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# Enhancing advanced vocabulary in EFL writing: an AI-assisted intervention for English studies students in Poland

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**Abstract:** Effective use of advanced vocabulary is crucial for higher-level English language learners, particularly as they progress towards C1 proficiency according to the *Common European Framework of Reference for Languages* (CEFR). However, incorporating sufficiently sophisticated vocabulary in writing remains challenging for many learners. This quasi-experimental study investigated the effectiveness of an AI-assisted intervention designed to enhance awareness and use of advanced vocabulary among B2 level first-year English Studies students in Poland ($n$ = 71). The intervention, integrated into regular coursework over five sessions, included exposure to advanced vocabulary through reading, explicit instruction on word proficiency levels, and opportunities for vocabulary use in writing. Data were collected through summary writing and word recognition tasks. The CEFR checker, an AI-based text analyser, was employed to identify C1+ and B2 level vocabulary in students' writing. Results revealed modest but noticeable improvements in both the use and recognition of C1+ and B2 level vocabulary over time. The study also found changing correlations between vocabulary use and recognition across sessions, particularly for C1+ words. These findings highlight the potential of AI-assisted instruction in enhancing advanced vocabulary among higher proficiency EFL learners. The study contributes to the growing body of CALL literature on AI-assisted L2 instruction and opens avenues for further research on new pedagogical approaches to facilitate advanced vocabulary development in EFL writing.

**Keywords:** advanced vocabulary; EFL writing; higher proficiency learners; artificial intelligence; CEFR

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# 1 Introduction

Vocabulary constitutes a major component of texts and its use is explicitly stated in various writing assessment and examination rubrics (Leńko-Szymańska 2019). However, incorporating sufficiently advanced vocabulary in writing poses a challenge for many higher proficiency English language (L2) learners advancing towards the C1 level, the C1 level being defined by the *Common European Framework of Reference for Languages* (CEFR) (Council of Europe 2001, p. 23) as "an advanced level of competence suitable for more complex work and study tasks." Practitioners in L2 classrooms, like the present author who teaches EFL writing courses to English Studies students in Poland, can observe learners' difficulties, which are also documented in existing research. It has been reported that higher education L2 learners make limited progress in productive advanced vocabulary in writing (Hou 2017; Malmström, Diane, & Gustafsson 2016) and secondary school students tend to rely on simple, everyday language instead of academic or more sophisticated vocabulary in their written work (Maamuujav et al. 2021; Rokoszewska 2021). Moreover, studies have revealed that IELTS test takers often lack understanding of what vocabulary is considered advanced and perceive such words as unnecessary (Sajjad and Esmat 2023). These findings demonstrate the urgent need for effective instructional approaches to assist learners in developing an understanding of C1 level and higher (hereafter referred to as C1+) vocabulary and employing it appropriately in writing.

Research on technology-assisted vocabulary learning and teaching is extensive in the CALL field. In efforts to improve vocabulary learning outcomes, researchers have explored various tools, such as online dictionaries (e.g., Peters 2007), corpora (e.g., Tsai 2019), annotated 360° pictures (Papin and Kaplan-Rakowski 2024), visual novel games (e.g., Lai and Chen 2023), websites incorporating automatic speech recognition (Bashori et al. 2024), and glossed captions in Netflix series (Fievez et al. 2023). However, there is a gap in research on the efficacy of technology-assisted instruction specifically designed to raise awareness of word proficiency levels and advanced vocabulary use in writing among higher level L2 learners. The present study addresses this gap by focusing on the CEFR Checker (Cathoven A.I. 2023), a tool well-suited for this purpose.

To contextualise this study, two strands of research are considered. The first concerns awareness-raising vocabulary instruction for improving the quality of texts written by L2 learners, including explicit (focused) instruction aimed at raising learners' awareness of collocations (Oskuee et al. 2012), formulaic sequences (AlHassan and Wood 2015; Liou and Wen-Feng 2018), and academic lexical phrases (Cai 2016). The second strand is grounded in the growing body of literature within the CALL field which suggests that artificial intelligence (AI) technology can enhance L2 vocabulary

instruction. Research integrating AI-assisted approaches – such as conversational agents (e.g., Karataş et al. 2024; Pham et al. 2024), AI-driven platforms and mobile apps (e.g., Arini et al. 2022; Liang and Zhang 2024), image recognition and object detection (Hsu et al. 2023; Liu and Chen 2023), immersive environments (Divekar et al. 2022), as well as adaptive teaching materials (Yeh 2024), and computational thinking-based instruction (Tang and Ma 2024) – has demonstrated their effectiveness in various educational contexts. However, despite these advancements, a gap remains in the literature regarding AI-assisted interventions for advanced vocabulary development. Existing research has not explored the issue of improving advanced vocabulary recognition and use in writing, particularly in alignment with CEFR standards. Furthermore, there is a lack of research concerning the integration of AI to enhance L2 learners' awareness of word proficiency levels, which is relevant for advanced learners who face challenges in integrating sophisticated vocabulary into their writing.

Accordingly, a quasi-experimental study was conducted to investigate the effectiveness of an AI-assisted intervention designed to enhance awareness and use of advanced vocabulary in writing among B2 level first-year English Studies students in Poland. The underlying assumption of this study is that these students have knowledge of a substantial repertoire of words, including advanced ones, and understand the importance of using sophisticated vocabulary; however, they may lack clarity on which words are considered advanced or sophisticated. This problem is attributed to the absence of instruction on recognising *word proficiency levels* in alignment with CEFR standards. Specifically, students are not trained to distinguish between words at the C1+ level and those at lower levels, which leads to difficulties in incorporating advanced vocabulary into their writing. Thus, it was assumed that fostering learner awareness of *word proficiency levels*, in accordance with CEFR descriptors, was indispensable, alongside instruction on word form, meaning, and use (Barclay and Schmitt 2019; Schmitt 2019; Webb and Nation 2017). This research employs an AI-based text analyser, the CEFR Checker (Cathoven A.I. 2023), to facilitate the identification of word proficiency levels. As such, the present study adds to the growing body of CALL literature on AI-assisted L2 learning by contributing empirical evidence concerning advanced vocabulary instruction. It also informs L2 teachers and researchers about the benefits of using AI-based tools in the instructional process.

