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Research Paper

Investigating the Effects of Synchronous and Asynchronous Teacher Electronic Feedback on EFL Learners' Syntactic Complexity in Online Writing

Sahar Azareh[1], Elham Mohammadi[2], & Aiyoub Jodairi Pineh[3]

[1]English Language Department, Faculty of Humanities, University of Zanjan, Zanjan, Iran; *sahar.azarh@gmail.com*

[2]Corresponding author, English Language Department, Faculty of Humanities, University of Zanjan, Zanjan, Iran; *e_mohammadi@znu.ac.ir*

[3]English Language Department, Faculty of Humanities, University of Zanjan, Zanjan, Iran; *j.pineh@znu.ac.ir*

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Abstract

The present study aims to investigate the impacts of teacher electronic feedback (TEF) on syntactic complexity of online writing produced by advanced English as Foreign Language (EFL) learners. A total of 180 argumentative essays were written by 33 advanced EFL learners in a language institute in Zanjan, Iran. The learners were randomly assigned to two experimental groups and a control group, with twelve learners receiving synchronous TEF, and twelve learners receiving asynchronous TEF. Eight measures of complexity were used to calculate the learner's syntactic complexity. For data analysis, a series of one-way ANOVAs and two-way ANOVAs were performed to respectively ensure the participants' homogeneity prior to treatment and analyze the development of syntactic complexity over time. The results indicate that synchronous TEF provided through video conferencing and text chats, significantly improved the production of compound-complex sentences and longer noun phrases, while asynchronous TEF using Microsoft Word track changes had only a significant effect on the length of noun phrases. The findings indicate that synchronous and asynchronous TEF can be effective in increasing learners' syntactic complexity, and that combining both strategies may be the most effective approach for teachers to provide feedback in online writing classes.

***Keywords*:** Corrective Feedback; Electronic-Feedback; Synchronous Feedback; Asynchronous Feedback; Syntactic Complexity; Online Writing Class

1. Introduction

In recent years, writing in EFL/ESL classes has received significant attention with the learners' writing performance being a persistent concern. According to Bultè & Housen (2014), complexity has emerged as a crucial construct in investigating L2 writing development. Similarly, Martínez (2018) argues that syntactic complexity is one of the key factors influencing writing quality of students' essays. Her study found that essays with higher linguistic complexity received higher holistic ratings. Bultè and Housen (2012) defined complexity and introduced their taxonomy of complexity constructs after investigating a considerable body of research by that time. Based on this taxonomy, complexity consists of three areas: linguistic complexity, discourse-interactional complexity, and propositional complexity. In L2 writing research, linguistic complexity has received the most attention among researchers, where "linguistic complexity can be investigated at the level of the language system as a whole (or of its major subsystems) and at the level of the individual linguistic features (forms, structures, patterns, rules) that make up such (sub-) systems" ((Bultè & Housen, 2014, pp. 43-44). Syntactic complexity, a component of linguistic complexity, is recognized as an important construct in L2 writing studies (Yin et al., 2021). While Martínez (2018) demonstrates a link between syntactic complexity and writing quality, factors influencing and potentially increasing syntactic complexity remain unclear. Recognizing the variables that contribute to higher syntactic complexity is essential for EFL teachers in applying effective treatments in writing classes. As Hyland and Hyland (2006, p. 83) argue, feedback is a "central aspect of L2 writing",

and it seems logical to consider it as one of the elements affecting syntactic complexity. The increasing importance of online learning has highlighted the significance of examining feedback, particularly in the context of online classes. However, EFL teachers face challenges in providing personal feedback to students in online classes (Atmojo & Nugroho, 2020). Despite its importance, electronic feedback remains understudied, with little known about its effectiveness (Ene & Upton, 2018). To address this gap, this study aims to investigate the impact of the timing of teacher electronic feedback (TEF) on learners' syntactic complexity. Specifically, it investigates synchronous and asynchronous teacher electronic feedback (TEF) in online EFL writing class. Synchronous TEF involves feedback during online classes through video conferencing and text chats, while asynchronous TEF involves post-class feedback via electronic drafts with comments and track changes. The present study explores to determine how synchronous and asynchronous TEF influence the syntactic complexity of essays written by L2 learners online. In other words, it seeks to compare learners' writing performance in terms of various measures of syntactic complexity prior to delivering the feedback with their post-feedback performance in addition to comparing them across the groups to identify the most effective type of feedback to improve the syntactic complexity. Hence, the following research questions are formulated:

1. Do learners' syntactic complexity levels change significantly from pretest to posttest within the group receiving synchronous teacher electronic feedback?

