmatic planning in writing (Clachar, 1999), as well as the quality of the final writing product in terms of syntactic and content structure (Kean et al., 1987). A more recent study by Wang (2020) also suggested significant relationships between certain features of syntactic complexity and the emotionality of writing topics. Increasing attention has been paid to analyzing sentiment and syntactic complexity features and establishing how they interact in L2 writing. This research trend has accelerated along with the development of natural language processing (NLP) tools and large-scale corpora. In order to contribute to advancing our understanding of the role of emotional states or sentiment in the multiple aspects of syntactic complexity, this study aimed to investigate the relationship between sentiment, syntactic complexity, and L2 writing through a comprehensive corpus analysis using advanced computational tools.

LITERATURE REVIEW

Sentiment in L2 Writing

Research on L2 writing has traditionally focused on cognitive and linguistic dimensions. Cognitive factors include the mental processes involved in planning, generating, and revising texts, while linguistic factors encompass vocabulary, grammar, and syntactic structures. Key studies have highlighted the importance of syntactic complexity as a marker of advanced writing proficiency. For instance, research by Ortega (2003) and Norris and Ortega (2009) has shown that more proficient L2 writers tend to produce texts with greater syntactic complexity, characterized by longer sentences and more varied clause structures.

Affective factors, particularly emotions, are crucial in language learning and writing. Emotions can influence a writer's motivation, engagement, and performance. Positive emotions, such as enjoyment and interest, also enhance L2 writing

quality by fostering a greater willingness to write and experiment with the target language, potentially leading to more creative and engaging language production. Conversely, negative emotions, such as anxiety and frustration, can impede the writing process and result in less coherent and more error-prone texts (MacIntyre & Gardner, 1994; Pekrun et al., 2002).

Theoretical perspectives on emotion in language learning suggest that emotions are integral to cognitive processes. The Control-Value Theory (Pekrun, 2006) posits that emotions influence learners' motivation and cognitive resources, impacting their performance. In writing, emotions can affect the writer's focus, planning, and revision strategies, thereby influencing the quality of the essay produced. Empirical research has examined the impact of emotions on L2 writing performance. For example, Kean et al. (1987) found that L2 learners' anxiety level was found to be negatively correlated with the quality of their writings, suggesting that L2 writing performance could be affected by the emotional status of L2 learners. Clachar (1999) examined the language planning process of L2 learners during emotional and non-emotional composition using a thinking-aloud protocol. Findings indicated that emotional prompts were associated with a higher proportion of planning activities, which were dedicated to pragmatic factors in non-emotional rather than emotional composition. Moreover, the L2 learners in her study spent more time processing lexico-morpho-syntactic information when provided with the emotional prompt as compared to the non-emotional prompt. Additionally, Dewaele and Alfawzan (2018) found that positive emotions, such as enjoyment, were associated with higher writing proficiency and greater lexical diversity. In contrast, negative emotions, such as anxiety, were linked to lower writing quality and increased error rates. These studies underscore the significant role of emotions in shaping L2 writing outcomes as well as specific linguistic aspects of L2 writing.

Recent advancements in NLP have enabled automated detection of sentiment in written texts. Tools like sentiment analysis algorithms can classify texts based on their emotional tone (positive, negative, neutral). Studies using these tools have shown their potential in analyzing large corpora to identify patterns of emotional expression in L2 writing (Abdi Tabari & Wang, 2022; Li et al., 2020). However, challenges remain in accurately capturing nuanced emotional expressions and context-specific sentiments.

Syntactic Complexity in L2 Writing

Syntactic complexity is a critical factor in assessing L2 writing proficiency. It reflects an L2 learner's ability to produce varied and sophisticated sentence structures, which is often indicative of advanced language skills. Numerous studies have explored the relationship between syntactic complexity and L2 writing performance using various computational tools, such as Coh-Metrix and L2 Syntactic Complexity Analyzer (L2SCA; Lu, 2010) that provide detailed syntactic profiles of texts, facilitating large-scale analyses of L2 writing corpora (Crossley et al., 2011; Lu, 2010). High syntactic complexity indicates advanced linguistic proficiency and the ability to produce varied and intricate sentence constructions (Hwang, 2013; Lu, 2011). Studies have shown that syntactic complexity increases with proficiency and academic writing experience (Wolfe-Quintero et al., 1998). Advanced writers use a greater variety of syntactic structures, including subordinate clauses and complex noun phrases, which contribute to more sophisticated and nuanced texts.

