

Evaluating and analyzing the use of sentiment analysis techniques in developing reading comprehension skills among English language learners

Soliman, Layla

(English Language Department, Tripoli University, Tripoli, Libya)

l.soliman@uot.edu.ly

ORCID 0009-0002-6847-7481

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Abstract

This study investigated whether the use of sentiment analysis methods would improve the reading comprehension skills of students learning English as a Foreign Language. A quasi-experimental pretest-posttest control group design was used in this research, which enrolled 60 intermediate level students enrolled as EFL students. The students were randomly assigned to an experimental group ($n = 30$) or a control group ($n = 30$). The experimental group was taught using reading instruction based on sentiment analysis techniques, while the control group received reading instruction through traditional teaching methods (e.g., teacher lectures, classroom discussions).

There were no significant differences found between the two groups in the pretest (Experimental: $M = 62.40$, $SD = 6.85$; Control: $M = 61.90$, $SD = 7.10$; $p > 0.05$). However, significant differences were found in the posttests, with the experimental group ($M = 78.60$, $SD = 6.20$) significantly outperforming the control group ($M = 68.10$, $SD = 6.75$). There was a large effect size (Cohen's $d = 1.60$) and a large proportion of variance explained by the type of curriculum used for the posttest (40%). Additionally, positive correlations were demonstrated between the posttest scores for reading comprehension and the following questionnaire dimensions: 1) Learner engagement ($r = 0.69$); 2) Perceived improvement in comprehension ($r = 0.74$); 3) Motivation and ease of learning ($r = 0.71$); and 4) Overall satisfaction ($r = 0.77$) at $p < 0.01$. Thus, these results demonstrate that utilizing sentiment analysis-based instruction enhances both the cognitive and affective aspects of reading comprehension. Furthermore, this study demonstrates that using this type of instruction will benefit EFL students' ability to learn.

Keywords: *Sentiment Analysis, Reading Comprehension, EFL Learners, Natural Language Processing, Technology-Enhanced Language Learning*

المخلص

سعت هذه الدراسة إلى تقصي أثر استخدام أساليب تحليل المشاعر في تنمية مهارات الفهم القرائي لدى متعلمي اللغة الإنجليزية كلغة أجنبية. واعتمدت الدراسة المنهج شبه التجريبي، مستخدمة تصميم الاختبار القبلي-الاختبار البعدي بمجموعتين (تجريبية وضابطة). وتكوّنت عيّنة الدراسة من (60) طالباً من متعلمي اللغة الإنجليزية كلغة أجنبية في المستوى المتوسط، حيث تم توزيعهم عشوائياً إلى مجموعتين: مجموعة تجريبية ($n = 30$) ومجموعة ضابطة ($n = 30$).

تلقت المجموعة التجريبية تعليم القراءة القائم على تقنيات تحليل المشاعر، في حين تلقت المجموعة الضابطة تعليم القراءة باستخدام الأساليب التدريسية التقليدية، مثل محاضرات المعلم والمناقشات الصفية. وأظهرت نتائج الاختبار القبلي عدم وجود فروق ذات دلالة إحصائية بين المجموعتين (المجموعة التجريبية: المتوسط الحسابي = 62.40، الانحراف المعياري = 6.85؛ المجموعة الضابطة: المتوسط الحسابي = 61.90، الانحراف المعياري = 7.10). $p > 0.05$.

في المقابل، كشفت نتائج الاختبار البعدي عن وجود فروق ذات دلالة إحصائية بين المجموعتين لصالح المجموعة التجريبية، حيث بلغ المتوسط الحسابي لها (78.60) بانحراف معياري قدره (6.20)، مقارنة بالمجموعة الضابطة التي بلغ متوسطها الحسابي (68.10) بانحراف معياري قدره (6.75). كما أظهرت النتائج حجم أثر كبير وفقاً لمعامل كوهين (Cohen's $d = 1.60$)، إضافة إلى أن نوع المنهج المستخدم أسهم في تفسير نسبة (40%) من التباين في نتائج الاختبار البعدي.

كما أظهرت النتائج وجود علاقات ارتباط إيجابية دالة إحصائياً عند مستوى ($p < 0.01$) بين درجات الفهم القرائي في الاختبار البعدي وأبعاد الاستبانة التالية: تفاعل المتعلم ($r = 0.69$)، والتحسين المدرك في الفهم القرائي ($r = 0.74$)، والدافعية وسهولة التعلم ($r = 0.71$)، والرضا العام ($r = 0.77$).

وتشير هذه النتائج إلى أن توظيف التعليم القائم على تحليل المشاعر يسهم بفاعلية في تعزيز الجوانب المعرفية والوجدانية للفهم القرائي، كما يؤكد أن هذا النوع من التعليم يُعد مدخلاً فعالاً لتحسين تعلم اللغة الإنجليزية كلغة أجنبية لدى الدارسين. الكلمات المفتاحية:

تحليل المشاعر، الفهم القرائي، متعلمو اللغة الإنجليزية كلغة أجنبية، معالجة اللغة الطبيعية، التعلم اللغوي المعزز بالتكنولوجيا.

1.introduction

In light of globalization and the openness the world has witnessed in recent years, learning languages, especially English, which ranks first among the most widely used languages in the world [Atasheva, (2024). 58-62.], has become essential. It is used in business transactions and contracts, in education, particularly in medical and engineering fields, and even in social communication between different peoples [Wiranata. (2024). 26439.]. With the advancement and development of computing, programming, and artificial intelligence, and their fundamental reliance on English, this language has become the most important among the world's languages. In short, it can be described as a bridge of communication between peoples, regardless of their language or ethnicity. Figure (1) illustrates the percentage of English speakers compared to other widely used languages [Zeng. (2024), 1-9.].

