



## RESEARCH PAPER

# Measuring the Impact of Logical Metafunction on Syntactic Complexity: An Experimental Study of Pakistani ESL Learners at Secondary Level

<sup>1</sup>Muhammad Abrar and <sup>2</sup>Dr. Hafiz Muhammad Qasim

1. M.Phil. Scholar, Department of Applied Linguistics, Government College University Faisalabad, Punjab, Pakistan
2. Assistant Professor, Department of Applied Linguistics, Government College University Faisalabad, Punjab, Pakistan

\*Corresponding Author [abrarrtariq@gmail.com](mailto:abrarrtariq@gmail.com)

## ABSTRACT

This study set out to investigate the impact of logical metafunction on syntactic complexity, and in doing so, it also measured the extent to which it impacted syntactic complexity. This study applied a one-group pre-test post-test experimental research design on 30 participants across a span of 40 sessions. To measure syntactic complexity, L2SCA accessed through TAASSC was used. A paired-sample t-test was employed in samples to make comparison of syntactic complexity deduced from the 14 indices. Furthermore, the study measured the Cohen's d values to discern the practical implication within the mean differences observed. A substantial enhancement in all indices of syntactic complexity was noted, except for one index (CP/C) which had a moderate effect. The study proved that this theory can be used by ESL educators and learners to make their writings logically connected and complex, resulting in marked enhancement of academic writing skills and language proficiency.

**KEYWORDS** English Writing, Logical Metafunction, Logico-Semantics, Syntactic Complexity, Taxis

## Introduction

Systemic Functional Linguistics (SFL) developed by Michael Halliday in 1970s is a comprehensive approach that stands out as a prominent contribution in the field of linguistics. This linguistic framework has evolved and expanded in the subsequent years by Halliday himself as well as other linguists after its initial development. Major contributions have been made over decades by various linguists including Butt et al. (2001), Eggins (2004) Martin and Rose (2003), Bloor and Bloor (1995), and Thompson (2004). According to Halliday (1978), language goes beyond the denotative meaning and influences by the social factors with the focus of its strategic use to accomplish communicative goals in everyday life. The comprehensive grammatical framework emerged from Systemic Functional Linguistics is termed as Systemic Functional Grammar (SFG) that primarily emphasizes language as a tool of communication and social interaction rather than a combination of syntactic structures (Bloor & Bloor, 2004). SFG proposes the idea that language is not merely a set of abstract rules that are used to convey denotative meanings but places language in a dynamic context through which individuals navigate social and cultural landscapes by creating a meaningful discourse. It focuses on the social function of the language that how language is used to express and convey meanings. According to SFL, context of the situation defines the use of language in oral as well as written discourse. Thus, it is a unifying force that interconnects the different

branches of linguistics i.e. syntax, semantics, pragmatics, discourse, sociolinguistics, and functional linguistics within the study of language.

Apart from the grammatical functions of language, there are also communicative functions that depend upon the context in which language is used. Halliday (1994) puts forward three major metafunctions of language. These metafunctions include ideational metafunction, interpersonal metafunction, and textual metafunction. Ideational metafunction deals with the way language is used to express the ideas and experiences about the real world. It is further classified into experiential metafunction and logical metafunction. Experiential metafunction encapsulates conveying experiences of world through linguistic choices whereas logical metafunction deals with the arrangement of ideas and formation of logical patterns in a text. Interpersonal metafunction solely focuses on the social perspective of language use. Textual metafunction is concerned with the syntactic structures of the language that are used to make text coherent. These three metafunctions represent field, tenor and mode respectively. All the metafunctions collaborate in unison to establish a successful communication.

### **Language Teaching in Pakistan**

Pakistan is a linguistically diverse country owning English and Urdu as its official languages. Urdu holds the status of national language whereas English language plays a pivotal role in official documents. English holds a revered position in Pakistan. People willfully intend to learn, peruse and promote it as they consider it an emblem of higher social standing. Among numerous teaching methods, the most commonly preferred method of teaching English in Pakistan is Grammar Translation Method (GTM). In Grammar-Translation Method, grammar rules and vocabulary are taught to students to make them able to translate the sentences from native language to target language and vice versa. It is a classical method of teaching that has faced harsh criticism for lacking emphasis on communicative skills of the learners.