2. Do learners' syntactic complexity levels change significantly from pretest to posttest within the group receiving asynchronous teacher electronic feedback?

3. Do the changes in syntactic complexity vary significantly across the different groups (i.e. synchronous, asynchronous, and control)?

2. Literature Review

Recent years have seen a surge on L2 writing in EFL research, with exploring various aspects of this skill. Writing skills are crucial for EFL learners, and studies have examined factors that influence performance and quality of students' writing (Naghdipour, 2016). Syntactic complexity is pivotal in determining writing quality, with numerous studies indicating its importance (e.g., Jiang et al, 2019; Martínez, 2018). Despite the interest researchers have shown in complexity, defining and measuring it lack consensus. Bultè and Housen (2014), for instance, examined empirical studies and found that there are at least 40 measures to assess complexity, but observed that many of these measures suffer from low content validity due to their narrow operationalization of the constructs.

On the other hand, feedback as an indispensable part of writing pedagogy has transformed from teacher-written comments to new means such as peer and computer-delivered feedback over the past twenty years (Hyland & Hyland, 2006). Recent studies have shown that corrective feedback (CF) can have a positive impact on L2 writing accuracy (Bitchener & Knoch, 2010). Yet, with the emergence of computer-mediated communication and online learning, little is known about the effectiveness of feedback in online classes. The following section reviews the relevant literature on syntactic complexity and corrective feedback.

2.1. Feedback

Feedback, crucial for learning, comes from various sources: teacher, peer, or tutor (Ene & Upton, 2018). It supports learning and evaluates performance (Hattie & Timperley, 2007). Feedback aids learning and assesses achievement (Joughin, 2009). However, SLA theories differ on feedback's impact; some consider it harmful, while others view it as essential. While behaviorist theories perceive errors negatively, Chomsky's Generative Grammar sees errors as indicative of learners' mental processes (Chomsky, 1959). In Acquisition-Learning Hypothesis, Krashen (1985) distinguished between language acquisition and learning. In this theory, learning a language occurs consciously, while its acquisition happens intuitively. Accordingly, explicit instructions and CF play no role in language acquisition, and they only have a limited role in language learning (Jin et al., 2016).

In EFL writing research, teacher-written feedback on students' essays is an essential aspect of pedagogy (Li, 2013; Cheng & Zhang, 2021). Responses to linguistic errors, known as CF, are a traditional tool that EFL teachers apply to improve students' accuracy in writing (Mao & Lee, 2020). With the rapid growth of technology and developments in adoption of technological devices, the role of computers in providing and delivering feedback has become more salient (Hyland & Hyland, 2006). Recently, new means of delivering CF, such as electronic feedback, have been widely used in

EFL writing classes. In this approach, teachers provide electronic feedback (TEF) on students' work by using online platforms such as chats, forums, or Microsoft Word Processing (Chang et al., 2018; Elola & Oskoz, 2017).

Considering the timing, teachers can deliver feedback to students while writing an essay or after completing their work (Shintani, 2016). Synchronous e-feedback is delivered when students and teachers interact in real time, and students receive feedback spontaneously during writing through digital technology such as online chat boxes (Hussien et al., 2021). In contrast, asynchronous TEF involves the teacher feedback after students have completed their writing task. Chang et al. (2018) argues that asynchronous TEF is the most common type of electronic feedback; it involves text editors with review features such as Microsoft Word and Google Docs.

The debate over the effectiveness of CF in improving grammatical accuracy has persisted since Truscott's (1996) claim that grammar correction is ineffective and does not help students' accuracy. While Chandler (2003) and Ferris (2006) reported improvements, their studies lacked control groups. Later studies, like Bitchener et al. (2005), supported the efficacy of CF in enhancing accuracy. Ferris (2010) advocated blended research designs for better understanding, recommending a focus on specific errors. Studies on Iranian EFL learners (Hosseiny, 2014; Abuseileek & Abualsha'r, 2014) and Chinese university students (Chen et al., 2016) echoed the benefits of CF in improving writing skills and test scores.

Regarding the timing and method of feedback delivery, Ene and Upton (2018) found synchronous and asynchronous electronic feedback effective, especially when combined. While research on CF's impact on syntactic complexity is limited, studies by Van Beuningen et al. (2012) and Fazilatfar et al. (2014) demonstrated positive outcomes. However, recent studies by Valizadeh and Soltanpour (2021) and Valizadeh (2020) suggest mixed results, indicating a need for further investigation.