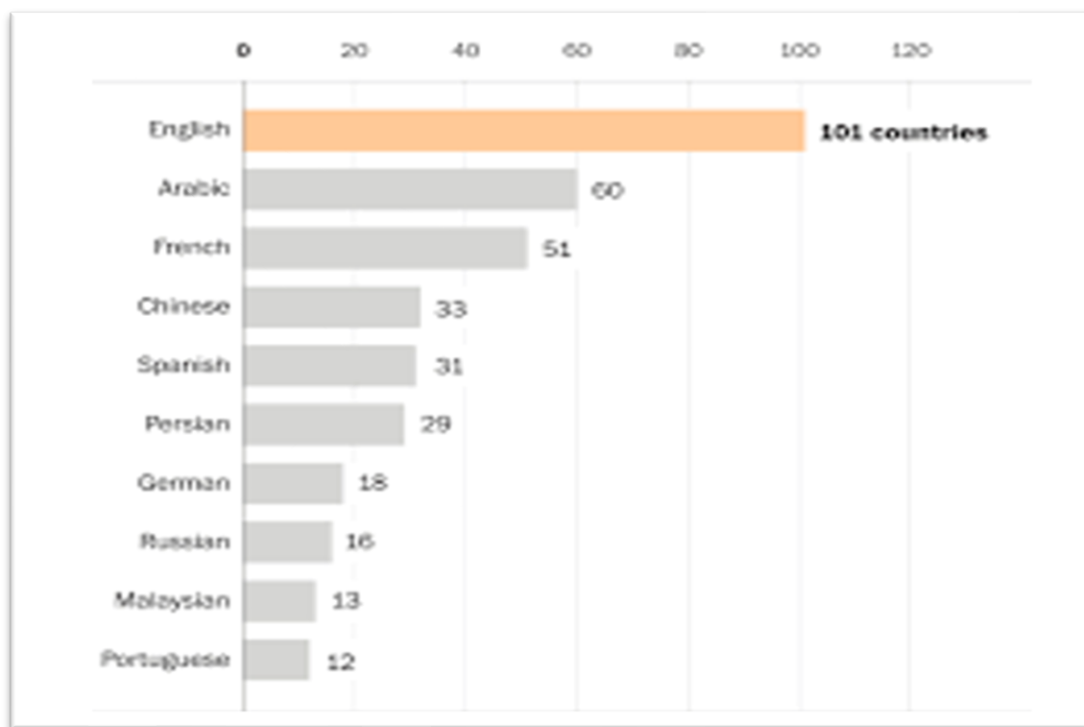


Figure (1) :illustrates the percentage of English speakers compared to other widely used languages

Reading comprehension plays a pivotal role in foreign language learning and helps learners gain insights from the text, understand the central theme or idea presented and find meaning. Unfortunately, there are numerous challenges associated with reading and understanding implied meaning and emotional undertones for many EFL learners. Recent technology advancements allow for the emergence of AI technology and more specifically NLP based Sentiment Analysis. Sentiment Analysis can be used as a tool for automatically identifying the emotional polarity of the text providing instructors with an innovative way to enhance EFL reading comprehension. This study investigates the use of Sentiment Analysis techniques in assisting instructors in their EFL reading instruction and provides an evaluation of the effectiveness of such techniques on improving comprehension skillsets for EFL learners [Yu, B., (2024). 3325.].

The present study will examine the degree to which the use of sentiment analysis within EFL (English as a Foreign Language) reading instruction affects students' ability to comprehend texts better than before they were exposed to them[Leovigildo Lito, (2025), 17-27.] This research seeks to determine: the effect that performing a sentiment-based analysis upon a piece of text has upon a learner's ability to identify the main idea; the ability of learners to make inferences (i.e., derive meaning from context); the ability of the learner to understand the emotional tones of the authors of the texts read as a result of completing sentiment-based analyses; and the attitudes students hold regarding the use of sentiment analyses as a supplemental tool to support learning in English as a Foreign Language classes[Dia, (2024). pp. 13-25.]. This research will contribute to the growing body of knowledge on the benefits of artificial intelligence technology in assisting

language learners with their reading comprehension skills. Additionally, it will provide educators and curriculum developers with practical approaches for applying sentiment analysis techniques to create a more meaningful learning experience for EFL students as they read and understand written materials [Hasan (2024)., 207-227.].

Reading comprehension is central to EFL learners; however, learners find it difficult to comprehend the implicit meanings, emotional connotations and the author's intention out of the written text. Reading instruction in EFL, usually, focuses on the surface of the text (as in learning vocabulary) instead of on how a reader feels about a specific text, or how a reader wishes to interact with the text (through the use of words or sentence structure) or how they might wish to react to the author, to the text itself, and to the implicit meanings in the text [Coady, (2020, 524-532.]. Although sentiment analysis has been widely used in many areas, such as social media (opinion mining), it has yet to be utilized for educational purposes, particularly for EFL reading comprehension. There are no empirical studies reporting on how to incorporate sentiment analysis strategies into EFL reading instruction as part of a systematic way to facilitate reading comprehension; therefore, this study will explore how the use of sentiment analysis techniques can assist EFL readers in overcoming persistent comprehension difficulties, as well as improve their overall performance [Mandour, (2025). (pp. 67-112].

2. Literature Review

Prior studies have demonstrated that utilizing technology-enhanced learning has improved outcomes for students in reading comprehension. Furthermore, prior research with regards to the utilization of natural language processing (NLP) in educational settings presents evidence that utilizing automated text analysis tools supports vocabulary acquisition, semantic understanding, and learner engagement. In addition, sentiment analysis (an emerging technology in social media and opinion mining) has received attention in education for its potential to support students when identifying the emotional tone and author stance of a text. However, few empirical studies have investigated the impact of sentiment analysis on EFL students' reading comprehension. This study will fill this gap by providing experimental evidence of the effectiveness of using sentiment analysis-based instruction [Yu, J. H., (2025). 4307-4348.].

2.1. Theoretical Background and Analytical Framework

The theoretical basis for this research study has been established through the integration of cognitive and constructivist theories of reading comprehension, which emphasize that the reading process is more than simply decoding text; it is a process where a reader actively creates meaning.

According to Schema Theory, reading comprehension involves activating existing knowledge from long-term memory and linking it (the activation of next knowledge) to the linguistic and contextual elements of the new text being read (for example, emotional and author attitudinal cues). Affective schemata are activated when emotional polarity is identified in a text. This process enhances understanding of that text because it allows for a more complete reconstruction of the reader's mental model of the text at the moment of reading [Kastrati, (2021). 3986.].

The study also utilizes the Reader Response Theory, which focuses on the active interaction that readers have with the text and how the reader's own emotional engagement shapes their understanding of meaning. Finally, the research study also incorporates perspectives from Technology-Enhanced Language Learning and Cognitive Load Theory, which provide insight into developing effective tools using technology for EFL learners by reducing extraneous cognitive load, thus directing learners' focus to important semantic and emotional aspects of a text.