English is considered as a mandatory subject in Pakistan from grade one but despite its inclusion in compulsory subjects, it has been noticed that there is a dire need for the development of the robust writing skills among students at secondary level of education in Pakistan. This study is majorly aimed to contribute in improving the writing skills of the students at secondary level by deploying the various syntactic structures through logical metafunction. Logical metafunction plays a crucial role to create cohesive flow by creating complex and interconnected structures thereby enhancing the intelligibility of written discourse.

### **Syntactic Complexity**

Syntactic complexity in writing is indeed one of the very significant aspects in the realm of education. It involves presenting syntactic structures in a way that portrays the logical connections between clauses. Clarity, preciseness and well-organized syntactic connections are the prerequisites of academic writing. Syntactic complexity is an indispensable component to accomplish all these significant features of academic writing: it is not only important but undeniably required to make writing more logical, coherent and clear.

Frequency-based measurement and length-based measurement are the two parameters for the measurement of syntactic complexity. Frequency-based measurement involves counting the number of NPs and independent clauses in a sentence whereas length-based measurement includes the measurement of length of linguistic units. Apart

from this, there are also many indices proposed by different scholars to measure syntactic complexity. This study deployed Lu 's (2010) fourteen indices of L2 syntactic complexity.

This study was conducted with the core purpose of improving the writing skill of students at secondary level of education and bringing syntactic complexity in the writing through logical metafunction.

### **Literature Review**

Ngongo (2018) analyzed 10 English theses of undergraduate students of Artha Wacana Christian University to explore the use of taxis and logico-semantic relations. It was a descriptive qualitative study in which analysis was done using textual metafunction. Hypotaxis relation was identified 172 times that surpassed the parataxis relation that was found 89 times. Parataxis relations were developed by the use of paired conjunctions whereas subordinate conjunctions were used to develop hypotaxis relations. This study revealed that students frequently use several taxis in the writing to bring perfection.

A comparative analysis was carried out to measure the degree of complexity in 24 unique TEFL reading textbooks. To and Mahboob (2018) conducted this study by the use of Systemic Functional Linguistics (SFL) as a theoretical framework. Scientific and non-scientific literature was selected as sample of the study. The study aimed to examine linguistic complexity, lexical density and nominalization employing mixed methodology as it followed quantitative as well as qualitative approach. The higher tendency of linguistic complexity was observed with respect to the level of books. The study found the comparable grammatical features in both realms and suggested to incorporate the advanced linguistic features in academic textbooks that effectively demarcate scientific literature from non-scientific ones.

Seo (2019) conducted a study and investigated the writings of Korean undergraduate freshmen. The data was collected from 22 students who were selected randomly. Systemic Functional Linguistics (SFL) of Halliday was deployed as the theoretical framework to successfully carry out the analysis. The sole focus of the study was on textual metafunction with specific attention given to Themes and Thematic Progression. The conclusion of the study emphasized the significance of language proficiency in educational writing for educators as well as students.

The development of hypotaxis and parataxis in TEDx Talks of Josh Kaufman was analyzed by Panggabean (2020). The data was collected in the form of videos that were watched several times by the researcher. A descriptive qualitative design was used. The researcher parsed the sentences into clauses to conduct analysis. The findings revealed the prevailing implication of parataxis constructions that surpassed hypotaxis relations. The presence of other elements i.e. extension, enhancement, locution and elaboration were also noticed but their occurrence was less than the taxis. So, it was concluded that logico-semantic relations play a vital role to bring grammatical perfection in the speech.

The editorials published in Thisday Newspaper were analyzed for the exploration of English nominal patterns by Lagu (2021). This study was carried out with the core objective of investigating the effect of common noun phrase on the comprehension of the readers. To conduct the analysis, Halliday's Experiential and Logical metafunctions were employed. Five editorials were chosen randomly by the researcher for analysis. It was noted that editorials published in Thisday contained superfluous information density, a higher prevalence of noun phrases, and more complex noun phrase forms. The findings concluded that the repeated use of noun phrases brought complexity in writing. The study

suggested that the use of noun phrases had a positive impact on the grasping ability of readers.

Ngongo et al. (2023) conducted a study in which the focus was on the logico-semantic linkages in Kupang Malay version of the Luke Gospel. The study intended to explore the interdependence of taxis and the relations among projection, expansion and semantics. 24 chapters of Gospel of Luke's were analyzed using document analysis. Systemic Functional Linguistics (SFL) was employed as theoretical framework. It was observed that parataxis and hypotaxis relations were constructed using coordinate and subordinate conjunctions respectively. Furthermore, the frequent occurrence of expansion and projection was also noticed. The study revealed that the use of phrases made writing coherent and also established the logical flow of semantics. The study suggested that perpetuate logical constructions of semantics brought syntactic complexity in the written discourse.