With respect to electronic CF, in a study by Tan et al. (2022), it was revealed that combining automated written CF and asynchronous computer-mediated communication lead to better results in terms of complexity in writing. Kataoka et al. (2024) study also found that the group who received TEF showed greater learning gain in grammar error categories in speaking than the group who did not receive TEF. Additionally, Savaşçı and Akçor (2023) referred to the benefits of screen casting as a multimodal technology-mediated feedback in improving second language writing and boosting students' engagement and motivation in writing classes. The effectiveness of TEF for writing competence was recently confirmed in Oktay and Öcal (2023) and Taskiran et al. (2024) as well.

2.2. Syntactic Complexity

Complexity in language learning refers to the richness and intricacy of learners' language production (Ellis & Barkhuizen, 2005). It encompasses various sub-constructs and components, with linguistic complexity being a primary focus (Bultè & Housen, 2012). Syntactic complexity, a subset of linguistic complexity, is crucial in L2 writing research (Jagaiah et al., 2020; Ha, 2022). It involves compound and complex sentences (Yang et al., 2015), evolving at sentential, clausal, and phrasal levels (Norris & Ortega, 2009).

Various metrics exist to gauge syntactic development, yet consensus is lacking (Ansarifar et al., 2018). Traditionally, however, there are two strands of syntactic complexity measurements: first, the traditional T-unit based measures, which focus on the length of production, and second, the fined-grained measures, which focus on clausal and phrasal complexity (Martínez, 2018).

Empirical studies have delved into various measures aimed at assessing syntactic complexity in academic writing. Bultè & Housen (2012) conducted a comprehensive review of 40 studies, identifying ten measures that primarily focused on the average length of linguistic units, such as T-units and words per sentence. Expanding on this work, Yang et al. (2015) categorized syntactic complexity into global and local-level measures, including mean length of sentence, T-unit per sentence, and more. Additionally, Jagaiah et al. (2020) synthesized findings from 36 studies, reporting a total of 48 measures, with mean T-unit length being among the most common.

Although research about syntactic complexity has broadened our understanding of language produced by EFL learners and the different variables affecting it, we do not yet know the extent to which syntactic complexity improvement leads to better scores gained by holistic ratings (Casal & Lee, 2019). Furthermore, studies have demonstrated improvements in lexical complexity and sentence structures over time (Mazgutova & Kormos, 2015). However, the precise relationship between syntactic complexity and writing quality remains a topic of ongoing debate (Crossley &

McNamara, 2014). While some researchers argue that increased syntactic complexity leads to higher-quality writing, others suggest that syntactic complexity alone may not guarantee superior writing outcomes.

Moreover, several factors influence syntactic complexity. L1 background, for instance, has been shown to impact syntactic structures, with differences observed among English learners from diverse linguistic backgrounds (Lu & Ai, 2015). Additionally, topic choice and genre play significant roles in shaping syntactic complexity (Staples & Reppen, 2016). Different writing tasks, varying in complexity and planning conditions, also affect syntactic development, highlighting the dynamic nature of language production (Rahimi & Zhang, 2018).

In light of these findings, it is evident that syntactic complexity is a multifaceted construct influenced by a myriad of factors. Further research, therefore, is necessary to elucidate the intricate relationship between syntactic features and writing outcomes, thereby enhancing our understanding of language proficiency and development.

3. Methodology

To explore the impact of synchronous and asynchronous TEF on Iranian EFL learners' written syntactic complexity, the current study employed a quasi-experimental (pretest, posttest) design. In other words, Time which represents pretest and posttest, and Feedback which entails three levels (synchronous, asynchronous, control) serve as independent variables of the study while eight measures of syntactic complexity are regarded as dependent variables.

3.1. Participants

Thirty-three participants were selected via convenience sampling from adult upper-intermediate EFL learners in Safir Language Academy, Zanjan, Iran. Three classes were randomly assigned to as control, synchronous TEF, and asynchronous TEF groups, consisting nine, twelve, and twelve learners, respectively. Participants attended general English classes for two six-week semesters, with three weekly sessions. The participants comprised six males and twenty-seven females, ranging in age from 17 to 36.

The homogeneity of English knowledge was established via placement tests aligned with CEFR (The Common European Framework of Reference for Languages), indicating a B2 proficiency level. Representative sampling was employed to enable generalizability of the findings to Iranian upper-intermediate EFL learners. The wide range of syntactic complexity identified in the essays confirmed the heterogeneity of the participants. Therefore, it is believed that the sample is representative enough to make cautious generalizations. In addition, ethical considerations were taken into account by ensuring participant confidentiality and informed consent.