More recently, a more advanced computation tool, the Tool for the Automatic Analysis of Syntactic Sophistication and Complexity (TAASSC), was developed to measure L2 writing proficiency and development (Kyle & Crossley, 2017, 2018). Kyle and Crossley extensively utilized TAASSC to investigate the development of syntactic complexity in L2 learners. Their studies highlighted the positive correlation between higher syntactic complexity scores and improved writing quality. By analyzing large corpora of L2 writing, they demonstrated that advanced learners tend to use more complex syntactic structures, which are associated with higher proficiency levels. In another study, Kyle et al. (2021) examined the longitudinal development of syntactic complexity in L2 writers. They found that syntactic complexity indices, particularly those related to clausal and phrasal complexity, increased over time as learners gained more exposure to the target language. This progression underscores the dynamic nature of syntactic development and its importance in achieving higher levels of writing proficiency. Park and Yoon (2021) employed TAASSC to compare the syntactic complexity of L2 English essays written by Korean learners at different proficiency levels. Their findings indicated that advanced learners produced texts with significantly higher syntactic complexity compared to intermediate learners. This suggests that syntactic complexity measures can effectively distinguish between different proficiency levels in L2 writing. Thongyoi and Poonpon (2020) used TAASSC to analyze Thai EFL learners' writing. Their study revealed that students with higher syntactic complexity scores received better evaluations from raters, affirming the role of syntactic complexity as a key indicator of writing quality. Wind (2020) investigated the impact of instructional interventions on syntactic complexity in L2 writing. Using TAASSC to measure changes before and after the intervention, the study found that targeted instruction significantly improved students' syntactic complexity, highlighting the tool's utility in educational settings. In addition to L2 writing, TAASSC has also been applied to trace L1 writing development. Overall, the use of TAASSC in these studies underscored the importance of

syntactic complexity in L2 writing performance. By providing detailed and fine-grained analyses of syntactic features, TAASSC facilitates a deeper understanding of how learners develop advanced writing skills and helps educators tailor their instructional strategies to enhance syntactic sophistication in student writing.

The Present Study

Previous research has highlighted the importance of sentiment and syntactic complexity in L2 writing. Sentiment influences motivation and writing performance, while syntactic complexity serves as a key indicator of linguistic proficiency. The interplay between these factors can provide deeper insights into the L2 writing process. While existing research has separately examined sentiment and syntactic complexity in L2 writing, only recently has L2 writing research taken an integrated approach to explore the interplay between these factors (Wang, 2020). Accordingly, little has been discovered as to how the overall sentiment of a writing topic, which can elicit positive or negative emotions from L2 writers, affects the sentiment of the learner essays and syntactic complexity represented with multiple features. Furthermore, the use of advanced computational tools to analyze these dimensions simultaneously remains underutilized. The current study aimed to address these gaps by employing advanced NLP tools to analyze sentiment and syntactic complexity in a corpus of 1,004 L2 learner essays. By integrating these analyses, this study has sought to advance our understanding of how sentiment and syntactic complexity interact to influence L2 writing performance. Specifically, the following research questions were addressed:

- 1) How does the sentiment of writing topics influence the sentiment expressed in L2 learners' essays?
- 2) How does the sentiment of writing topics impact the syntactic complexity of L2 learners' essays?

METHOD

Corpus Data

The present study used a corpus of English expository essays written by Korean high school students. A total of 1,004 essays were collected from five different schools during the Fall semester of 2023. The students completed one essay about a topic their teachers had chosen, considering the students' interests and relevance to the English curricula. In order to control extraneous factors that could affect the quality of L2 writing, the essays were given as in-class work so that the students could carry out the task under the same conditions. The students were given 10 minutes to plan for writing and 30 minutes to complete the writing task. They were not allowed to use any electronic devices or a dictionary during the task; however, they could consult with their teacher about the language and the task itself. Since the majority of the students reported that they were unfamiliar with typing English, the essays were hand-written, and the teachers transcribed them for computational analysis. As shown in Table 1, the corpus contains 1,004 essays written by first-year students at five different high schools (215.93 words on average). Directions for the writing tasks were prepared by the researcher and doublechecked by the five teachers who collected the data at the schools, thereby being uniform across the schools and classes where the data collection happened. However, the writing prompts were created by the teachers according to the topics of the reading passages that were discussed in their own class sessions.