The diverse studies mentioned above contributed in the current study by providing insights about different ideas, methodologies and approaches relevant to proposed field of this study.

There are several previous studies that have used other metafunctions to enhance the writing skill of learners. The obvious dearth of precedent research studies about logical metafunction accentuated researcher to make a pioneer endeavor at secondary level of education in the Pakistani context to improve syntactic complexity in writing of the students through the application of logical metafunction.

At secondary level of education in Pakistan, it has been noticed that students face considerable difficulty in writing skill. One of the major factors is unavailability of trained ESL educators that hampers their writing skills to grow. To make writing more complex, coherent and logical, it is mandatory for learners as well as educators to enhance writing skill.

## **Material and Methods**

### **Methodological Approach**

This study used quantitative methodological approach. In the pretest, the learners wrote a paragraph on a given topic. It was evaluated and the results were shown quantitatively. For the post-test, results were numerically shown. Both the results were compared to see to what extent there existed differences. In this sense, it used the quantitative approach.

### **Research Design**

This study used an experimental research design. Among 3 experimental group designs proposed by Mills and Gay (2019), this study fell under pre-experimental design. The pre-experimental design has three designs: the one-shot case study, the one-group pretest-posttest design, and the static-group comparison. This study used a one-group pretest-posttest design. The reason for choosing the one-group pretest-posttest design was that it was a preliminary study and this design could serve better as an initial investigation to understand the potential relationship between syntactic complexity and logical metafunction intervention in the writing of ESL learners at the secondary level in Pakistan.

## **Variables**

In the study, syntactic complexity was the dependent variable because it was the variable that was measured and observed. It was expected to be influenced by the independent variable. On the other hand, Logical Metafunction was the independent variable because it was manipulated in the study. It was the variable that was believed to affect the dependent variable.

## **Participants**

The participants in this study were 30 learners enrolled in a secondary school under the ambit of the Federal Directorate of Education, Islamabad. All students were of matriculation level. All had the same gender, male; and all belonged to the same age group, 14-16. All the students belonged to the same background, the middle class. All of them had been studying in government schools since childhood. So, they had been taught through a traditional, formal approach.

## **Intervention**

The intervention was administered for forty sessions. In the intervention, the focus was on teaching writing through logical metafunction. The system of clause complex was explained to the learners, and they were provided with authentic texts for practice.

## **Instrument for the Data Collection**

“Test” as a data collection tool was used for this study. The reason for choosing the test as a data collection was that it was possible only through written tests that writing samples could be obtained.

## **Data Collection Procedures**

Data was collected from pretest and posttest. 30 paragraphs were collected from 30 learners in the pretest and the same number of paragraphs from the same learners were collected in the posttest. So, a total of 60 paragraphs were used as data. Both tests were taken on pages and later corpora of the paragraphs were prepared by the author of the thesis.

## **Data Analysis Procedures**

For this study, data was analyzed according to research questions. To answer the first research question, the data was analyzed using the software, L2 Syntactic Complexity Analyzer (LU, 2010). The syntactic complexity of pre-test and post-test writing samples was measured using this software. To answer the second research question, the Paired-Sample T-test was applied through SPSS (v. 25) on 14 indices of syntactic complexity. This research question was concerned with finding out the extent to which syntactic complexity can be increased by employing logical metafunctions in teaching English writing.

## **Results and Discussions**

### **Is syntactic complexity increased by logical metafunction?**

The first research question was about finding whether there existed any difference in syntactic complexity between the pre-test and the post-test. This question was addressed using L2SCA (LU, 2010) accessed through TAASSC (Kyle, 2016). The analysis was done

against 14 classical indices of syntactic complexity. The results generated by TAASC (Kyle, 2016) showed enhancement in the results in the post-test, but it was not sufficient to make any explicit statement. So, it was necessary to find out the extent to which there existed difference.

### To what extent is syntactic complexity increased, and what are implications of the study for ESL educators?

The second research question was about finding out the extent to which syntactic complexity in the post-test improved. Answering the first research question established that there existed a difference in syntactic complexity between the pre-test and the post-test, though that question was addressed just based on values of 14 indices of syntactic complexity gained through TAASSC (Kyle, 2016). This comparison was insufficient and proper statistical analysis was conducted to establish that there existed any statistically significant difference. Paired-sample T-test was chosen for the study because there was the need to compare the means of two measurements collected from the same individuals.