# 2 Literature review

## 2.1 Advanced vocabulary: conceptual considerations

The term "advanced vocabulary" does not have a precise definition (Juanggo 2018; Leńko-Szymańska 2019). Advanced – or sophisticated – words are generally conceptualised as

low-frequency, rarely used words (Crossley 2020; Kim et al. 2018). These words go beyond the 2,000 most commonly used words; they are determined based on word frequency data from corpora (Leńko-Szymańska 2019) and are typically found in specialised fields, e.g., academic texts (Crossley 2020). Apart from frequency, there has been limited consensus on the definition of advanced (sophisticated) words. Kim et al. (2018), for example, extend that definition and argue that advanced words are "words that are less frequent, less concrete, less imageable, less orthographically and phonologically dense, more specific, exposed and acquired at a later age, and processed more slowly" (p. 137). In addition to this, the conceptualisation of advanced lexical items has been expanded to include advanced bigrams and trigrams (Crossley 2020; Crossley and Kristopher 2018; Kim et al. 2018; Kyle and Crossley 2016). Yet, it is important to note that while relying solely on word frequency in defining advanced vocabulary has been criticised, corpus-based frequency information often remains a key classification criterion (Leńko-Szymańska 2019).

The CEFR (Council of Europe 2001, 2018), which establishes standards for L2 teaching and testing not only in Europe, does not explicitly define the term "advanced vocabulary" either. Rather, it provides criteria that describe vocabulary range and control at various proficiency levels. Specifically, the vocabulary range scale describes language users' or learners' ability in terms of "the breadth and variety of expressions used" (Council of Europe 2018, p. 132), while the vocabulary control scale denotes users' or learners' ability "to choose an appropriate expression from their repertoire" (Council of Europe 2018, p. 134), both of which, as Leńko-Szymańska (2019) points out, can be related to language proficiency complexity and accuracy. The C1 level, known as "Effective Operational Proficiency," is considered advanced as it "represents an *advanced level* of competence suitable for more complex work and study tasks" (CEFR 2001, p. 23; present author's emphasis). With this in mind, Tables 1 and 2 display the vocabulary scales for the C1 proficiency level, alongside the B2 and C2 levels for comparison.

As demonstrated above, the C1 level user exhibits a command of a wide range of vocabulary, including idioms and colloquialisms. Furthermore, while B2 level users can utilise the specialised vocabulary, C1 level users are able to employ a range of technical vocabulary. Notably, the C1 level user displays the command of less common vocabulary in a manner that is idiomatic and suitable, which is not mentioned for the B2 level user. This shows the differences between proficiency levels concerning the quality of vocabulary. However, the analysis also reveals that there exists ambiguity regarding the exact definition of "less common vocabulary" expected from C1 level learners and the differentiation between technical and/or specialist words deemed suitable for C1 as opposed to B2 levels. These uncertainties give rise to practical challenges, making it difficult for instructors and examiners to effectively teach and assess vocabulary in accordance with CEFR guidelines.

**Table 1:** Descriptors for vocabulary range (Council of Europe 2018, p. 132).

| B2 | C1 | C2 |
|---|---|---|
| Can understand and use the main technical terminology of their field, when discussing their area of specialisation with other specialists.<br>Has a good range of vocabulary for matters connected to their field and most general topics.<br>Can vary formulation to avoid frequent repetition, but lexical gaps can still cause hesitation and circumlocution.<br>Can produce appropriate collocations of many words/signs in most contexts fairly systematically.<br>Can understand and use much of the specialist vocabulary of their field but has problems with specialist terminology outside it. | Has a good command of a broad lexical repertoire allowing gaps to be readily overcome with circumlocutions; little obvious searching for expressions or avoidance strategies.<br>Can select from several vocabulary options in almost all situations by exploiting synonyms of even words/signs less commonly encountered.<br>Has a good command of common idiomatic expressions and colloquialisms; can play with words/signs fairly well.<br>Can understand and use appropriately the range of technical vocabulary and idiomatic expressions common to their area of specialisation. | Has a good command of a very broad lexical repertoire including idiomatic expressions and colloquialisms; shows awareness of connotative levels of meaning. |

**Table 2:** Descriptors for vocabulary control (Council of Europe 2018, p. 134).

| B2 | C1 | C2 |
|---|---|---|
| Lexical accuracy is generally high, though some confusion and incorrect word/sign choice does occur without hindering communication. | Uses less common vocabulary idiomatically and appropriately.<br>Occasional minor slips, but no significant vocabulary errors. | Consistently correct and appropriate use of vocabulary. |

## 2.2 CEFR-based vocabulary-oriented tools

The use of existing CEFR-based tools can offer substantial relief to instructors and examiners involved in English language teaching. Tools such as the *English Vocabulary Profile* (accessible at https://www.englishprofile.org/) or the *Oxford Advanced Learner's Dictionary* (accessible at https://www.oxfordlearnersdictionaries.com/) serve as valuable resources, providing precise information about word proficiency levels. Importantly, these tools enable instructors and learners to ascertain the

words and phrases that are known and utilised by language users at various, including advanced, CEFR levels. However, despite the usefulness of these tools, their integration into EFL writing courses presents its own set of challenges. The process of individually checking word proficiency levels using these tools can be very time-consuming for both teachers and learners. Moreover, the need to assess numerous texts written by multiple students throughout the course makes frequent word proficiency level checking impractical.

The CEFR Checker developed by Cathoven A.I. (2023) offers a solution addressing the aforementioned problems. The CEFR Checker is a text analyser that utilises artificial intelligence, i.e. natural language processing, techniques. This tool examines the structure of sentences, verb tenses, and vocabulary employed in a given text, making it possible to assess and estimate the corresponding CEFR level (Cathoven n.d.). What is important, however, information about its accuracy or reliability is not provided by developers at the time of writing this paper.

Moving forward, a question arises: how can the CEFR Checker be incorporated in the L2 classroom as a teaching tool to enhance students' awareness of advanced words and their ability to apply them in their writing? In order to address this issue, the next sections overview existing research on awareness-raising vocabulary instruction for improving the quality of texts written by L2 learners as well as research on AI-based tools for vocabulary instruction.

## 2.3 Research on awareness-raising vocabulary instruction for quality writing

Given the lack of research on the efficacy of technology-assisted instruction for raising the awareness of word proficiency levels and advanced vocabulary use in writing among higher proficiency L2 learners, this study builds on insights from previous research on explicit instruction. Specifically, it draws from studies focused on enhancing learners' awareness of collocations (Oskuee et al. 2012), formulaic sequences (AlHassan and Wood 2015; Liou and Wen-Feng 2018), and academic lexical phrases (Cai 2016). This strand of research provides a foundation for exploring how similar explicit instructional strategies can be applied using technology to support advanced vocabulary development.