3.2 Materials and Instruments

3.2.1. The Course Book (Viewpoint 1)

The course book used during the study was Viewpoint 1 (McCarthy et al., 2012). Viewpoint 1 is an innovative high-intermediate course book for EFL learners around the globe, designed to help learners communicate successfully and fluently in today's world. The book consists of twelve units covering four skills: speaking, listening, reading, and writing. Each unit has a specific writing syllabus focusing on the key processes, language, and text organization skills essential to successful academic writing. Based on CEFR, Viewpoint 1 corresponds to the B2 level, which is suitable for upper-intermediate EFL learners.

3.2.2. The Online Learning Environment

During the study, the participants used an online platform named Skyroom, a specifically designed tool to run online classes. In this platform, the teacher and the learners can interact simultaneously through video conferencing and a chat box. The teacher can upload the material and the presentations to Skyroom, which the learners can then download them. This online platform equips the teachers with what they have in traditional classes, such as a board and a system to play the audio files.

3.2.3. Syntactic Complexity Measures

A plethora of measures is available in the literature to gauge the syntactic complexity of a piece of written text. Considering the aims of this study, we used the eight syntactic complexity measures (Martínez, 2018) driven from Bultè

and Housen's (2014) study. These eight measures which gauge the complexity at sentential, clausal, and phrasal levels are: mean length of sentence, simple sentence ratio, compound sentence ratio, complex sentence ratio, compound-complex sentence ratio, coordinated clause ratio, dependent clause ratio, and mean length of noun-phrase. In this regard, the mean length of a sentence is obtained by counting the total of the words in an essay divided into the number of sentences. For sentence composition, the number of simple, compound, complex, and compound-complex sentences are divided into the total number of sentences. The coordinated clause ratio is obtained by dividing the total number of coordinated clauses into the number of sentences. The dependent clause ratio is calculated by dividing the total number of dependent clauses into the total of clauses in a piece of written text. Finally, the mean length of noun phrases is the total number of words in noun phrases divided into the total number of noun phrases.

Table 1. *Measures of Syntactic Complexity (Bulté & Housen, 2014)*

Length of sentential unit
- Mean length of sentence (word/sentence)
Sentence composition
- Simple sentence ratio
- Compound sentence ratio
- Complex sentence ratio
- Compound complex sentence ratio
Proposition combining and clause linking:
- Coordinate clause ratio (coordinated clauses/sentence)
- Dependent clause ratio (dependent clauses/clause)
Syntactic phrasal complexity:
- Mean length of noun phrase (noun phrase/clause)

3.3. Procedure

Initially, the researchers chose upper-intermediate classes in Safir Language Academy using convenience sampling. The learners were from three distinct classes, which were randomly labeled as the control, synchronous TEF, and asynchronous TEF group. At the beginning of the semester, the Oxford Placement Test was administered to ensure the homogeneity of the participants. The learners participated in the study for two semesters comprising of twelve weeks. Every two weeks, the teacher provided the learners with a specific argumentative topic, and they wrote essays during class time.

The learners in the synchronous group received feedback on their essays during class time through video conferencing and an online chat box, while the asynchronous group received feedback after the class, before the following writing, in Microsoft word format through comments and track changes. No feedback was provided for the control group, but some extra writing practice activities were delivered as a placebo. The researcher chose the topics from IELTS Cambridge Series (1-16) and to reduce the topic effect, the first and the last essays were about the same topic.

The first essay written by learners was considered the pretest, and the sixth essay was considered as the posttest. The pretests and posttests were archived in Microsoft Word format. The researchers calculated all eight syntactic complexity measures for each essay and recorded them in a Microsoft Excel table. Later, this table was used for later data analysis.

To answer the research questions about the possible effects of synchronous and asynchronous TEF on written syntactic complexity, a series of one-way ANOVAs were conducted to examine the homogeneity of syntactic complexity measures in the pretest writing samples. Next, in order to identify how learners have developed across the three groups over time with regard to the measures of syntactic complexity, a series of two-way ANOVAs were performed.

4. Results

The research questions were aimed at identifying how the syntactic complexity of learners developed within and across the three groups over time by focusing on its eight measures. In other words, there were three groups who were examined on two occasions (prior to and after the treatment sessions). Learners had a pretest at the beginning and several essay-writing tasks during the research process. Each essay was analyzed in terms of eight measures of syntactic

complexity. A posttest was finally administered to identify any significant differences among and within the groups. To analyze and interpret the research findings, SPSS version 25 was employed.