Two types of hypotheses i.e., null hypothesis and alternative hypothesis were used for the paired-sample T-test.

$$H_0: \mu_1 - \mu_2 = 0$$

The null hypothesis states that the difference between the paired means is zero.

$$H_1: \mu_1 - \mu_2 \neq 0$$

The alternative hypothesis states that the difference between the paired means is not zero.

**Table 01**  
*T values and Cohen's d values*

Sr.	Index	t(29)	P (Sig, 2 tailed)	Mean increase	Cohen's d value
1	Mean length of sentence (MLS)	-13.361	0.001	-7.62668	-3.213
2	Mean length of T-unit (MLT)	-8.900	0.00	-5.50586	-1.973
3	Mean length of clause (MLC)	-4.777	0.00	-1.91992	-0.826
4	Clauses per sentence (C/S)	-10.359	0.00	-5.8693	-1.932
5	Verb phrases per t-unit (VP/T)	-7.653	0.00	-0.56406	-1.920
6	Clauses per t-unit (C/T)	-6.781	0.00	-.35366	-1.661
7	Dependent clauses per clause (DC/C)	-5.485	0.00	-.15197	-1.019
8	Dependent clauses per T-unit (DC/T)	-5.516	0.00	-.28649	-1.461
9	T-units per sentence (T/S)	-4.547	0.00	-.17282	-0.882
10	Complex t-unit ratio (CT//T)	-7.261	0.00	-0.19171	-1.739

11	Coordinate phrases per t-unit (CP/T)	-3.902	0.001	-0.25877	-0.834
12	Coordinate phrases per clause (CP/C)	-2.430	0.022	-0.12198	-0.501
13	Complex-nominals per T-unit (CN/T)	-6.424	0.00	-0.82869	-1.464
14	Complex-nominals per clause (CN/C)	-4.691	0.00	-0.41852	-0.958

The paired-sample T-test's results for all 14 indices of syntactic complexity are quoted above. T-test was applied to compare the means of the pre-test and the post-test. It was done to measure whether the average of means differs from zero. Because data was paired, a paired-sample T-test was used. The pairing occurred because measurements were taken before and after treatment was administered to the same individuals.

The P-value in a paired-sample t-test is very significant because it helps in concluding the statistical significance of the obtained results; also, it helps in determining whether to reject or fail to reject the null hypothesis. The null hypothesis (H<sub>0</sub>) claims no significant difference between the means of the pre-test and the post-test. The alternative hypothesis (H<sub>a</sub>) claims the existence of a significant difference between the means of the pre-test and the post-test.

The p-value reports the likelihood of getting the obtained results under the assumption that the null hypothesis is true; that is, it quantifies the magnitude of the evidence against the null hypothesis. The lower p-value is an indication of stronger evidence against the null hypothesis and stronger support for the alternative hypothesis.

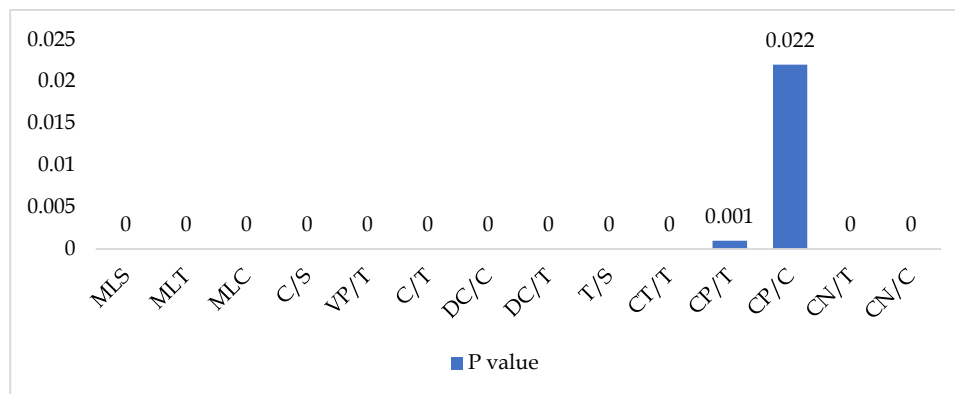


Figure 01 Scores for P-value

The above chart shows the p-value for all indices of syntactic complexity. It can be seen that the p-value of all indices except two is zero, which is less than the chosen significance level of 0.05. The p-values for CP/T and CP/C are also less than 0.05. So, the null hypothesis cannot be rejected. It can be concluded that the mean difference between the pre-test and the post-test is statistically significant.