In one study, Oskuee et al. (2012) aimed to understand the effect of pre-teaching vocabulary and collocations on writing development. The researchers made the assumption that learners can enhance their writing skills gradually over time, as a result of receiving instruction, feedback, and engagement in regular practice. Forty advanced EFL learners in Iran who completed intermediate and upper-intermediate courses were randomly assigned to either a control or experimental group, and pre-test and post-test

compositions were administered to both groups. The learners took part in twenty sessions of instruction and wrote five texts. In the experimental group, the learners were engaged in a treatment involving the selection of a topic of their interest, receiving instruction on relevant vocabulary related to various topics, and being provided with the phrases that were regarded as useful. They were also given exercises that allowed for vocabulary and collocations practice. After that, the learners were assigned a writing task that required them to write about a specific topic. The results indicate that pre-teaching vocabulary and collocations can be an effective strategy for enhancing students' writing quality, as there was noticeable difference between the two groups.

In the second study, AlHassan and Wood (2015) sought to investigate the effect of focused instruction of formulaic sequences on academic paragraph writing skills. Twelve participants – learners of English in Canada with different proficiency levels, ranging from lower-intermediate to upper-intermediate and advanced – were involved in the study. For a duration of ten weeks, the participants were taught formulaic sequences for 90 min per week. The researchers created lists of thematically arranged phrases using, among others, the Corpus of Contemporary American English. Worksheets were prepared to introduce the participants to the desired formulaic sequences and collocations. Explicit instruction was centered on awareness-raising, which involved the presentation stage, practice including activities such as writing introductory/concluding sentences using sentence frames or completing matching tasks, and the production stage, during which the participants were required to apply the target formulaic sequences in sentences. Three paragraphs – summaries written in response to the prompt – were produced by each participant, which were next rated by three judges. According to the first judge, there was a rise in scores across the three writing sessions. However, in two other judges' assessment, there was a moderate increase in mean scores between the pre-test and post-test, followed by a slight decrease in mean scores for the delayed post-test, although the latter still remained higher than the pretest mean. Based on their results, the researchers conclude that when an explicit instructional approach involving the presentation, practice and production stages is implemented for formulaic sequences, it can lead to an improved acquisition of the sequences.

Similarly, Liou and Wen-Feng (2018) conducted a study to examine the effects of teaching academic formulaic sequences on writing skills. The participants were fifteen EFL third-year English-major students taking a writing course at a private university, who had been learning English for a minimum of eight years. In this study, the explicit instruction was developed based on the principles of noticing, retrieving, and generating. Using these principles, the researchers created five-week instruction that focused on fifty specific formulaic sequences selected from five academic formula lists. The explicit instruction consisted of presentation, as well as practice and production activities. During the presentation stage, the participants were taught the meaning, usage, and functions of the targeted

formulaic sequences using example sentences and online corpus sources. Following the presentation stage, the participants were assigned in-class tasks such as constructing sentences or completing gap-filling and multiple-choice exercises using the formulaic sequences they had learned. In order to help the participants remember the formulaic sequences, the researchers gave them extra materials and assigned homework in which the students wrote a paragraph using at least three formulaic sequences they had learned. Additionally, they were required to read texts, write summaries, book reports and research reports. Research data were drawn from tests, writing tasks, and a questionnaire. It was found that explicit instruction led to an increase in the number of formulaic sequences used in the participants' writing, with 60 % of the taught sequences being present in their written work.

Finally, Cai (2016) incorporated genre-based pedagogy and corpus-informed explicit instruction in the teaching of academic lexical phrases. The course was structured into four units, each focusing on a different part of research articles, i.e. Introduction and Review, Methods, Results, and Discussion and Conclusion. This study was conducted in China with Masters students over 15 weeks, each lesson lasted 70 min. The academic formulas list and language learner corpora were the sources from which the lexical phrases were selected. Data were gathered via receptive knowledge test, genre and lexical phrases awareness test, knowledge scale, as well as the rewriting task. The findings showed that the participants made considerable progress in the understanding of lexical phrases, and learners with varying proficiency levels achieved comparable levels of proficiency after receiving instruction.

This body of research offers valuable insight into interventions aimed at improving the writing skills of advanced language learners through explicit instruction and the enhancement of their understanding of specific lexical items. The findings generally suggest that exposing learners to such vocabulary and explicitly teaching these phrases can increase their awareness and ultimately led to the incorporation of those into their own texts. However, there is a lack of empirical investigation into instruction focused on developing learners' knowledge of word proficiency levels. Consequently, there is limited understanding about the pedagogical practices that can enhance advanced vocabulary recognition and use in EFL writing classrooms.

## 2.4 Research on AI-based tools for vocabulary instruction

Advances in AI technology have created new opportunities for L2 vocabulary instruction. Consequently, the CALL field has seen growing interest in integrating AI-based tools to

support vocabulary learning, particularly among EFL learners. While research in this area is still emerging, initial studies have yielded promising results in terms of facilitating student vocabulary learning and teacher-led vocabulary instruction.

To support student learning, a range of AI technologies, including conversational agents, AI-driven language learning mobile apps, image recognition, object detection, and immersive environments, have been implemented. Conversational agents (chatbots) facilitate vocabulary learning by engaging learners in conversations during which learners can practise word meaning and use (Yildiz 2023). For instance, ChatGPT and Poe, by affording real-time dialogue interactions, enable students to learn new expressions, refine vocabulary to communicate with more precision, and build confidence in language use (Karataş et al. 2024; Pham et al. 2024; Yeh 2024). In addition, mobile apps such as Duolingo, Babbel, or NovoLearning adjust content based on learner performance (Arini et al. 2022; Liang and Zhang 2024; Zhao et al. 2024). Next, AI-supported image recognition and object detection technologies are used to contextualise vocabulary learning by connecting words with visual prompts, which helps learners associate vocabulary with real-world contexts (Hsu et al. 2023; Liu and Chen 2023). Lastly, immersive AI-extended reality (AI-XR) environments create conditions where learners engage in authentic conversation practice (Divekar et al. 2022).