The combination of these theories provides an analytic framework for this study to explain how sentiment analysis can improve reading comprehension for EFL learners through improved cognitive processing, emotional awareness, and active engagement with text. The theories also serve to demonstrate the role that technology-enhanced language learning tools play in facilitating the construction of knowledge [Duke, (2021), 663-672.].

2.2. Basic Concepts of the Study

Through the study's basic concepts, an insightful perspective can be formed regarding the study's objectives, importance, and key findings.

1. Reading Comprehension

The ability to read and understand written text involves using various skills to make meaning from it, such as understanding the main idea, making inferences, understanding implied meaning, etc. The multiple dimensions of reading comprehension include attention, degree of comprehension, and development of personal values. Reading Comprehension is influenced by several factors, including the reader's previous knowledge, the text's comprehension level, whether or not it was read independently, and how much time the reader spends on it [Agüero- (2021)., 107].

2. Sentiment Analysis

Sentiment Analysis is a natural language processing technique for identifying the emotional tone of a writing. The study found that Sentiment Analysis as an instructional strategy promotes the reader's ability to understand, interpret, and create meaning from written materials by helping the student understand the emotional content, attitudes, and stance of the writer regarding the subject. Using Sentiment Analysis as a learning tool enhances EFL reading comprehension [Dang, (2020). 483.].

As mentioned in the introduction, EFL reading comprehension research is still in the early stages. While the effect of emotion on reading comprehension has been studied, there is very little literature on using Sentiment Analysis as an instructional method to improve reading comprehension of EFL students. The present study addresses this gap by providing experimental evidence regarding the effectiveness of Sentiment Analysis when used as an instructional tool in EFL Reading Comprehension [Xue, H., (2025). 15].

3. English as a Foreign Language (EFL)

English as a Foreign Language (EFL) is the study of English in situations where English is not the primary mode of communication. A major challenge that many EFL students face is their inability to identify cultural references or understand how to interpret how emotions were expressed in written texts. This research examines the role of technology

as a tool to help facilitate the reading skills of intermediate-level EFL students [Yuan, (2022), 43].

4. Natural Language Processing (NLP)

Natural Language Processing (NLP) is a branch within the field of Artificial Intelligence that enables computers to interpret human language so they can create, interpret and understand written text. NLP assists in performing automated operations on written material for the purpose of language-learning assignments [Rayati, M. (2021). 44-64.].

5. Technology-Enhanced Language Learning (TELL)

Technology-Enhanced Language Learning (TELL) combines digital and Artificial Intelligence resources, as well as existing resources of technology, to assist in improving language instruction by using a variety of resources to assist in achieving learning objectives. Sentiment analysis is a new technology within the TELL environment that has the potential to enhance reading instruction through increased student participation and facilitate student engagement and enjoyment [Zainuddin, (2023). 69-79.].

6. Learner Engagement

Learner Engagement is the level of cognitive, affective, and behavioral involvement that students exhibit when completing learning projects within educational settings. By using sentiment analysis to support reading task, learner engagement is stimulated, as it fosters student participation and improves both motivation and comprehension through reflection on their reading experiences [Shadiev, (2020). 524.].

3.method and Methodology

The methodology used in the study is a quasi-experimental methodology supported by quantitative and qualitative analysis through measuring the effect and analyzing how this effect occurs and the factors affecting it, in addition to using the descriptive methodology to describe the data and results and the comparative methodology to compare the variables.

3.1. the applied framework of the study

The applied framework of the study is a framework that clarifies the procedures of the applied study, starting from defining the objective and formulating the research problem, through collecting, processing and verifying data, then designing the experiment and recording the results, and then analyzing and evaluating these results to draw conclusions and provide recommendations. Figure No. 2 illustrates the applied framework of the study.

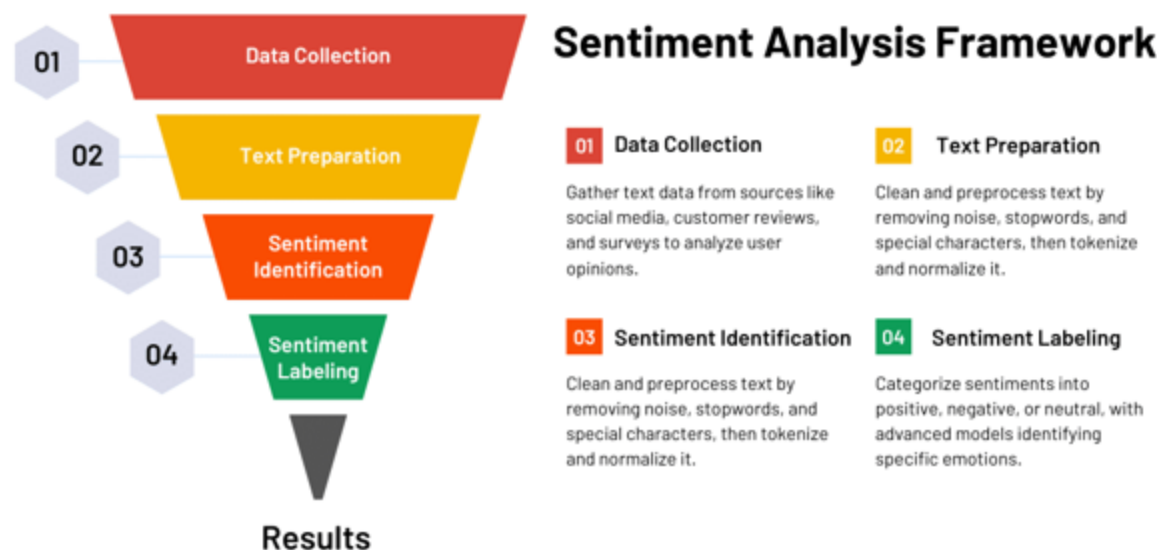


Figure (2) :illustrates the applied framework of the study

3.2. Study design

The study design was carried out through a series of steps, which are as follows:

1.data collection

Regarding the data related to basic concepts, methods, mechanisms, and the formulation of tests and questionnaires, this was collected from online databases, previous studies, and books. As for the remaining data, it consisted of the results of tests conducted on the study sample, as well as the results of the questionnaires from students of the English language department, Tripoli University. This data was processed manually by excluding all outliers and statistically through variance testing, significance assessment, and validation.