TABLE 1

Description of Subcorpora

Corpus	Number of essays	Average N of words (SD)	Total N of words
School A	146	233.33 (60.65)	34,840
School B	90	217.00 (80.31)	20,285
School C	417	209.17 (68.23)	90,508
School D	238	204.50 (78.71)	50,466
School E	113	215.67 (52.77)	31,902
Total	1,004	215.93 (68.13)	228,001

Data Analysis

Sentiment Analysis

Following Wang (2020), the emotionality of the writing prompts and the learner essays was evaluated using sentiment analysis, a text-based emotion detection tool, which has gained popularity for extracting emotional information in the fields of computer and language science (Balahur et al., 2014; Kaur & R. Saini, 2014; Liu, 2015). This tool has recently been suggested as a complementary instrument in clinical intervention for depression treatment (Provoost et al., 2019). Sentiment analysis functions as an automated emotion detector, which can identify and quantify emotional content in texts based on sentiment polarity, including positive, neutral, or negative. Words with positive valence (e.g., “delightful”) contribute to a positivity score, while negative words (e.g., “furious”) increase the negativity score. The overall sentiment score is derived by subtracting the negativity score from the positivity score. A positive sentiment score (+) indicates that the text's overall emotion is positive, whereas a negative score (-) suggests a negative emotional tone. This tool is particularly useful for detecting the emotional states of L2 writers during composition, especially when analyzing corpus-based text data. Sentiment analysis can provide valuable insights into how emotional states influence writing, offering a quantitative measure to complement more traditional qualitative assessments. This dual approach can enhance our understanding of the interplay between emotion and language production in L2 writing contexts.

For the current study, emotional information was extracted from the writing prompts and the learner essays through a series of sentiment analyses performed in R (R Development Core Team, 2024) using the *SentimentAnalysis* package (Liu, 2015). In this analysis, the sentiment valency for each writing prompt and learner essay was computed using the Harvard-IV Dictionary, a psychological dictionary published by Harvard University (<http://www.wjh.harvard.edu/~inquirer/>) and utilized in the *General Inquirer* software (Stone et al., 1962). Sentiment scores were encoded as positive for positive values (+), negative for negative values (-), and neutral for zero scores.

Within the current corpus, a total of 71 writing prompts were analyzed for the overall sentiment each of them contained. Among the prompts, 29 were identified as positive, 14 as negative, and the rest 28 as neutral. Example topics of the prompts by the sentiment polarity are shown in Table 2 below. Also, more than half of the learner essays (804) were evaluated as positive, while 132 were assessed as negative, and 68 were judged as neutral.

TABLE 2
Examples of Prompts by Sentiment Polarity

Positive	Neutral	Negative
Write about joyful memories of your childhood	Write about how technology plays a role in your daily life	Write about a time when you failed at something important to you
Describe the personal traits that you are most proud of	Reflect on recent changes or developments in your city	Think of a situation where you faced injustice
Write about how you can maintain a positive attitude during tough times	Think of a piece of advice you've received that has stuck with you	Describe a major conflict you experienced, either with another person or yourself
Reflect on your proudest achievements and the steps you took to achieve them	Reflect on the last book you read	Write about a significant regret in your life
Write about your dreams and aspiration for the future	Discuss a personal collection you have or used to have	Reflect on a time when you felt deep shame

Syntactic Complexity Analysis

For this study, TAASSC was utilized to assess the syntactic complexity of the L2 learners' essays. TAASSC measures a wide range of detailed syntactic complexity and sophistication indices, primarily for evaluating L2 writing development but also applicable to L1 writing development. TAASSC was designed to evaluate a wide range of syntactic complexity indices across four primary categories based on the parser used for their calculation: general (traditional) syntactic complexity, clausal complexity, phrasal complexity, and syntactic sophistication. Each category provides insights into different aspects of syntactic use, such as the frequency and variety of subordinate clauses, noun phrases, and sophisticated structures (see Table 3). This makes it a valuable resource for researchers and educators.