AI also holds benefits for teachers as this technology allows for more efficient vocabulary instruction through the use of AI-powered platforms, chatbots, adaptive teaching materials, and computational thinking principles. Platforms, such as UNIPUS AIGC and iTEST, provide customised learning support and assessment (Wang et al. 2024). As to chatbots integrated into classroom activities, such as those built using Google's Dialogflow, those assist teachers in dynamic vocabulary assessment by providing graduated assistance (Jeon 2023). AI applications also support teachers in designing adaptive materials (Yeh 2024). Finally, interventions based on computational thinking principles have been employed to improve vocabulary use in essay writing (Tang and Ma 2024).

Taken together, although the reviewed studies demonstrate the potential of AI-based tools to enhance vocabulary learning, the benefits of applying these tools to support advanced vocabulary development in writing remains underexplored. Current studies have not addressed the issue of how AI can support learners' word recognition and use in writing in alignment with CEFR standards. Moreover, there is a need to investigate the role of AI technology in raising L2 learners' awareness of word proficiency levels. Accordingly, this study bridges these gaps by investigating the effectiveness of an AI-assisted intervention using the CEFR Checker to enhance B2 level students' awareness and use of C1+ and B2 level vocabulary in their writing. By employing the CEFR Checker, an AI-based text analyser, this study aims to provide empirical evidence on how AI-assisted instruction can improve students' ability to

recognise and incorporate advanced vocabulary into their writing. The investigation is guided by the following research questions (RQs):

**RQ1:** To what extent does the AI-assisted intervention improve students' use of C1+ and B2 level vocabulary in their writing over time?

**RQ2:** To what extent does the AI-assisted intervention improve students' recognition of C1+ and B2 level vocabulary in their writing over time?

**RQ3:** How does the relationship between vocabulary use and recognition change throughout the AI-assisted intervention?

# 3 Research design

This study adopted a quasi-experimental design with five repeated measurements across four treatment groups, all of which were taught by the author. The design was considered appropriate due to the use of intact classes and the researcher's inability to randomly assign participants to groups. All four groups received the same treatment to examine its effect across the groups. To assess progress over time, five assessments were administered. The independent variable in the study was the AI-assisted vocabulary instruction, while the dependent variables were: 1) the use of C1+ and B2 level words in writing, operationalised as the number of C1+ and B2 level words used by students in their summaries; and 2) the recognition of C1+ and B2 level words in own writing, operationalised as the number of these words correctly identified by students in their own summaries.

## 3.1 Participants

Participants were selected through convenience sampling from first-year BA full-time and extramural English Studies students enrolled in a Writing course, an obligatory component of the Practical English curriculum at a university in Poland. Initially, 103 students were enrolled in the course across four groups. However, only data from students who provided informed consent for the use of their coursework at the end of the course were analysed. Consequently, the final sample consisted of 71 students with the number of participants in each group varying across the sessions due to irregular student attendance (see Table 3 for detailed participant information).

**Table 3:** Participant information.

| Group | Number of enrolled students | Number of students who provided informed consent |
|---|---|---|
| G1 | 25 | 19 |
| G2 | 26 | 19 |
| G3 | 25 | 16 |
| G4 | 27 | 17 |
| Total | 103 | 71 |

The students' English language proficiency was approximately at the B2 level, as defined by the *Common European Framework of Reference for Languages* (CEFR) (Council of Europe 2001). This proficiency level was demonstrated by their performance on the extended B2 level secondary school leaving examination, which is a prerequisite for admission to the university programme. The CEFR, widely adopted in Europe and beyond to guide language curricula, examinations, and coursebooks, serves as a reference framework for this study due to its integration into the Polish educational system. Poland, as a member of the European Union, has aligned its foreign language education policies with the standards set in the CEFR, which defines language proficiency goals for each stage of education.

## 3.2 Instruments

Two tasks were used in this study: a summary writing task and a word recognition task. In the summary task, students were asked to write summaries of articles they had read. This task allowed the researcher to analyse the students' use of vocabulary, specifically focusing on the occurrence of B2 and C1+ level words. Each instance of a B2 or C1+ word used in the summary was awarded one point. The word recognition task required students to identify three B2 and three C1+ level words in their own writing. This task provided data on students' ability to recognise these words in their texts. Students could earn up to three points for correctly identifying B2 words and up to three points for C1+ level words.

The CEFR Checker (Cathoven A.I. 2023) was used during the intervention to identify B2 and C1+ level words in the students' texts. The tool was available without usage limitations or a subscription fee, presenting advantages in terms of time efficiency when determining word proficiency levels according to CEFR standards.

## 3.3 Intervention

Following the introductory session, the intervention took the form of five sessions integrated into the regular coursework. Each session consisted of three phases: 1) exposure to written texts containing vocabulary that corresponds to the target level (C1+), 2) the use of C1+ words in writing, and 3) explicit instruction on word proficiency levels with regard to C1+ versus B2 levels (see Tables 1 and 2 for the vocabulary scales corresponding to the B2, C1, and C2 proficiency levels). Those activities were considered optimal, following research results concerning the challenges in advanced writing (Hou 2017; Maamuujav et al. 2021; Malmström et al. 2016; Rokoszewska 2021; Sajjad and Esmat 2023) and explicit instruction of collocations (Oskuee et al. 2012), formulaic sequences (AlHassan and Wood (2015); Liou and Wen-Feng 2018), and academic lexical phrases (Cai 2016). Each stage is described in more detail below.

**Introductory session.** The intervention was initiated by the researcher-instructor discussing the quality of vocabulary the students are expected to produce, what vocabulary is considered advanced (C1+), and how it differs from B1 and B2 levels. The students were then displayed an online text (accessible at https://thinkingallowedjournal.weebly.com/university-life1/staying-motivated) written by a peer taking the course a year earlier, and were asked to find three B1 words, three B2 words, and three C1+ words. Afterwards, the instructor showed the text with words annotated according to their proficiency level using the CEFR Checker. B1 words were displayed in light blue, B2 words were in dark blue, C1 words were in yellow, C2 words were in orange, and words beyond the C2 level were in red (Figure 1). The students were instructed to check the accuracy of their answers.

**Exposure to written text.** Prior to class, the students were asked to read a free article from the *Nature*, *New Scientist*, or *Scientific American* websites. The websites were selected based on the assumption that these contain vocabulary that exemplifies the quality expected in the writing of advanced EFL learners (readability checkers were not employed for the measurement of text difficulty in this study). To ensure task completion, the students were asked to paste links to the articles of their choice in a specific space provided on Moodle – the Virtual Learning Environment platform provided by the researcher's university for online/blended learning and teaching.