2. Study sample

The sample for the study consisted of learners identified as learners of a foreign language according to set criteria (Language Proficiency / Academic Level). Participants were purposively sampled based on their meeting criteria that were relevant to the research goal(s). The learners were then randomly assigned to either an experimental or control group in order to reduce any bias and ensure the similarity of both groups. The size of the sample (60) was selected in accordance with the criteria of the quasi-experimental design and the requisite sample size for achieving acceptable statistical power for representing the study population and adequately analyzing the findings (results of the study).[Pavani, (2024 (pp. 1-5).]

3. Study tools

1) Reading Comprehension Test: Standardized or researcher-designed test

Includes:

- Main idea
- Conclusion

- Identifying the emotional tone of the text
- Administered pre- and post-test

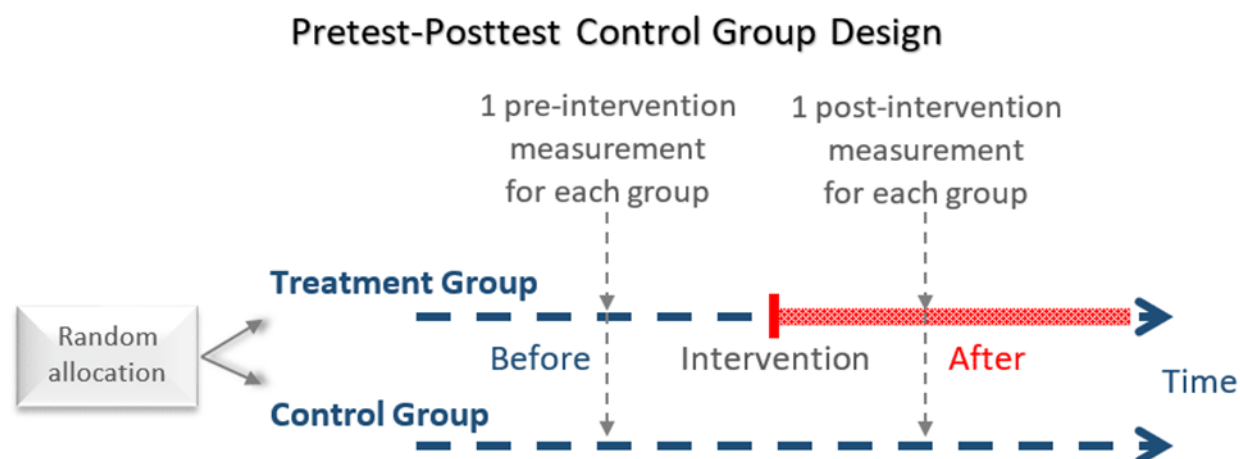


Figure (3) :illustrates pretest-posttest design

2) Emotion Analysis System

An Emotion Analysis System is an artificial intelligence and natural language processing-based computer program that analyzes writing and identifies the emotions in that writing (for example, joy, sadness, anger, fear, or neutrality). The EAS offers a more complete analysis of the writing than traditional word analysis by looking at the emotional context and concepts of the writing, rather than just the literal meaning of individual words.

In this research, the EAS supports learners' understanding of what a particular piece of writing is attempting to communicate by providing a defined categorization of written text by its emotional state. This categorization assists learners' understanding of the author's tone and emotional bias, and how to read between the lines and infer meaning from the writing. The EAS uses either pre-defined or pre-trained models like emotional dictionaries or deep learning-based models. The EAS is being implemented in classroom or e-learning environments in order to facilitate student interaction and improve English language learning for non-native speakers[Fei, Z., (2020). 212-227.].

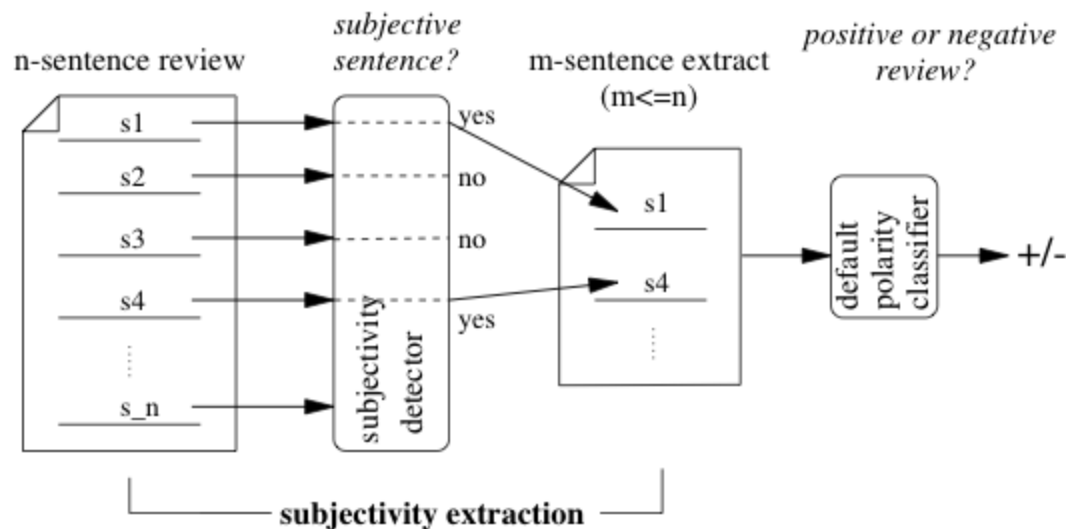


Figure (4) :illustrates Emotion Analysis System

- 3) Student attitudes survey
- 4) Statistical analysis programs: Excel and SPSS, in addition to MATLAB.

3.3. Implementation procedures

After defining the research objective and problem, collecting and processing the data, the remaining implementation procedures were carried out as follows:

1. Creating a pre-test/post-test

As shown in figure (5) which depicts a research design that is a quasi-experimental design that has been created using a pre-test/post-test design by comparing an experimental or "treatment" group to a control or comparison group. The experimental or "treatment" group will receive a particular type of instructional intervention based on a structured approach to professional development, while the comparison group will use traditional methods of preparation for instruction. Since all participants in both the treatment and comparison groups completed a pretest prior to starting the instructional phase of the study, the purpose of the pretest(s) was to establish baseline equivalence between the two groups. Classroom observations were conducted during the instructional phase of the study to determine the extent to which each group implemented the instructional practices associated with their respective intervention (e.g., instructional intervention, professional development, etc.). Finally, a posttest was given to both groups to determine not only what participants in both groups learned but also how well an instructional intervention performed compared to a traditional form of instruction.