Initially, a test of normality was run to ensure the normal distribution of data and select a proper statistical technique (parametric or non-parametric) for data analysis. The results of Kolmogorov-Smirnov statistics indicated that the data distribution is normal. Hence, parametric statistical techniques were chosen for data analysis. Table 2 shows the descriptive statistics for the eight components of syntactic complexity. The abbreviations are used to represent various components of syntactic complexity (i.e., MLS: Mean Length of Sentence; PSS: Proportion of Simple Sentences; PCdS: Proportion of Compound Sentences; PCxS: Proportion of Complex Sentences; PCdCxS: Proportion of Compound-Complex Sentences; CCR: Coordinate Clause Ratio; DCR: Dependent Clause Ratio; MLNP: Mean Length of Noun Phrases).

Table 2. *Descriptive Statistics for Eight Measures of Syntactic Complexity*

	Group	Mean	Std. Deviation	Std. Error Mean
Syntactic Complexity (N= 66)	MLS	10.20	33.80	20.5189
	PSS	.00	.66	.2802
	PCdS	.00	.60	.1562
	PCxS	.00	.66	.3244
	PCdCx	.00	.71	.2300
	CCR	.00	1.50	.5808
	DCR	.07	.45	.2853
	MLNP	1.52	3.16	2.2235
	Valid N (listwise)			

One-way ANOVA was initially conducted to find whether there is a significant difference in the pretest scores in terms of writing syntactic complexity. The results, presented in the table below, revealed that there is no statistically significant difference between the participants' scores for all the measures of syntactic complexity in their pretest. This indicates that the students in three groups were homogenous regarding their syntactical complexity prior to the treatments.

Table 3. *The Results of ANOVA for all the Pretest Scores*

Measures of Syntactic Complexity (Pretest)	Sum of Squares	Mean Square	F	Sig.
MLS	5.423	2.712	.176	.840
PSS	.062	.031	1.280	.293
PCdS	.008	.004	.189	.829
PCdCxS	.030	.015	.614	.548
PCxS	.048	.024	1.582	.222
CCR	.033	.016	.165	.849
DCR	.009	.005	.649	.530
MNLP	.390	.195	1.550	.229

Since the scores of the learners' syntactic complexity regarding its eight variables in the three groups were compared on two different occasions (i.e., before and after the implementation of feedback as the treatment), two-way ANOVA was adopted as an appropriate analytical technique to compare the mean scores. Therefore, a series of two-way ANOVAs were performed. Subjects were divided into three groups according to the type of feedback they received (i.e., Group 1: synchronous feedback, Group 2: asynchronous feedback, Group 3: no feedback). Time 1 includes the scores collected before the learners received synchronous and asynchronous feedback for their writing (i.e. pretest scores) and Time 2 refers to the scores obtained after delivering the treatment (i.e. posttest scores).

The results obtained for syntactic complexity measures of the study are reported in two following sections. The first focuses on MLS, PSS, PCdS, and PCxS and the second on PCdCxS, CCR, DCR, and MLNP.

4.1. The Results for Measures of MLS, PSS, PCdS, and PCxS

In order to explore the simultaneous impact of time and group on the learners' writing syntactic complexity in terms of the measures, a two-way ANOVA was performed. Table 4 shows the results for all above-mentioned variables (i.e., MLS, PSS, PCdS, and PCxS).

Table 4. *The Results of Tests of between Subjects Effects for the Measures of MLS, PSS, PCdS, and PCxS (All Groups Combined)*

	Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
MLS	Time	151.369	1	151.369	7.810	.007
	Group	29.019	2	14.509	.749	.477
	Time * Group	24.981	2	12.490	.644	.529
PSS	Time	.196	1	.196	9.144	.004
	Group	.004	2	.002	.093	.911
	Time * Group	.114	2	.057	2.660	.078
PCdS	Time	.019	1	.019	1.043	.311
	Group	.036	2	.018	.978	.382
	Time * Group	.005	2	.002	.130	.878
PCxS	Time	.004	1	.004	.154	.696
	Group	.018	2	.009	.359	.700
	Time * Group	.022	2	.011	.442	.645

The interaction between time and grouping had no significant effect on the MLS scores, *F (2, 60) = .644, p=.53*. There was a significant main effect for time, *F (1, 60)* = 7.81, *p*=.007. An increase was observed in total MLS scores across all three groups from Time 1 (M=18.90, SD=3.82) to Time 2 (M=22.12, SD=4.83), indicating that the mean MLS score for the posttest was significantly different from the pretest. However, the main effect for grouping *F (2, 60)* = .749, *p*=.477, was not statistically significant.

The results for the next measure, PSS, demonstrate that there was no statistically significant interaction between time and grouping, *F (2, 60) = 2.66, p=.078*. Learners had a different performance in the posttest (M=.34, SD=.157) compared to the pretest (M=.21, SD=.138), and this suggested a significant main effect for time, *F (2, 60) = 9.144, p=.004.* However, the main effect for grouping (*F (2, 60) = .093, p=.91)*, was not statistically significant.