**Using C1+ words in writing.** In class, the students did a summary writing task, i.e., the students were instructed to write a paragraph summarising the article read prior to class for 10 min. The writing was performed on paper and the minimum word count was not required for the summaries.

**Explicit instruction–noticing.** Having finished writing, the students did a word proficiency level recognition task. Specifically, they were asked to list three B2 words

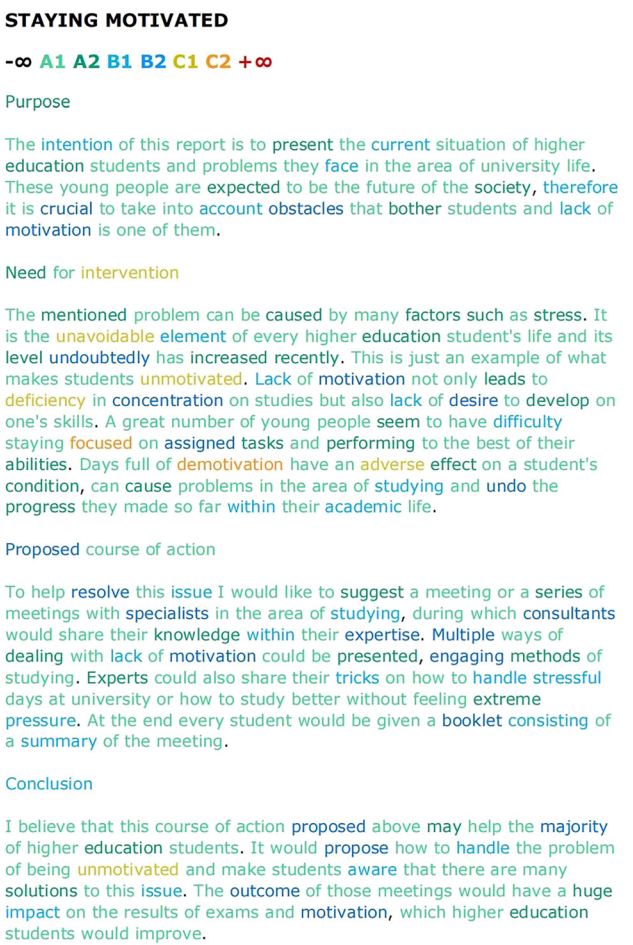


**Figure 1:** Introductory session. The text annotated with the CEFR checker displaying word proficiency levels.

and three C1+ words they used in their summaries below their text. The instructor collected the texts.

After class, the instructor typed the texts in MS Word, correcting spelling mistakes in the B2 and C1+ level words to enable their identification by the CEFR Checker. Next, each text was analysed using the CEFR Checker; B2 words were circled in blue and C1+ words were circled in orange by the instructor. The accuracy of the words provided by the students in the recognition task was also confirmed (Figure 2).

In the next class, the instructor returned the texts to the students, allowing them time to become familiar with the results. The students could seek clarification on any

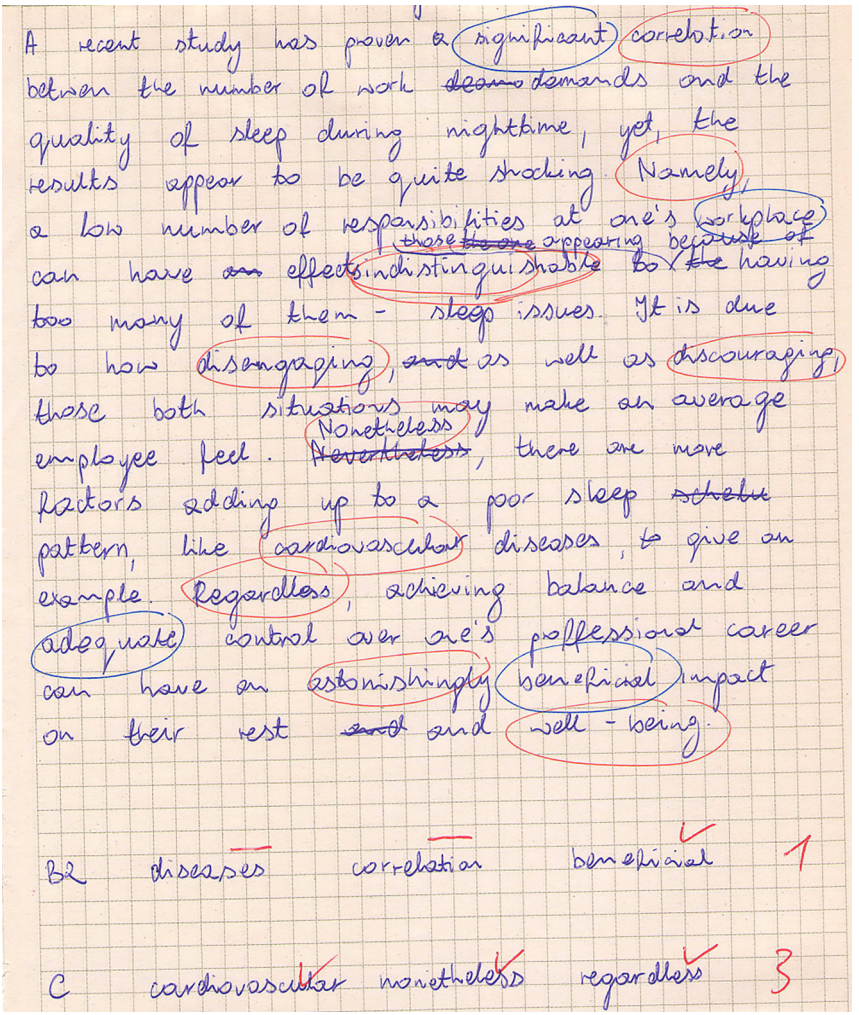


**Figure 2:** A sample of student text with words labelled for word proficiency levels using the CEFR checker.

questions or concerns they may have had regarding their work. After that, the students worked in small groups to complete two practice tasks. First, each student individually called out the words they used in their text for which other students were to supply word proficiency levels (B2 or C1+). The student who called out the word would then confirm the accuracy of the provided level. Next, the students would take turns in their group to recall the B2 (round 1) and C1+ words (round 2) used by themselves and their peers.