ASSESSMENT FOR ACQUISITION

INTERPRETIVE RUBRIC

ADVANCED		I can identify details from the text. I can give insightful evidence to support my conclusions and to make inferences. I can interpret unfamiliar words based on context.	A
PROFICIENT		I can identify the main idea and details about the text. I can give evidence from the text to support conclusions. My ability to make inferences is limited as I can understand familiar words, but I have trouble interpreting new words.	B
DEVELOPING		I can identify the main idea and a few details about the text. I struggle to provide evidence and make inferences. I can understand familiar words when they are used in familiar contexts.	C
EMERGING		My ability to interpret individual words significantly limits my understanding of the text. I can identify the main idea of the text, but I cannot give details or textual evidence to support conclusions about the text.	D
BEGINNING		I cannot understand the words in the text well enough to be able to identify the main idea or any details about the text.	F



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Figure (6): illustrate Administering the test to the study sample

- Administering the questionnaire
created a structured survey to investigate what students think about using Sentiment Analysis in their reading classes. The purpose of the survey was to determine what students think about the method of teaching, how engaged they were, and how the Sentiment Analysis affected their ability to understand what they read. The survey contained closed-ended questions that were rated based on a five-point Likert scale ranging from Strongly Disagree to Strongly Agree. The survey was divided into four dimensions: Engagement, Perceived Comprehension Improvement, Motivation & Ease of Learning, and Overall Satisfaction & Usefulness. The first dimension (Engagement) measured how well the use of Sentiment Analysis in reading lessons increased student interest and attention and encouraged active participation in their reading tasks. The second dimension (Perceived Comprehension Improvement) contained questions about the student's perceived ability to comprehend main ideas, make inferences about the author's intent, and gauge the emotional tone and position of the author. The third dimension (Motivation & Ease of Learning) measured whether the use of Sentiment Analysis made reading tasks more enjoyable, easier to understand, and less mentally

taxing. Finally, the fourth dimension (Overall Satisfaction & Usefulness) measured how willing students would be to use Sentiment Analysis tools in the future for similar reading tasks. After completing the instructional intervention, the experimental group (the group that received the interactive reading lessons) was given the survey at the end of the intervention. The data provided through the survey reinforced the quantitative results of the tests by allowing students to share their personal experiences and gave additional evidence to the hypotheses tested through the statistics.

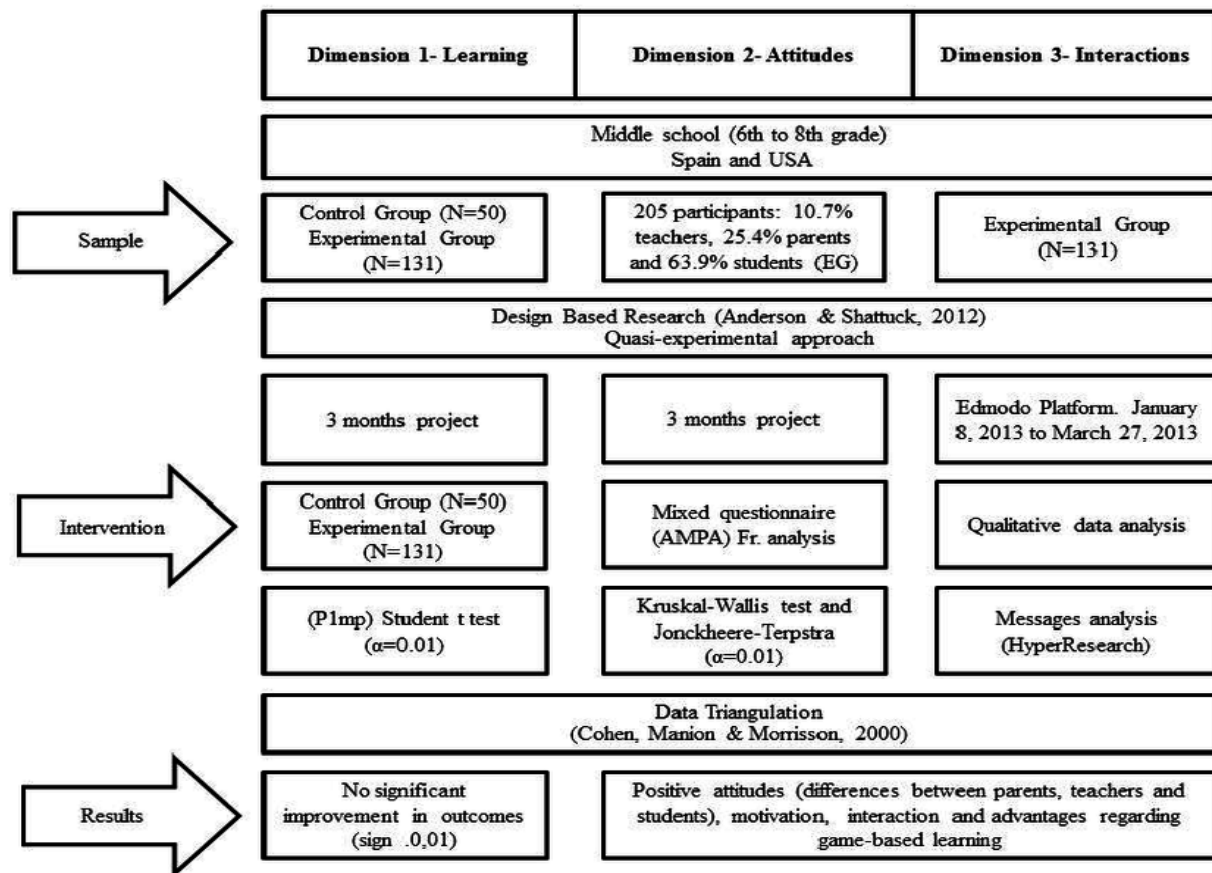


Figure (7): illustrate Questionnaire design and scope

4. Analyzing by sentiment analysis

The study analyzed the connection between how reading is taught and how well students are able to read by establishing sentiment analysis techniques as the independent variable, and reading comprehension ability as the dependent variable. The independent variable denotes how emotion and sentiment analysis tools are embedded into how reading is taught, while the dependent variable represents how students understand the texts they read, including understanding the main idea, drawing inferences from the text, and recognizing the emotional tone and author's point of view.