These findings imply that the intervention involving the teaching of writing through the resources of logical metafunction had a substantial effect on the syntactic complexity in the writing of ESL learners at the secondary level in Pakistan. The significant p-values indicate that the changes observed in the various indices were not likely due to chance. They were a result of the intervention.

Measuring the statistical difference between the means of the pre-test and the post-test scores is not sufficient to establish the cause-effect relationship. Measuring the magnitude of the effect is equally important to establish the practical significance of the findings. Effect size quantifies the strength of a relationship between the pre-test and the post-test results. It is important in interpreting the results of a t-test. While smaller impact sizes could be less practically significant, greater effect sizes suggest a stronger practical significance. Effect size helps researchers understand the magnitude and impact of the results beyond simple statistical significance. That is why it is a useful addition to statistical significance testing.

Cohen's *d* (1998) is an effect size measure that is commonly used to quantify the standardized difference between two means. It is used when the means of two groups are to be compared. It shows the practical significance of the difference. Cohen's *d* value close to zero shows that there is no practical difference between the means of the two groups, indicating that the means are very similar. Cohen (1998) proposed T-test conventional effect sizes as 0.2 (small effect), 0.5 (moderate effect), and 0.8 (large effect).

A negative value in Cohen's *d* simply suggests that the mean of the first group is less than the mean of the second group. Cohen's *d* is calculated by subtracting the mean of the first group from the mean of the second group and then dividing it by the pooled standard deviation. If the mean of the first group is less than the mean of the second group, then the difference will be negative, resulting in Cohen's *d* being also negative.

In the present study, Cohen's *d* value for all 14 indexes was negative. It was so because the first group was the pre-test and the second group was the post-test. Of course, the pre-test would have a lower value than the post-test. So, the focus was put on the magnitude of effect size, not on the sign. The sign of Cohen's *d* did not impact the interpretation. As the negative sign was not of much importance, it was ignored in the chart below for practical purposes.

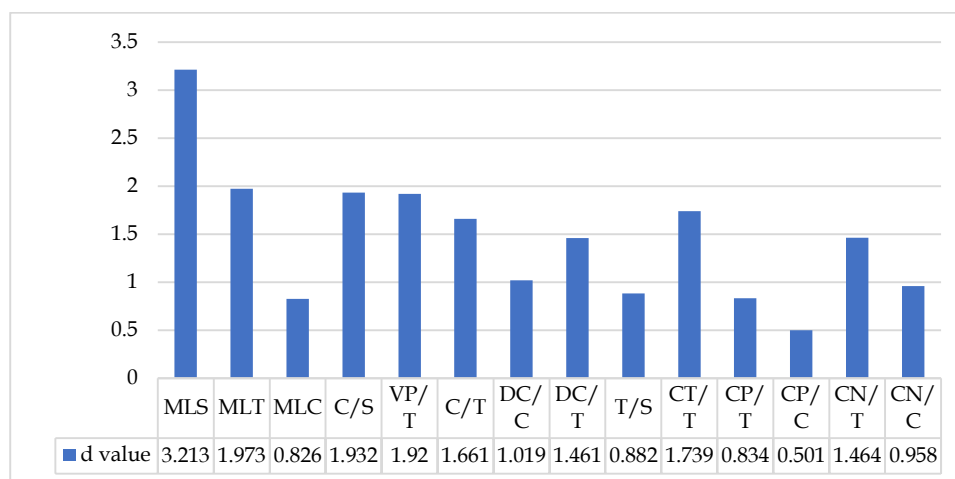


Figure 02 Cohen's *d* Values

The above chart shows Cohen's *d* value for all fourteen indices of syntactic complexity. It can be observed that the *d* value for MLS is above 0.3. The *d* values for MLT, C/S, VP/T, C/T, DC/C, DC/T, CT/T, and CN/T is more than 0.1. The *d* value for MLC, T/S, and CP/T is equal to 0.8. So, all these are considered to have a strong effect. Only CP/C has a moderate effect size, 0.5.



These results indicate that the majority of the syntactic complexity indices, as indicated by their respective Cohen's *d* values, have significant effects. MLS stands out in particular for having an extraordinarily large impact size. MLS with an effect size of more than 0.3 indicates that the logical metafunction intervention had a significant impact on syntactic complexity. When learners learn to use paratactic and hypotactic relations in their writing, the mean length of the sentence is automatically increased, resulting in increased syntactic complexity.