TABLE 3*Description of TAASSC Indices*

Index	N	Description
Traditional syntactic complexity	14	indices measured by the L2SCA: number of words, clause, phrases, Tunits in text
Clausal complexity	32	average number of particular structures per clause
Phrasal complexity	132	average number of particular structures per phrase
Syntactic sophistication	185	the frequency of the VACs, VAC faith, VAC delta P and VAC collocation strength
Aggregated syntactic component scores	9	aggregated syntactic component scores related to clausal complexity, phrasal complexity, and syntactic sophistication
Total	372	

TAASSC adopts a frequency-driven approach to measure syntactic sophistication in writing using 14 traditional syntactic complexity indices from the L2SCA (Lu, 2010), 32 fine-grained clausal complexity indices (e.g., dependents per clause), and 132 phrasal complexity indices (e.g., dependents per nominal) for syntactic complexity. Furthermore, TAASSC includes 185 syntactic sophistication indices calculated based on the frequency of verb argument constructions (VACs) and the strength of associations between VACs and the verbs used in VACs. Traditional indices of syntactic complexity calculated by the L2SCA are also included in TAASSC. Such metrics include the mean length of T-unit, subordination index, and number of dependent clauses. The TAASSC indices are based on the Corpus of Contemporary American English (COCA) and follow usage-based theories of language development (Goldberg, 1995; Langacker, 2009; Ellis, 2002). TAASSC facilitates a comprehensive analysis of syntactic complexity and sophistication, essential for examining L2 writing proficiency and development. Its robust capabilities enable detailed assessment and comparison of syntactic structures, making it an invaluable tool for the present study on the relationship between sentiment and syntactic complexity in L2 writing. In this study, only the traditional syntactic complexity indices were included in analyses (Table 4), as suggested by Kyle et al. (2021) and Dong and Pu (2024). Kyle et al. and Dong and Pu noted that the L2SCA indices are highly reliable with L2 data and have been found to be positively correlated with L2 writing development. By integrating syntactic indices with sentiment analysis, this study aimed to uncover deeper insights into how emotional tone and structural complexity interplay in L2 composition.

TABLE 4*Indices for Traditional Syntactic Complexity (Lu, 2010)*

Dimension	Index (Code)
Length of production unit	Mean length of clause (MLC)
	Mean length of sentence (MLS)
	Mean length of T-unit (MLT)
Amount of subordination	Clauses per T-unit (C/T)
	Complex T-unit per T-unit (CT/T)
	Dependent clauses per clause (DC/C)
Amount of coordination	Dependent clauses per T-unit (DC/T)
	Coordinate phrases per clause (CP/C)
	Coordinate phrases per T-unit (CP/T)
Degree of phrasal sophistication	Verb phrases per T-unit (T/S)
	Complex nominals per clause (CN/C)
	Complex nominals per T-unit (CN/T)
Overall sentence structure	Verb phrases per T-unit (VP/T)
	Clauses per sentence (C/S)

Statistical Analysis

To address the first research question, the correlation between the emotion scores of prompts and written texts was calculated using Pearson regression. A series of Linear Mixed-Effects (LME) models were constructed for the second research question. Unlike traditional analyses, LME models include both fixed and random effects, allowing for the consideration of variations across participants and items. The R programming language (R Development Core Team, 2024), along with the lme4 (Bates et al., 2015) and lmerTest (Kuznetsova et al., 2015) packages, was used for model construction. The MuMIn package was utilized to calculate effect sizes based on marginal and conditional R^2 values. Marginal R^2 represents the variance explained solely by fixed factors, whereas conditional R^2 includes both fixed and random factors. In the LME models of this study, syntactic complexity indices were used as outcome variables. Fixed effects included the sentiment types of both the prompt and the learner essays. Given that the learner essays were collected from five different high schools in Korea, the school was treated as a random factor. Any significant findings would indicate an emotional effect on syntactic complexity.

FINDINGS

Sentiment in Writing Prompts and Learner Essays

Sentiment scores were calculated for both the writing prompts and learner essays within the dataset. Positive values indicate positive emotionality, while negative values represent negative sentiment in the essay. For the entire dataset ($N = 1004$), the average sentiment score of the writing prompts was 0.142, while the mean sentiment score for the learner essays was 0.089, with both mean values being above zero. According to a one-sample t -test, the mean sentiment score for the writing prompts was significantly different from the zero baseline, $t(1003) = 8.32, p < 0.001$, Cohen's $d = 0.20$. Additionally, the mean score for the learner essays differed significantly from the zero baseline, $t(1003) = 53.88, p < 0.001$, Cohen's $d = 1.07$.