As for the measure of syntactic complexity PCdS, the outcome of two-way ANOVA showed a non-significant interaction between time and grouping, *F (2, 60) = .13, p=.87*. In addition, there was no statistically significant main effect for time, (*F (2, 60)* = 1.04, *p*=.31) and neither was the main effect for grouping, (*F (2, 60)* = .97, *p*=.38).

Regarding the changes of PCxS variable over time and across different groups, the statistical analysis revealed no significant interaction between time and grouping (*F (2, 60) = .44, p=.64)*. Furthermore, there was no statistically significant main effect for time, *F (1, 60)* = .154, *p*=.696, and neither was the main effect for grouping, *F (2, 60)* = .359, *p*=.70.

Regarding the first and second research questions, the results indicated that among the four measures of syntactic complexity, MLS and PSS were positively influenced by the type of feedback, synchronous and asynchronous, received by the learners.

Next, we conducted multiple comparisons to examine the differences between study groups in terms of syntactic complexity mentioned earlier. Table 5 below presents the outcome of analysis.

Table 5. *Multiple Comparisons for the Measures of MLS, PSS, PCdS, and PCxS*

Tukey HSD

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
MLS	Synchronous	Asynchronous	-.5963	1.27086	.886
	Control	Synchronous	-1.0769	1.37268	.714
		Asynchronous	-1.6732	1.37268	.447
PSS	Synchronous	Asynchronous	-.0167	.04227	.918
	Control	Synchronous	.0013	.04565	1.000
		Asynchronous	-.0154	.04565	.939
PCdS	Synchronous	Asynchronous	-.0550	.03940	.349
	Control	Synchronous	.0243	.04255	.836
		Asynchronous	-.0307	.04255	.752
PCxS	Synchronous	Asynchronous	-.0371	.04572	.698
	Control	Synchronous	.0293	.04939	.824
		Asynchronous	-.0078	.04939	.986

To answer the third research question, the actual difference in the mean scores between the groups was observed. In terms of MLS, the difference was found to be quite small and non-significant, suggesting that the type of feedback given to the learners had no statistically significant effect on this measure of complexity. This indicated that learners had tendency to use longer sentences in their last essay compared to their first essay, regardless of the type of feedback received. These results are consistent with the ANOVA findings.

With regard to PSS, while learners used fewer simple sentences in their last writing task compared to their first, the analysis reveals no significant difference among the groups. Therefore, this suggests that despite an increase in the syntactic complexity over the time, the type of feedback given as the treatment did not statistically affect learners' scores in terms of PSS. This may imply the overall effectiveness of feedback regardless of the time of its delivery.

A multiple-comparison analysis of PCdS reveals that there were no significant differences among the mean scores across the groups. Therefore, providing the two types of feedback did not significantly influence learners' PCdS scores.

Concerning the measure of PCxS, it was observed that learners in both synchronous (M=.32) and asynchronous (M=.35) groups performed better in the posttests. However, the mean difference between the groups was not statistically significant. This suggests that the provided feedback did not have a significant influence on the number of complex sentences used in the learners' essays.

In conclusion, the analysis of first four measures of syntactic complexity reveals no significant difference between the study groups. This finding provides a part of the answer to the third research question.

4.2. The Results for Measures of PCdCxS, CCR, DCR, and MLNP

The same statistical test (i.e., two-way ANOVA) was conducted to examine any changes in the variables of *PCdCxS* CCR, DCR, and MLNP.

Table 6. *The Results of Tests of between Subjects Effects for the Measures of PCdCxS, CCR, DCR, and MLNP*

	Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
PCdCxS	Time	.298	1	.298	14.303	.000
	Group	.167	2	.083	3.993	.024
	Time * Group	.061	2	.031	1.473	.237
CCR	Time	.057	1	.057	.469	.496
	Group	.049	2	.024	.201	.819
	Time * Group	.120	2	.060	.495	.612
DCR	Time	.002	1	.002	.233	.631
	Group	.001	2	.001	.110	.896
	Time * Group	.010	2	.005	.794	.457
MLNP	Time	.023	1	.023	.214	.646
	Group	.833	2	.417	3.814	.028
	Time * Group	.005	2	.002	.022	.978

In regard to the component of PCdCx, the analysis revealed that the interaction between time and grouping was not statistically significant, $F\ (2, 60) = 1.4$, $p=.23$. However, there was a statistically significant main effect for time, $F\ (1, 60) = 14.3$, $p=.00$, showing that the mean PCdCx score for the post-test (M=.304, SD=.174) was significantly higher than the pretest (M=.161, SD=.125). Additionally, the main effect for grouping was statistically significance $(F\ (2, 60) = 3.9, p=.024)$.