### 3.4 Data collection and analysis

Data were collected over five sessions within one winter semester (October-January). The full-time group ($n$ = 1) completed all the sessions by December, whereas the extramural groups ($n$ = 3) took a break over the Christmas period and had a final session in January. The summaries were analysed for the use and recognition of B2 and C1+ level words at the end of the intervention.

The analysis included both descriptive and inferential statistics. Descriptive statistics (frequency, means, standard deviations) were calculated for the number of B2 and C1+ words used and recognised in each session. As to inferential statistics, paired $t$-tests were conducted to compare performance between the first and last sessions. Pearson correlations were calculated to examine the relationship between word use and word recognition for both B2 and C1+ levels. Effect sizes were also calculated to determine the magnitude of observed changes; the Pearson correlation coefficient was used to provide effect size values, interpreted as small ($r$ = 0.25), medium ($r$ = 0.4), and large ($r$ = 0.6) (Plonsky and Oswald 2014). The analyses were conducted using GNU PSPP (PSPP – GNU Project 2013).

## 4 Results

### 4.1 Use of C1+ and B2 level words in the summaries

Table 4 shows that the mean number of C1+ level words applied in summaries increased from M = 4.74 (SD = 3.26) in Session 1 to M = 5.98 (SD = 3.68) in Session 4. Although there was a slight decline in the mean number of words used in Session 5 to M = 5.26 (SD = 2.98), this was still higher than the mean number of words used in Session 1. A paired-samples $t$-test was conducted to determine whether a statistical difference existed in the number of C1+ words used by the students between the first

**Table 4:** Used C1+ level words – mean number of words per session.

| Sessions | Number of students | Mean nr of words | SD |
|---|---|---|---|
| Session 1 | 69 | 4.74 | 3.26 |
| Session 2 | 60 | 4.97 | 3.00 |
| Session 3 | 63 | 5.49 | 4.04 |
| Session 4 | 64 | 5.98 | 3.68 |
| Session 5 | 65 | 5.26 | 2.98 |

**Table 5:** Used C1+ level words – distribution of the number of students by the number of words used per session.

| Number of words | Number of students in Session 1 | Number of students in Session 2 | Number of students in Session 3 | Number of students in Session 4 | Number of students in Session 5 |
|---|---|---|---|---|---|
| 0 words | 3 | 3 | 0 | 1 | 0 |
| 1 word | 5 | 5 | 8 | 5 | 3 |
| 2 words | 8 | 5 | 7 | 4 | 7 |
| 3 words | 12 | 8 | 8 | 8 | 11 |
| 4 words | 15 | 7 | 7 | 6 | 12 |
| 5 words | 3 | 8 | 7 | 7 | 8 |
| 6 words | 8 | 8 | 8 | 10 | 3 |
| 7 words | 5 | 4 | 4 | 5 | 6 |
| 8 words | 1 | 2 | 3 | 5 | 5 |
| 9 words | 0 | 5 | 2 | 3 | 6 |
| 10 words | 2 | 2 | 2 | 2 | 1 |
| 11 words | 3 | 2 | 3 | 3 | 0 |
| 12 words | 2 | 1 | 0 | 1 | 1 |
| 13 words | 1 | 0 | 1 | 0 | 1 |
| 14 words | 1 | 0 | 0 | 2 | 0 |
| 15 words | 0 | 0 | 0 | 1 | 1 |
| 16 words | 0 | 0 | 1 | 0 | 0 |
| 17 words | 0 | 0 | 1 | 1 | 0 |
| 18 words | 0 | 0 | 0 | 0 | 0 |
| 19 words | 0 | 0 | 0 | 0 | 0 |
| 20 words | 0 | 0 | 1 | 0 | 0 |

and last sessions. The results did not reveal a statistically significant difference ($t(63) = -0.93$, $p = 0.358$) between the number of C1+ words used in Session 1 and Session 5, and the effect size was small ($r = 0.2$).

Table 5 presents the distribution of the number of students using C1+ words in their summaries across the sessions. In Sessions 1 and 2, many students applied up to 7 words in their texts, but rarely used more than 8 words (though there were 5 students who used 9 words in session 2), and none of them used 15 words or more in their texts. In addition, in Session 1, there were three students who did not apply any Cl+ level words. In Sessions 3 and 4, there were a few students who applied 8 or more words, with one student applying 20 words in their text in Session 3. In the last session, there were no students who displayed the use of 0 words.

As presented in Table 6, the mean number of B2 level words used in summaries increased from M = 4.87 (SD = 2.33) in Session 1 to M = 6.27 (SD = 2.67) in Session 4 (Table 5). While there was a decrease in Session 5 (M = 5.5, SD = 2.63), the mean

**Table 6:** Used B2 level words – mean number of words per session.

| Sessions | Number of students | Mean nr of words | SD |
|---|---|---|---|
| Session 1 | 69 | 4.87 | 2.33 |
| Session 2 | 60 | 5.40 | 3.04 |
| Session 3 | 63 | 6.08 | 2.58 |
| Session 4 | 64 | 6.27 | 2.67 |
| Session 5 | 65 | 5.51 | 2.63 |

number of words was higher than the mean number of words used in Session 1. The results of the paired-samples *t*-test did not reveal a statistically significant difference (t (63) = –2.06, $p$ = 0.44) between the number of B2 words used in the first and last sessions, but the effect size was medium ($r$ = 0.5).

Table 7 presents the distribution of the number of students applying B2 words in their summaries across the sessions. In Session 1, while many students applied up to 7 words, they rarely used more than 8 words in their texts, albeit one student used 13 words in their text. In Sessions 2–5, there were slightly more students who used 8 or more words, with one student applying 14 words in their texts in Session 2 and 4.