When sentiment scores were grouped into three categories, the sentiment scores for the writing prompts appeared to be more polarized. For the negative writing prompts, the average sentiment score was -0.386, with a standard deviation of 0.174 and a range of -0.932 to -0.153. On the other hand, the average sentiment score for the positive prompts was 0.458, with a standard deviation of 0.201 and a range of 0.112 to 0.989. The learner essays displayed a less polarized score structure. For instance, the mean score of the negative essays was -0.049, with a standard deviation of 0.042 and a range of -0.214 to -0.005. For the positive essays, the average sentiment score was 0.135, with a standard deviation of 0.073 and a range of 0.007 to 0.432. The sentiment types of the writing prompts and essays were used as predictors when analyzing the syntactic indices. The overall interaction between the sentiment of the writing prompts and the emotionality of the learner essays was examined using Pearson's correlation, $r = 0.656, p < .001$. The positive correlation suggests that the emotionality of the writing prompts may effectively predict the overall sentiment in the learner essays. It also indicates that EFL adolescent students were more likely to produce positive essays if the writing prompts contained positive sentiments.

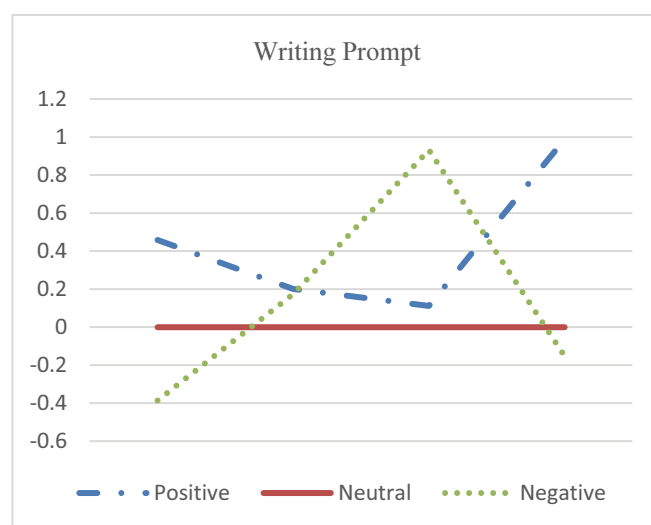
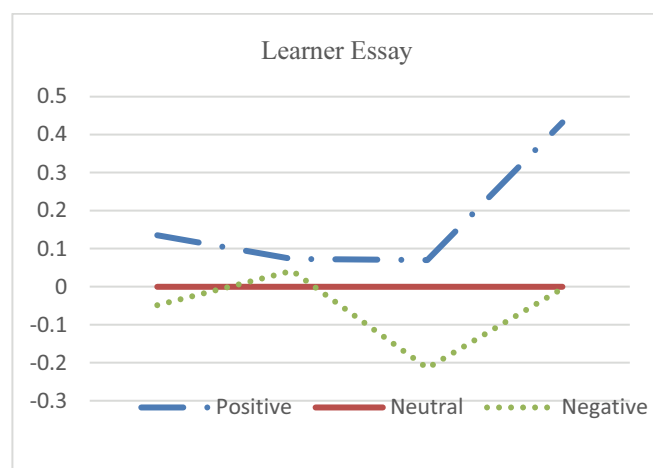


FIGURE 1

Mean Sentiment Scores of the Writing Prompts

**FIGURE 2**

Mean Sentiment Scores of the Learner Essays

The regression analysis demonstrated that the emotionality of the writing topics is a significant predictor of the sentiment score for L2 writers' production. Specifically, it was observed that the sentiment scores of the writing prompts and the learner essays were positively correlated, indicating that students tended to produce more positive essays when the topics in themselves elicited more positive emotions (Figures 1 and 2).

This finding demonstrated the influence of prompt emotionality on the affective tone of student writing. However, the two emotional scores exhibited different mean values. Notably, L2 writers' essays tended to be nearly neutral (sentiment score close to zero) even when the writing prompts were highly negative (sentiment score close to -1). The following excerpts from learners' essays show how the positive sentiment of a writing prompt elicits positive language use (Excerpt 1), while the negative sentiment of a writing topic leads to a learner's choice of neutral language (Excerpt 2):

Excerpt 1. Writing task (positive): Describe the personal traits that you are most proud of.