Exploring the potential impact of time and grouping on the learners' CCR scores showed that there is not a statistically significant interaction between the two variables, $F\ (2, 60) = .49$, $p=.61$. Moreover, no significant difference was observed for the main effect of time ($F\ (1, 60) = .46$, $p=.49$) and grouping ($F\ (2, 60) = .2$, $p=.81$).

DCR, as the next measure of syntactic complexity, was examined using the same statistical procedure. The interaction between time and grouping was found to be statistically non-significant, $F\ (2, 60) = .794$, $p=.457$. Also, no statistical difference was observed for the time ($F\ (1, 60) = .233$, $p=.631$) and grouping ($F\ (2, 60) = .110$, $p=.896$) variables.

Concerning how MLNP has changed, the analysis revealed that the interaction between time and grouping was not significant (*F (2, 60)* = .022, *p*=.97*)* on the learners' relevant scores. However, a statistically significant main effect for grouping was observed, *F (2, 60)* = 3.814, *p*=.028, indicating that the mean MLNP scores were significantly different among the study groups. In contrast, the main effect for time did not show any statistical significance (*F (2, 60)* = .21, *p*= .64).

Based on this analysis, among the four measures of the syntactic complexity (i.e. PCdCxS, CCR, DCR, and MLNP) it appears that PCdCxS is the only variable that shows significant changes as a result of receiving synchronous feedback. Therefore, PCdCxS provides a partial answer to the first question of the study.

Then a series of multiple comparisons were conducted to examine the differences among study groups regarding the variables of PCdCxS. CCR, DCR, and MLNP. As Table 7 shows, with respect to PCdCx a significant difference (*p=.018*) was observed between synchronous (M=.401, SD=.13) and asynchronous groups (M=.24, SD=.13) with a mean difference of .1175. This finding suggests a significant impact of synchronous feedback on the number of compound-complex sentences used by the learners.

Table 7. *Multiple Comparisons for the Measures of PCdCxS, CCR, DCR, and MLNP*

Tukey HSD

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
PCdCxS	Synchronous	Asynchronous	.1175*	.04170	.018
	Control	Synchronous	-.0675	.04504	.299
		Asynchronous	.0500	.04504	.512
CCR	Synchronous	Asynchronous	.0596	.10066	.825
	Control	Synchronous	-.0079	.10873	.997
		Asynchronous	.0517	.10873	.883
DCR	Synchronous	Asynchronous	.0108	.02319	.887
	Control	Synchronous	-.0043	.02505	.984
		Asynchronous	.0065	.02505	.963
MLNP	Synchronous	Asynchronous	-.2308*	.09541	.048
	Control	Synchronous	-.0063	.10306	.998
		Asynchronous	-.2371	.10306	.063

The results for the differences between study groups with respect to the variable of CCR are presented in the above table. Given that, no significant difference was found between the study groups. Therefore, this suggests that providing the two types of feedback did not result in any statistically significant change between the groups in terms of CCR scores.

With regard to the variable of DCR, the results show that learners in the asynchronous group outperformed in the posttest, (M=.30). However, the mean difference did not exhibit any statistical significance for this variable. This suggests that asynchronous feedback had no significant impact on the ratio of dependent clauses found in the learners' essays.

As the above table indicates with respect to MLNP, there is a significant difference (*p=.048*) in learners' scores between synchronous (M=2.14, SD=.32) and asynchronous groups (M=2.39, SD=.36). This finding suggests that the learners receiving the two types of feedback outperformed on MLNP compared to the control group.

In view of these results, the ultimate response to the third research question can be stated in the following way. Among all measures of syntactic complexity, PCdCxS showed significant difference across the study groups. More precisely, synchronous group outperformed the asynchronous group in terms of proportion of producing compound-complex sentences. Additionally, a non-significant impact of asynchronous feedback was also observed regarding DCR compared to other groups. Learners receiving asynchronous feedback produced slightly more dependent clauses than the rest of the participants. Lastly, the performance of learners in both feedback groups (synchronous and asynchronous) was found to be significantly superior on MLNP when compared to the control group. Receiving feedback regardless of its timing had a positive influence on the length of noun phrases.