**Table 7:** Used B2 level words – distribution of the number of students by the number of words used per session.

| Number of words | Number of students in Session 1 | Number of students in Session 2 | Number of students in Session 3 | Number of students in Session 4 | Number of students in Session 5 |
|---|---|---|---|---|---|
| 0 words | 2 | 0 | 1 | 0 | 0 |
| 1 word | 3 | 4 | 0 | 2 | 3 |
| 2 words | 4 | 4 | 2 | 1 | 2 |
| 3 words | 9 | 6 | 8 | 6 | 8 |
| 4 words | 12 | 14 | 9 | 6 | 11 |
| 5 words | 14 | 11 | 8 | 13 | 15 |
| 6 words | 11 | 6 | 8 | 10 | 8 |
| 7 words | 7 | 2 | 8 | 9 | 7 |
| 8 words | 3 | 4 | 7 | 4 | 2 |
| 9 words | 2 | 1 | 4 | 3 | 3 |
| 10 words | 1 | 2 | 6 | 6 | 2 |
| 11 words | 0 | 3 | 1 | 2 | 1 |
| 12 words | 0 | 1 | 1 | 1 | 2 |
| 13 words | 1 | 1 | 0 | 0 | 1 |
| 14 words | 0 | 1 | 0 | 1 | 0 |

**Table 8:** Identified C1+ level words – mean number of words per session.

| Sessions | Number of students | Mean nr of words | SD |
|---|---|---|---|
| Session 1 | 69 | 1.04 | 0.99 |
| Session 2 | 60 | 1.43 | 1.00 |
| Session 3 | 63 | 1.59 | 1.04 |
| Session 4 | 64 | 1.73 | 1.00 |
| Session 5 | 64 | 1.72 | 1.02 |

## 4.2 Recognition of C1+ and B2 level words in the summaries

As displayed in Table 8, the mean number of C1+ level words recognised in summaries increased from M = 1.04 (SD = 0.99) in Session 1 to M = 1.73 (SD = 1.00) in Session 4, with a slight decline in Session 5 (M = 1.72, SD = 1.02) (Table 7). The results of the paired-samples *t*-test revealed a statistically significant difference (t (62) = –3.97, $p$ = 0.00) between the number of C+ words found in Session 1 and Session 5. The effect size was small ($r$ = 0.3).

Figure 3 displays the distribution of the number of students who recognised C1+ words in summaries across the sessions (Figure 2). The number of students not recognising any words decreased, from 24 students in Session 1 to 8 students in Sessions 4 and 5. In addition, the number of students recognising 3 words increased, from 8 students in Sessions 1 and 2 to 18 students in Session 5.

Table 9 indicates that the mean number of B2 level words identified in summaries increased from M = 0.91 (SD = 0.90) in Session 1 to M = 1.09 (SD = 0.85) in Session 5. However, there was a small decrease in Session 4 with M = 0.94 (SD = 0.77). The results of the paired-samples *t*-test did not reveal a statistically significant difference (t (62) = –1.24, $p$ = 219) between the number of B2 words found in Session 1 and Session 5, and the effect size was small ($r$ = 0.033).

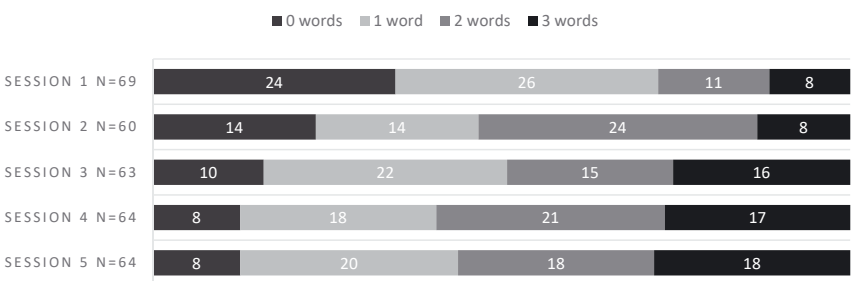


**Figure 3:** Identified C1+ level words – distribution of the number of students by number of words identified per session.

**Table 9:** Identified B2 level words – mean number of words per session.

| Sessions | Number of students | Mean nr of words | SD |
|---|---|---|---|
| Session 1 | 69 | 0.91 | 0.90 |
| Session 2 | 60 | 0.92 | 0.83 |
| Session 3 | 63 | 0.97 | 0.95 |
| Session 4 | 64 | 0.94 | 0.77 |
| Session 5 | 64 | 1.09 | 0.85 |

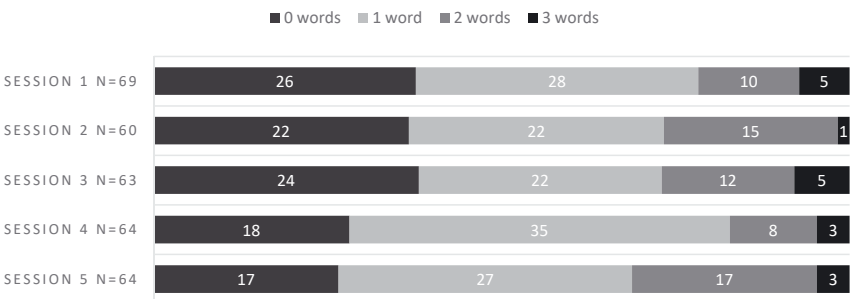


**Figure 4:** Identified B2 level words – distribution of the number students by number of words identified per session.

Figure 4 presents the distribution of the number of students who recognised B2 words in their summaries across the sessions. Sessions 1–3 presented a similar distribution of words recognised, many students identifying 0 words or 1 word, a few of them identifying 2 words, but very few identifying 3 words. In Session 4, the majority of students found 1 word, and, at Session 5, there were more students who identified 2 words, compared with previous sessions. Moreover, the number of students recognising 0 words slightly decreased across the sessions, from 26 students in Session 1, to 17 students in Session 5.

## 4.3 Changes in the word use-recognition relationship over time

Word use and recognition were positively correlated, as presented in Tables 10 and 11. For the C1+ level words, all the correlations were strong and statistically significant, the strongest being in Session 1 ($r$ = 0.677) and second strong in the final session. With regard to the B2 level, the correlation was the strongest and statistically significant in Session 1 ($r$ = 0.485). The correlations in the next two sessions were far

**Table 10:** R-Person for C-level vocabulary applied and vocabulary identified across sessions.

| | S1 vocabulary identified | S2 vocabulary identified | S3 vocabulary identified | S4 vocabulary identified | S5 vocabulary identified |
|---|---|---|---|---|---|
| S1 vocabulary used | 0.677* | | | | |
| S2 vocabulary used | | 0.537* | | | |
| S3 vocabulary used | | | 0.506* | | |
| S4 vocabulary used | | | | 0.558* | |
| S5 vocabulary used | | | | | 0.598* |

*$p < 0.05$.