5. statistical analysis

Statistical analysis of the data included inferential and effect size tests. The statistical methods used to analyze the quantitative data included: the independent samples t-test to examine differences in mean reading comprehension scores after the test between the

experimental and control groups; the paired samples t-test to examine differences in mean reading comprehension scores before and after the test within each group; and Cohen's coefficient (d) to assess the size of the educational effect. Qualitative information collected from interviews and classroom observations was analyzed using common themes to identify patterns related to learners' interaction with their books and their comprehension processes, as well as their views on the use of emotion-based learning. Consistency and variance testing of the survey results were also conducted, and Cronbach's alpha coefficient was calculated. The cross-sectional value of Cronbach's alpha is 75%, indicating greater consistency among the survey's components. Correlation coefficients between the survey's components were also determined using Pearson's correlation coefficient [Lund, B. (2023, 1-10.).

4.results

Table 1:Demographic Characteristics of the Study Group

Variable	Category	Experimental Group (n = 30)	Control Group (n = 30)	p-value
Age (years)	Mean $\pm$ SD	21.3 $\pm$ 1.4	21.1 $\pm$ 1.6	0.58
Gender	Male, n (%)	14 (46.7%)	15 (50.0%)	0.8
	Female, n (%)	16 (53.3%)	15 (50.0%)	0.12
Academic Year	Second Year, n (%)	12 (40.0%)	11 (36.7%)	0.91
	Third Year, n (%)	18 (60.0%)	19 (63.3%)	0.43

Table(1) indicate that there are no statistically significant differences at baseline between the two groups (e.g., age, gender, or academic year) and that both groups were similar demographically at that time (i.e., the two groups were equal at the beginning of the study). Thus, the findings provide support for comparing learning outcomes in both groups later in the study.

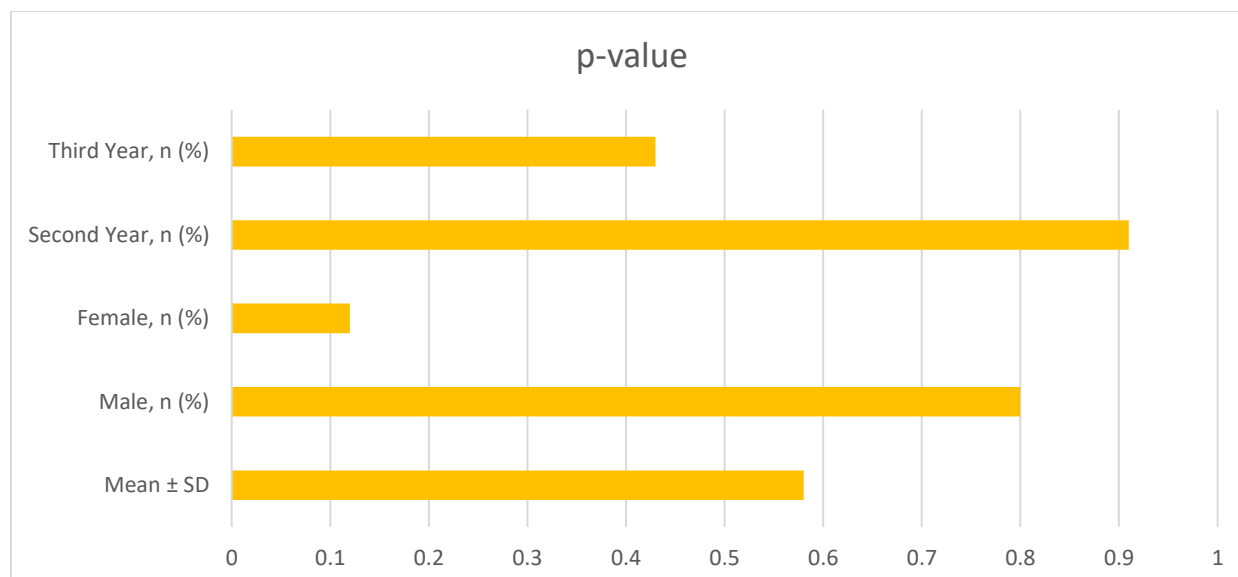


Figure 8: shows Demographic Characteristics of the Study Group

The demographic characteristics included in figure (8) are not statistically significant; all p values are greater than .05. Therefore, there are no statistically significant demographic differences between experimental and control groups for age, gender, and academic year. This demonstrates that prior to conducting this study, both experimental and control groups were comparable in demographic characteristics. Evidence to substantiate that both groups were equal prior to conducting an experimental study was also confirmed [Yu, J. H., (2025). 4307-4348].

Table 2: Language test results before and after the intervention procedure

score	Experimental Group (n = 30)	Control Group (n = 30)	F	p-value
Pre-test				
Mean ± SD	62.40 ± 6.85	61.90 ± 7.10	0.08	0.77
max-min	75 - 50	74 - 49		
Post-test				
Mean ± SD	78.60 ± 6.20	68.10 ± 6.75	38.94	< 0.001
max-min	90 - 65	80 - 55		

Table (2) shows that The results show no statistically significant differences ($p=0.77$) between the experimental and control groups regarding comprehension of reading before beginning their respective programs (pre-test), indicating both groups started on the same level (baseline equivalency). The analysis of the post-test indicated that there was a statistically highly significant difference ($p<0.001$) favoring the experimental group concerning improvement in reading comprehension due to instruction that used sentiment analyses [Baskara, R. (2023). 343-358].

Table 3: Questionnaire Dimensions, Reliability, and Importance Levels

Questionnaire Dimension	Number of Items	Possible Score Range	Cronbach's Alpha (α)	Mean Variance	p-value	Importance Level
Learner Engagement	6	6-30	0.88	4.25	0.012	High
Perceived Improvement in Reading Comprehension	7	7-35	0.91	4.4	0.017	High
Motivation and Ease of Learning	5	5-25	0.86	4.3	0.01	High
Overall Satisfaction and Perceived Usefulness	4	4-20	0.89	4.45	0.001	Very High
Total Questionnaire	22	22-110	0.93	4.35	0.01	High

Table (3) shows that there is very high internal consistency of Cronbach's Alpha (0.86 - 0.93) across all dimensions of the questionnaire used to collect the data. The high mean variance scores across all dimensions of the questionnaire reflect that learners perceived the advantages of using sentiment analyses in reading instruction in a positive way. All dimensions had statistically significant p-values ($p < 0.05$) and the overall satisfaction and perceived usefulness of the instructional approach were found to be the most important aspect of the instructional method. Therefore, the results confirm that the questionnaire is reliable and valid, and the instructional method was highly accepted by learners.