5. Discussion

The findings of the present study indicated that both synchronous and asynchronous TEF had a positive impact on syntactic complexity in writing. Regarding the first research question, the researchers investigated impacts of synchronous TEF on syntactic complexity. The analysis revealed that providing synchronous TEF increased the number of compound-complex sentences (PCdCxS) and the length of noun phrases (MLNP) produced by learners. Therefore, the first null hypothesis was refuted. Considering the second research question, the findings revealed that asynchronous TEF had also a positive impact on syntactic complexity. More precisely, this type of feedback helped learners produce longer noun phrases (MLNP) compared to the control group which rejects the relevant null hypothesis. In order to answer the third research question, a comparison of the two types of feedback was conducted. It was found that TEF was more effective in promoting the use of compound-complex sentences, while asynchronous TEF was more effective in increasing the length of noun phrases. At the same time, both groups outperformed the control group in using lengthy noun-phrases.

The results of this study contradict Truscott (1996) and Valizadeh and Soltanpour (2021). Truscott (1996) claimed that when feedback is given, learners tend to use less complex constructions. Accordingly, he claimed that grammar correction is ineffective and should be abandoned since it does not help learners' accuracy. Valizadeh and Soltanpour (2021) focused on direct CF by using a pretest-treatment-posttest design. After calculating five syntactic complexity indices, it was concluded that CF did not affect the syntactic complexity of the learners. Unlike Truscott's (1996) and Valizadeh and Soltanpour (2021), the present study's results show that synchronous and asynchronous TEF in online writing classes effectively develop the learners' syntactic complexity. The students produced more at least in terms of compound-complex sentences and lengthy noun phrases.

The findings of this study corroborate the claim that providing corrective feedback makes a positive change in online writing classes. Synchronous and asynchronous modes of CF affect the syntactic complexity and grammatical accuracy of the EFL learners. These results are consistent with numerous studies that investigated the effectiveness of feedback in improving EFL learners' writing skill (e.g., Fazilatfar et al., 2014; Hosseiny 2014; and Van Beuningen et al., 2012). For example, Van Beuningen et al. (2012) explored the impact of direct and indirect CF on L2 learners' written accuracy. The findings revealed that CF improved accuracy during revision and in new writing texts. Similarly, Fazilatfar et al. (2014) found that unfocused CF led to syntactic and lexical complexity. The measurement was carried out by calculating the subordination ratio and the average length of sentences in learners' written texts.

Particularly, the current study's findings on the electronic facet of feedback and its overall positive impact on writing complexity are compatible with Tan et al. (2022) who noted the same phenomenon in writing due to combining automated CF and offline electronic feedback. Kataoka et al. (2024) also reported greater learning gains in the productive skill of speaking through the use of TEF. Savaşçı and Akçor (2023), in a similar vein, unmasked the effectiveness of screen casting, a form of e-feedback, on improving second language writing. Furthermore, recent studies such as Oktay and Öcal (2023) and Taskiran et al. (2024) confirmed the usefulness of TEF for enhancing writing competence, which are in line with the outcome of the present study.

Finally, the findings of this study reinforce what Ene and Upton (2018) had claimed earlier. They observed that despite higher frequency of teacher asynchronous feedback compared to synchronous mode, the proportion of TEF that ended in successful revision was high for both feedback types. Hence, it can be suggested that combining synchronous and asynchronous TEF may be an effective strategy for teachers to use in online writing classes.

6. Conclusion

This study aimed to enrich existing body of feedback research and inform the development of online writing instruction. Feedback is a well-established approach and remains crucial in enhancing writing, as supported by numerous studies (e.g., Ene & Upton, 2018; Hattie & Timperley, 2007; Joughin, 2009). Our findings highlight the importance of feedback, delivered via different modalities (online vs. offline), in enhancing syntactic complexity. Synchronous TEF was found to be significantly influential in developing compound-complex sentences and noun-phrase length, while asynchronous TEF also had positive effect on noun-phrase length.

As far as the pedagogical implications are concerned, there is a need for reevaluating teaching methodologies in the face of rapid technological advancements and tackling widespread pandemics such the COVID-19. According to

Atmojo & Nugroho (2020), teachers' most significant challenge in online courses is providing individual feedback. It seems they are in hardship finding enough time to deliver ample feedback in online writing classes. A mixed approach, utilizing both feedback types, is recommended to maximize learning outcomes.

The current study is not without limitations, including limited access to participants and the use of convenience sampling, restricting the generalizability of the findings. Additionally, the study overlooks participants' gender and focuses solely on B2 level students. To address these limitations, future research should explore feedback effects across various proficiency levels, ages, genders, and learning contexts, aiming for a broader understanding. Furthermore, investigating alternative feedback methods, such as peer feedback, and examining oral syntactic complexity could provide valuable insights into language acquisition.

Author Contributions

All of the co-authors of this paper confirm that they have discussed and conceived the article together.

Conflict of Interest

The authors have no conflicts of interest to declare.

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