... I remember a time when a classmate was struggling with bullying. I offered support, listening to her experiences and helping her find resources to help with the issue. My ability to empathize made her feel more empowered to seek help. My empathy drives my passion for volunteer work and community service. I am proud of my empathy because it fosters kindness and understanding in my interactions with others...

Excerpt 2. Writing task: Think of a situation where you faced injustice.

... These experiences shaped my worldview in ways I couldn't fully understand at the time. They ignited a fire within me—a determination to fight against injustice and to stand up for those who were oppressed and would need help from others and society. I learned that being treated unfairly wasn't just a temporary issue—it was a reality many people face daily...

This discrepancy suggests that Korean adolescent learners might moderate their emotional expression in response to negative prompts, possibly due to cultural or educational norms that may emphasize restraint in emotional expression in academic settings. The near-neutral sentiment in the learner essays written as responses to negative prompts may also reflect a coping strategy where students avoid engaging deeply with negative emotions, thereby maintaining a more neutral or positive outlook in their written responses.

The findings of the present study are consistent with Clachar (1999), who examined cognitive distribution during L2 writing based solely on the emotionality of the prompts. Clachar's work suggested that emotional engagement with prompts influences cognitive processes and language use in writing. However, the method used in the present study does not assume a deterministic link between the prompts and the writing responses in terms of emotional states. Instead, it recognizes the variability in individual responses to emotional stimuli, which is consistent with research on individual differences in L2 writing (Andringa et al., 2012; Kormos, 2012; Llanes et al., 2018). Furthermore, the current findings concur with those of Wang (2020). Wang demonstrated that Chinese college-level students produced positive essays when the writing topics contained positive emotions, whereas they were less likely to show their negative emotions in their essays even when the prompts had negative or neutral valency. Wang suggested that Chinese students might have been culturally bound when it comes to expressing negative emotions, particularly in an academic setting. The Korean students in the present study might have been inept in exhibiting negative sentiment in L2 writing due to cultural effects. However, this study has not delved

into this issue; therefore, further research is called for.

The significant moderate positive correlation ($r = 0.652, p < 0.001$) observed in this study suggests that while there seems to be a general tendency for students to align their writing's emotional tone with the writing prompts, individual differences may play a crucial role. However, the role of individual differences was not explored in this study, and accordingly future research may be warranted to address this issue.

The Relationship between Sentiment Type and Syntactic Complexity

In examining the role of syntactic complexity in L2 writing performances, fourteen indices of syntactic complexity were analyzed using linear mixed models. These models incorporated tripartite factors (sentiment score > 0 , positive; $= 0$, neutral; < 0 , negative) for both sentiment in the writing prompt (i.e., prompt sentiment) and sentiment in the learner essay (i.e., essay sentiment) as fixed effects, while school and class were considered as random factors.

For indices that measure the length of the production unit (Mean Length of Clause [MLC], Mean Length of Sentence [MLS], and Mean Length of T-unit [MLT]), only MLC showed significant results for both prompt sentiment ($F(2, 1001) = 3.571, p = 0.014$) and essay sentiment ($F(2, 1001) = 6.547, p = 0.002$). However, the interaction between prompt and essay sentiments was insignificant ($F(4, 1001) = 1.147, p = 0.326$). Specifically, for MLC, the neutral sentiment essays significantly differed from the baseline ($\beta = 3.283, SE = 0.415, p = 0.000$), indicating that the Korean EFL students were likely to produce longer clauses when writing neutrally. In this corpus, MLC had the highest mean score for neutral essays ($M = 12.54, SD = 7.43$), while the mean scores for negative ($M = 10.27, SD = 1.92$) and positive texts ($M = 10.81, SD = 1.86$) were lower. This pattern was confirmed by a one-way ANOVA ($F(2, 1007) = 8.180, p < 0.001$). Post hoc Bonferroni tests revealed significant differences between neutral and positive essays ($p = 0.019$) and between neutral and negative essays ($p < 0.001$), but not between positive and negative texts ($p = 0.161$). Similarly, ANOVA results for prompt type alone showed significant differences ($F(2, 1007) = 5.302, p = 0.006$). Post hoc tests indicated significant differences between neutral and negative prompts ($p = 0.009$) and between neutral and positive prompts ($p = 0.031$).