Table 4: Correlation Matrix among Questionnaire Dimensions (Pearson's r)

Dimension	Learner Engagement	Perceived Improvement in Reading Comprehension	Motivation and Ease of Learning	Overall Satisfaction
Learner Engagement	1			
Perceived Improvement in Reading Comprehension	0.72**	1		
Motivation and Ease of Learning	0.68**	0.70**	1	
Overall Satisfaction	0.75**	0.78**	0.74**	1

Table (4) shows The correlation coefficients range from .68 through .78 and such high correlations indicate that there is a direct relationship between increased engagement and a student's ability to read, be motivated, and be more easily taught. The comprehensive driving force of satisfaction correlates with all aspects of the questionnaire showing the combined elements of the questionnaire work together to promote reading comprehension.

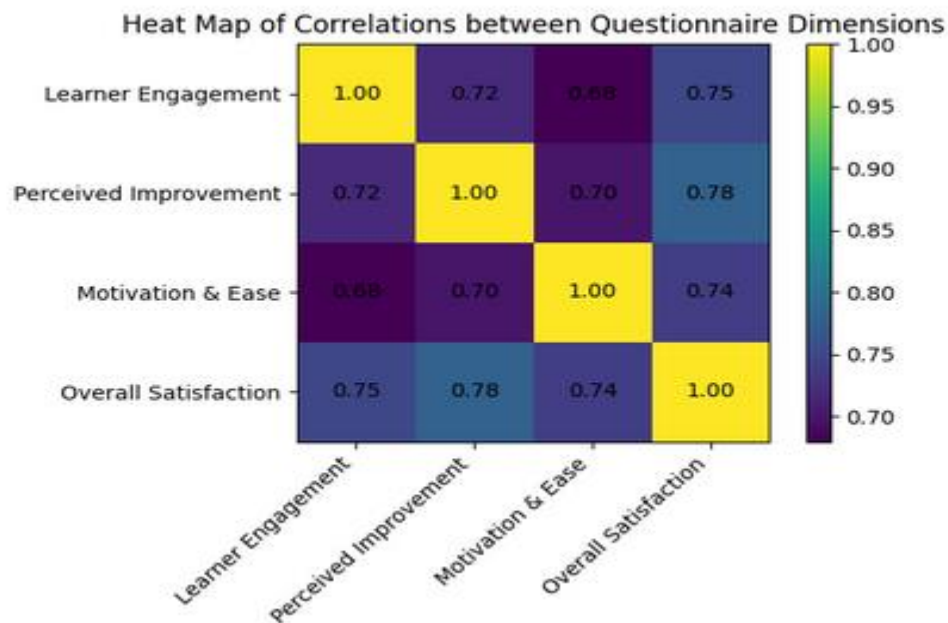


Figure 9: Heat map of correlation coefficients between survey axes

Figure (9), shows that there are strong positive correlations between all questionnaire axes (Correlation Coefficient between 0.68 – 0.78) The correlations are statistically significant at the 0.01 level. The results of this study suggest that learners who are highly engaged tend to have a better perception of reading comprehension; they are motivated to learn more, and find it easier to learn. They also tend to be satisfied with using sentiment analysis. The finding suggests that there is internal consistency across the questionnaire axes, and that they work together to support reading comprehension.

Table 5: Correlation between Questionnaire Dimensions and Reading Comprehension Post-test Score

Variable	Reading Comprehension Post-test Score	F	p-value
Learner Engagement	0.69**	26.84	< 0.001
Perceived Improvement in Reading Comprehension	0.74**	35.12	< 0.001
Motivation and Ease of Learning	0.71**	30.45	< 0.001
Overall Satisfaction and Perceived Usefulness	0.77**	41.08	< 0.001

Total Questionnaire Score	0.79**	46.67	< 0.001
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Pearson correlation coefficients indicate strong positive and statistically significant relationships between questionnaire dimensions and reading comprehension post-test scores.

** Correlation is significant at the 0.01 level ($p < 0.01$).

Table (5) shows that All Moderate Positive Relationships for All Questionnaire Dimensions Relative to Reading Comprehension Post-Test Scores The total questionnaire score demonstrated not only a significant correlation with reading comprehension post-test scores, but the highest positive correlation ($r = 0.79$) was with the perception of overall satisfaction and usefulness of the program ($r = 0.77$). This may indicate that as students engage more with the material, develop greater motivation to learn, develop a greater perception of progress or improvement from the course material, as well as develop a higher satisfaction level with taking the course, that their performance on reading comprehension increases [Kastrati, (2021), 3986.].