**Table 11:** R-Person for B2-level vocabulary applied and vocabulary identified across sessions.

| | S1 vocabulary identified | S2 vocabulary identified | S3 vocabulary identified | S4 vocabulary identified | S5 vocabulary identified |
|---|---|---|---|---|---|
| S1 vocabulary used | 0.485* | | | | |
| S2 vocabulary used | | 0.154 | | | |
| S3 vocabulary used | | | 0.218 | | |
| S4 vocabulary used | | | | 0.269* | |
| S5 vocabulary used | | | | | 0.382* |

*$p < 0.05$.

weaker and not statistically significant, though the value of the coefficient increased in the last two secessions, from $r = 0.154$ ($p > 0.05$) to $r = 0.382$ ($p < 0.05$) and was statistically significant.

# 5 Discussion

This study explored the impact of the AI-assisted instructional procedure that involved exposing students to advanced vocabulary through reading, having them use the target vocabulary in writing, and teaching about the proficiency level of the

lexis used by the students. Overall, it was found that the instruction led to modest but noticeable gains in the use and recognition of C1+ and B2 vocabulary. Importantly, while the intervention led to statistically significant gains in C1+ word recognition only, the remaining results provide valuable insights into vocabulary learning in this group of participants.

Specifically, the results of the study showed that the students' use of C1+ and B2 level words in writing improved across the sessions, with a slight deterioration in performance observed at the end of the instruction period. This finding is consistent with earlier research on the effects of explicit instruction of lexis among advanced EFL learners (Cai 2016; Liou and Wen-Feng 2018; Oskuee et al. 2012), including research in which a drop in scores after training was observed (AlHassan and Wood 2015). Although this is an encouraging finding, it also raises questions about the power and the lasting impact of the intervention on the use of advanced vocabulary in writing and suggests that students may need longer and more systematic support in the application of C1+ and B2 vocabulary in their writing.

Secondly, the students demonstrated improvement in their ability to identify C1+ and B2 level words, as indicated by their performance on the word recognition task. Although the number of words recognised was also modest, there was a positive trend in the number of recognised words over time, with a greater increase observed in C1+ level words compared to B2 level words. This novel finding suggests that, despite remaining challenging, identifying C1+ level words may be easier with the instruction provided. Overall, these results suggest that the classroom intervention helped improve students' word recognition skills, but continued long-term practice seems to be necessary to consolidate this emerging ability.

The relationship between vocabulary use and recognition changed over the course of the AI-assisted intervention, as evidenced by the correlation analysis. The study found significant and strong correlations between word use and word recognition at the C1+ level, suggesting that the students were quite aware of their use of C1+ words in their writing. However, in spite of the growing strength, only weak to moderate correlations were found when correlating word use with word recognition at the B2 level. This result suggests that the intervention did assist the students in incorporating C1+ and B2 words in their writing, with a more pronounced effect observed for C1+ words. Importantly, these findings imply that the growth of C1+ and B2 words usage cannot be separated from the development of word proficiency level recognition. As such, these results provide novel insights that have not been reported in prior research.

The integration of the CEFR Checker, an AI-based text analyser, represents a new approach to improving the use of advanced vocabulary in writing among higher proficiency learners. This study aligns with current CALL research investigating the potential of AI-based tools to increase the effectiveness of L2 vocabulary

teaching and assessment (e.g., Divekar et al. 2022; Jeon 2023; Tang and Ma 2024). The small but noticeable improvements suggest that such tools may supplement traditional instruction, potentially leading to more substantial vocabulary gains over time. Yet, the results also indicate the challenges of vocabulary learning at advanced levels and the need for longer-term, explicit instruction even with technological (AI) support.

Several limitations need to be addressed in this study. First and foremost, since the reliability of the tool is unknown, the results should be interpreted with caution. Next, the present study focused on the development of individual words, and not idiomatic, colloquial, etc., phases, which was due to the fact that the CEFR checker can analyse individual words only. Consequently, these types of lexical items were not evaluated in the students' texts and were not incorporated into the instruction. Therefore, future studies could investigate the effectiveness of instructional interventions designed to improve students' use and recognition of more complex lexical items, such as phrasal verbs, idioms, and colloquialisms. Another limitation of the study is that the instructional intervention was organised in five sessions, which means that the findings represent only short-term outcomes rather than longer-term learning gains. For this reason, the study does not provide information about knowledge retention, i.e., the impact of instruction on the learners' ability to use target vocabulary accurately and appropriately in the long run. Hence, longitudinal research that investigates the development of advanced vocabulary over an extended period of time could be conducted. Lastly, only quantitative data were gathered in the current study. Future research could, thus, investigate individual students' perceptions regarding the intervention, which may require collecting qualitative data through participant interviews. This would allow for a more comprehensive understanding of the role of AI tools in word proficiency level instruction within CALL.

The findings of this research have implications for the teaching of advanced vocabulary in EFL writing contexts. As advanced vocabulary is essential for higher proficiency L2 students to produce texts of the expected quality, it is crucial to design EFL writing courses in a way that facilitate the acquisition of learners' knowledge of word proficiency levels in accordance with CEFR standards. Based on the findings, it is vital to expose learners to advanced vocabulary, explicitly teach them these phrases, provide opportunities for learners to recognise these words, and use them in students' own writing. EFL teachers may, therefore, consider incorporating the activities presented in this study into their coursework. The CEFR Checker (Cathoven A.I. 2023) – an AI-based tool employed in this study – emerges as a valuable teaching aid due to its ability to determine word proficiency levels in alignment with CEFR standards. Specifically, it can provide relief from the time-consuming process of

individually checking word proficiency levels for EFL teachers and examiners. Furthermore, integrating this tool in the vocabulary learning process may allow higher proficiency learners to gain clarity on which words are considered advanced, contributing to the improvement in the recognition and use of advanced vocabulary in EFL writing among these L2 learners.

# 6 Conclusions

This study has demonstrated that an AI-assisted intervention, comprising exposure to advanced vocabulary, instruction on word proficiency levels, and the production of target words in writing, can lead to gains in the recognition and use of advanced vocabulary in EFL writing. Despite the limitations, this research makes a contribution to both theory and practice in the area of EFL writing. Specifically, this study adds to the growing body of CALL literature on AI-assisted L2 learning by providing empirical evidence regarding advanced vocabulary instruction. By using the CEFR Checker as an instructional tool, the study informs both L2 teachers and researchers about the benefits of AI-assisted instruction. All in all, this inquiry opens avenues for further investigation and the implementation of new AI-assisted pedagogical approaches that promote advanced vocabulary recognition and use among higher proficiency L2 learners-writers.

**Use of Large Language Models, AI and Machine Learning Tools:** ChatGPT was used to improve the language of this manuscript.

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# Bionote

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