The coordinate phrases per clause (CP/C) index was significant for prompt sentiment ($F(2, 1000) = 5.780, p = 0.005$), essay sentiment ($F(2, 980) = 5.705, p = 0.007$), and the interaction between them ($F(4, 1007) = 2.237, p = 0.021$). In the LME model, the neutral learner essay was a significant predictor ($\beta = 0.318, SE = 0.026, p < 0.001$), as was the interaction between positive prompts and neutral essays ($\beta = -0.311, SE = 0.063, p = 0.002$). Pairwise contrastive tests using Bonferroni adjustments revealed that the estimated marginal mean (EMM) difference between negative and positive prompts was significant ($p = 0.012$). However, the interaction difference was not significant between negative and neutral prompts ($p = 0.071$) or between neutral and positive prompts ($p = 0.823$). For essay sentiments, the marginal mean value was not significant among the three levels (positive, negative, and neutral) but was marginally significant between negative and neutral texts ($p = 0.048$). Specifically, when the essay contained neutral sentiment, the difference between negative and positive prompts was significant ($p = 0.009$). These results may demonstrate an interaction pattern when the learner essay was emotionally neutral.

Unlike the MLC index, which showed no interaction effect between prompt and essay sentiments, the emotional effect on the CP/C index was more sensitive when the prompts did not contain positive sentiments. Overall, the students tended to use more coordinate clauses in their compositions when writing neutrally, as shown in the excerpts below:

Excerpt 3. Writing task (neutral): Reflect on the last book you read.

...Reflecting on the last book I read, "Pachinko" by Min Jin Lee, evokes a sense of wonder and fascination. Set in a small neighborhood in Busan in the early 1900s, the story captivated me with its detailed descriptions, intricate plot, and enchanting characters...

Excerpt 4. Writing task (positive): Reflect on your proudest achievements.

...Reflecting on my proudest achievements fills me with a sense of gratitude and accomplishment. One of my proudest moments was graduating at the top of my class. I received recognition not only for my academic achievements but also for my leadership...

The other two indices measuring coordination, CP/T and T/S, did not reach significant levels in the mixed models. Similarly, indices measuring subordination (C/T, CT/T, DC/C, and DC/T) and phrasal sophistication (CN/C, CN/T, and VP/T) were not significant in the analysis. The overall complexity index, C/S, was also insignificant when checked by the mixed-effects model.

The analysis of syntactic complexity in L2 writing performances using LME models found significant results for certain indices, particularly MLC and CP/C. The results revealed that the Korean EFL adolescent writers produced longer clauses

when writing neutrally, as shown by the significant differences in MLC across essay sentiments and prompt sentiments. This suggests that the emotional neutrality of the text might facilitate more complex syntactic constructions.

More specifically, the significant results for the CP/C index highlight the sensitivity of coordinate phrase usage to the emotional tone of the writing prompts. The interaction effect observed for CP/C, particularly when essay sentiment is neutral, stresses the ways in which emotional context influences syntactic choices. These findings align with previous research suggesting that emotional content in prompts can shape the syntactic complexity of L2 writing (e.g., Andringa et al., 2012; Kormos, 2012; Wang, 2020). Prior research has shown that L2 learners tend to spend more time planning lexical and morphosyntactic structures when responding to an emotional writing prompt (Clachar, 1999). That being said, emotionally charged prompts, whether positive or negative, impose a relatively high cognitive load on L2 learners during their L2 writing processes.

The absence of significant results for other indices measuring coordination, subordination, and phrasal sophistication suggests that these aspects of syntactic complexity might be less influenced by emotional factors or that the specific measures used were not sensitive enough to detect such effects. This points to the need for further research using a broader range of syntactic complexity measures and different emotional contexts to fully understand the interplay between emotionality and syntactic complexity in L2 writing. Additionally, the findings highlight the importance of considering both prompt and learner sentiments when analyzing syntactic complexity. The interaction effects observed in the CP/C index suggest that the emotional tone of the prompts can modulate the impact of the emotional tone of the texts, leading to variations in syntactic complexity. This complex interaction underscores the need for a holistic approach in analyzing L2 writing performances, taking into account both the emotional and syntactic dimensions.