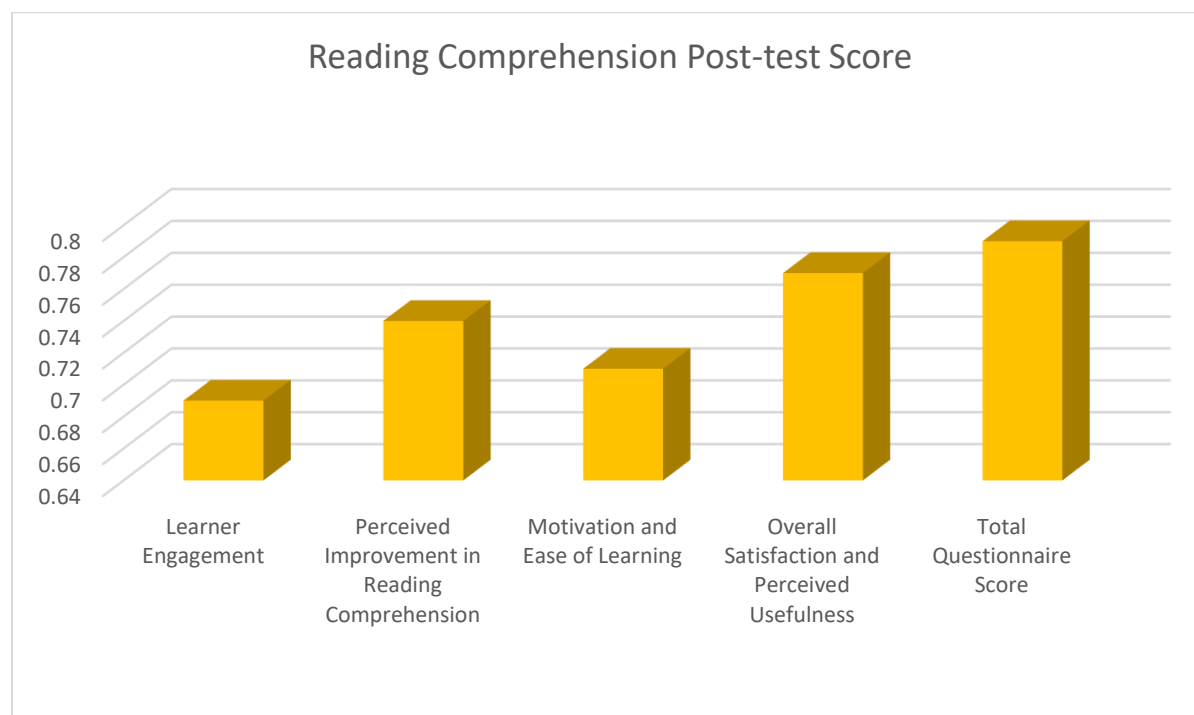


Figure 10: Correlation between Questionnaire Dimensions and Reading Comprehension Post-test Score

Figure (10) shows that there were strong associations between the five questionnaire dimensions and the participants' reading comprehension post-test scores. The total questionnaire score and overall satisfaction were the two highest associations, with perceived improvement in reading comprehension being third in ranking. This supports the conclusion that students' levels of engagement, motivation, and satisfaction have a

direct relationship with their ability to perform at a higher level in reading comprehension.

Table 6: Effect Size and Explained Variance of Sentiment Analysis on Reading Comprehension

Comparison	Mean Difference	Cohen's d	Explained Variance (%)
Experimental Group (Pre-test vs. Post-test)	16.2	2.1	52%
Control Group (Pre-test vs. Post-test)	6.2	0.65	10%
Experimental vs. Control Group (Post-test)	10.5	1.6	40%

Table (6) shows the experimental group's reading comprehension improved greatly from pre to post-test, had a very large effect size (Cohen's $d = 2.1$) and 52% of the post-test score was explained by the pre-test. On the other hand, the control group only had a moderate increase in reading comprehension after the intervention, $d = 0.65$ and explained 10% of the variance, therefore indicating that the intervention had a significant effect on the experimental group, as seen by the post-test results ($d = 1.6$) and 40% explained variance, compared to the control group.

6. Discussion

The conclusions reached by this research indicate that including Sentiment analysis methods into reading instruction for EFL learners has an extremely positive effect on improving reading comprehension of EFL learners. The Experimental Group performed much better on the Post-Test, as compared with the Control Group. When comparing performance between the Control Group and the Experimental Group, Sentiment-Based Instruction facilitated a more in-depth understanding of Text than Instruction without the use of Sentiment, by allowing learners to better recognize and distinguish between Emotional Tone, Author Stance, and Implicit Meaning, which are frequently very difficult for EFL learners to read and comprehend [Raharjo, (2025)., 485-496.].

The results of this study and the Positive Correlations between the dimensions in the questionnaires and the performance on the Post-Test Reading Comprehension support the Value of Pedagogy for the inclusion of Sentiment Analysis in Pedagogy. Positive Engagement, Improvements in Perception of Comprehension, Levels of Motivation, and overall Satisfaction related to Positive Engagement all correlate significantly with reading performance. Based on the findings from this research, the conclusion can be reached that Sentiment Analysis supports cognitive processing of Texts, and also supports Affective Engagement of EFL Learners, which are both critical factors for effective language acquisition [Hasan, (2024). 207-227.].

Moreover, given that the effect sizes are very sizable and the percentage of the variance explained is large, the improvement that is statistically significant has a real significance

in terms of education. The very large effect size that was documented within the experimental group serves to clearly indicate that the instructional intervention was robust. The results of this study are in agreement with both the constructivist and cognitive theories of reading and emphasise the importance of an active construction of meaning and also emotional input for a successful understanding of the meaning of text. Moreover, these findings correspond with previous research that has documented the effectiveness of technology-enhanced language learning tools in terms of their contribution to enhanced reading outcomes [Nugraha, (2025). 73-90.].

7. Conclusion

The conclusion of this research has been completed. "Sentiment Analysis Techniques" offer explicit assistance for aiding learners in their ability to read, and as such, provide a means for learners to develop a better skill set in reading comprehension in addition to their ability to effectively interpret their own reading [Oprea,. (2025)..]. The findings demonstrate that by using this type of instruction based on the use of "Sentiment, " significant increases can be observed in learners' level of achievement and motivation compared to traditional forms of "Reading." Educators and curriculum developers should therefore consider utilizing "Sentiment Analysis techniques" when developing reading curriculum for the "EFL" population. Additionally, there will be future research to determine whether this instructional approach will lead to similar results when examining the long-term effects of the instructional model and to determine whether the application of this type of instructional approach to individuals of varying proficiency levels will yield comparable findings. There should also be a study of the integration of other types of "AI Based Language Learning Technologies" into this instructional model.[Younis. (2023). 2864.]

7. Limitations and Future Research

Research limited due to the small size of the sample and also the limited time period for the instruction. Future investigations could address how well this general finding applies to long-term impacts, as well as the various proficiency levels of students learning to use AI-powered learning applications. In light of the conclusions from this study, one recommendation is for EFL teachers to incorporate the use of sentiment analysis tools in their teaching of reading in EFL to assist their students in improving their understanding of both the content of, and the emotional tone within, texts. By utilizing, in their teaching practice, the use of texts that have had their sentiments annotated and by leveraging the use of emotion-based reading task activities for students. Curriculum developers should also consider including these tools, such as sentiment analysis applications within the digital books they provide to their students, in order to support them in developing deeper engagement with the text and to cultivate critical reading abilities. Teacher training programs should also provide teachers with practical information about how to effectively use AI-powered educational tools in their teaching of language. Future researchers are also encouraged to conduct longitudinal studies examining how sentiment analysis affects various language abilities over time, as well as to explore how the application of sentiment analysis can be used across various proficiency levels of

language learners and to compare the effectiveness of different sentiment analyses when applied in different learning environments.

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