CONCLUSION

The present study investigated the interplay between emotionality in writing prompts and the syntactic complexity of essays written by Korean EFL adolescent students. For the first research question regarding the effect of the sentiment of writing prompts on the sentiment of learner essays, the emotionality of writing prompts was found to be a significant predictor of the emotional scores in L2 essays. A positive correlation indicated that the students tended to write more positively when the prompts were emotionally positive. Interestingly, there was a notable difference in baseline sentiment values between writing prompts and learner essays in that L2 learners' essays were closer to neutral sentiment when the prompts were highly negative. This finding suggests a potential difference in how emotional cues from writing prompts are processed and reflected when L2 learners produce written responses to the prompts.

As for the second research question concerning the relationship between the sentiment type (positive, negative, neutral) and syntactic complexity in L2 essays, analysis of syntactic complexity indices revealed that MLC was significantly affected by both prompt and essay sentiments, but there was no significant interaction between these two factors. The use of CP/C showed significant effects for both prompt and essay sentiments, as well as a significant interaction, indicating that emotionality in writing prompts affected the use of coordinate clauses differently depending on the emotionality of the learner essay. The current findings suggest that emotionally charged writing prompts may place excessive cognitive pressure on EFL writers, leading them to produce syntactically simpler clauses and sentences. This cognitive load could result in an underestimation of their writing proficiency, as their true capabilities might not be fully reflected under emotional stress. Consequently, the comparability of writing scores from prompts with different emotional polarities is at potential risk, raising concerns about the fairness and validity of such assessments. Thus, further considerations are necessary to justify the use of specific testing methods, particularly those involving emotionally loaded prompts.

The findings of the present study further suggest that language teachers and testers should be acutely aware of the role of sentimentality in L2 writing tasks. It is crucial to exercise caution when selecting writing prompts for high-stakes tests to avoid construct-irrelevant interferences that could compromise the assessment's validity. By recognizing and accounting for the emotional dimensions of writing prompts, educators and assessors can ensure a more accurate and fair evaluation of L2 learners' writing proficiency. The current findings also highlight the need for further research to determine whether this pattern is specific to EFL learners from Confucian backgrounds. Prior studies have documented that sociocultural factors significantly influence L2 writers' performance (Slavkov, 2015; Storch, 2018). For instance, the cultural context may shape how emotions are expressed and perceived in writing (Wang, 2020), with Korean students potentially exhibiting a restrained emotional style. Future research is warranted to explore this topic in different linguistic and cultural contexts to determine whether the observed trends are specific to Asian EFL learners or more broadly applicable. Additionally, investigating the underlying cognitive and affective mechanisms driving these patterns could provide deeper insights into the relationship

between emotionality and syntactic complexity in L2 writing.

The observed patterns may also reflect the stylistic features inherent in writing prompts and responses. Prompts are often designed to provoke thought and emotion, while responses might adhere to more structured, academic conventions that downplay overt emotional expression. Therefore, future research may aim to investigate the pedagogical implications of the current findings, examining how writing prompts can be designed to optimally engage students emotionally and cognitively, thereby enhancing their writing performance and language development. Specifically in the field of language assessments, these insights call for the development of more sophisticated assessment tools that can accommodate the emotional nuances of writing. Integrating emotional and cognitive dimensions in assessment practices can lead to a more comprehensive understanding of L2 writing performance. This approach not only benefits learners by providing a fairer assessment of their abilities but also informs instructional practices, helping educators to better support their students' language development in emotionally resonant ways. In conclusion, the present study contributes to the growing body of literature on the role of emotion in L2 writing by demonstrating the significant impact of prompt emotionality on student writing. -

Nonetheless, several limitations should be acknowledged. First, the study measured emotional information solely using a text-based approach, simplifying human emotion to a one-dimensional scale. Employing more accurate control methods, such as psycholinguistic experiments, could enhance the precision of emotion detection during L2 writing. In addition, other potentially relevant variables, such as genre and language proficiency level, were not included in the analysis. Future research should investigate whether these factors interact with the emotional variable, exerting different influences on the syntactic complexity of EFL writing.

Despite these limitations, the study's results have unveiled important and intricate relationships between emotion and writing in an EFL setting. These findings underscore the need to consider emotional factors when teaching and testing L2 writing in various educational contexts. As Clachar (1999) highlighted, practitioners should emphasize “a continuum of topics whereby aspects of linguistic and strategic knowledge, as well as the various mental processes associated with writing, must eventually be interconnected and manipulated by the L2 writer to function as an integral whole” (p. 57). This perspective encourages a holistic approach to language instruction and assessment.

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