Strong practical significance is also shown by effect size values of more than 1.0 (for MLT, C/S, VP/T, C/T, DC/C, DC/T, CT/T, and CN/T). The MLC, T/S, and CP/T indices, which have effect sizes of 0.8, are nevertheless thought to have a significant influence on the syntactic complexity in the writing of ESL learners at the secondary level in Pakistan. An effect size of 0.5 (for CP/C) is regarded as moderate. It indicates an influence that is apparent but not as strong as that of the other indices.

There are many practical implications of these findings in the ESL educational context. They range from learners' end to teachers' end. Syntactic complexity is an essential aspect of academic writing. Writing that has only simple sentences appears too basic; likewise, writing that has all complex structures is difficult to comprehend. There must be harmony between simple, compound, and complex sentences because monotony makes writing boring.

The study's findings show how crucial it is for ESL writing instructors to address syntactic complexity. To improve students' writing abilities, ESL educators may use focused interventions such as emphasizing logical metafunction. They can teach learners how to develop paratactic and hypotactic relations among clauses. Additionally, they also teach how to develop logic-semantic relations among clauses. During focused instructions, conjunctions can be introduced along with their function. Giving learners the chance to practice complicated syntactic structures can help them become better writers.

ESL educators should use a tailored approach to instruction because the effect of logical metafunction intervention varies across different indices of syntactic complexity. More effective learning outcomes may result from teaching practices that are tailored to the diverse requirements of learners. This can entail giving learners who are having trouble with particular writing difficulty issues scaffolding support while posing more difficult tasks for more advanced learners.

ESL teachers should get continuous professional development opportunities to implement approaches that improve syntactic complexity in the writing of learners. These opportunities will equip educators with the necessary skills that are essential in supporting the learners' writing development. Workshops and sessions should be conducted for educators. Specific writing strategies and intervention techniques should be made clear to them. Syntactic complexity and its indices should be made clear to them, so they can learn how to incorporate them into the writing instructions.

The study's findings are also helpful for curriculum designers for ESL writing courses. A well-rounded curriculum can be developed by integrating learning objectives related to syntactic complexity. Such a curriculum may address various writing aspects. Syntactic structures in each grade should be introduced gradually. Advanced learners should be introduced to advanced syntactic structures that may increase syntactic complexity. In the end, this enables ESL learners to communicate in English more effectively and confidently, opening doors to greater success on the academic and personal fronts.

## Conclusion

The primary objective of this study was to investigate whether teaching writing through logical metafunction increases syntactic complexity in the writing of ESL learners at the secondary level in Pakistan; and in particular, to what extent syntactic complexity is improved by logical metafunction. The secondary objective of the study was to explore how taxis and logico-semantic relations contribute to the enhancement of syntactic complexity and how ESL educators can implement it in the teaching of writing.

The study used a one-group pretest-posttest experimental research design. 30 ESL learners from a secondary school in Pakistan were participants in the study. Before the administration of intervention, a pre-test was conducted to mark the baseline of their syntactic complexity. The intervention included teaching writing through the resources of logical metafunction i.e., taxis and logico-semantic system, for 40 sessions. After the intervention, a post-test was conducted. The writing test was used as an instrument. In the pre-test and the post-test, learners were asked to write a narrative paragraph on the given topic. Syntactic complexity was measured using L2SCA (Lu, 2010) accessed through TAASSC (Kyle, 2016). A paired-sample t-test was applied to all 14 indices of syntactic complexity to investigate the extent of enhancement of syntactic complexity. Cohen's *d* values were also measured to calculate the effect size. AntConc was used to quote instances of how learners used taxis and logico-semantic constructions in their writing.

The analysis of syntactic complexity through TAASSC (Kyle, 2016) provided values for 14 indices of syntactic complexity for the pre-test and the post-test. Although the graphical representation of the results indicated that there was an increment in syntactic complexity in the post-test writing samples, it was insufficient to come to a conclusive point. For that, a paired-sample t-test was applied to know about the statistical significance. Additionally, Cohen's *d* value was calculated to contextualize the magnitude of the effect size. Cohen's *d* values helped gain insights into the practical significance of the observed change.

The first finding from the study was that syntactic complexity in the writing of ESL learners at the secondary level in Pakistan was increased by employing logical metafunction in the teaching of writing. The second finding from the study was that all the indices of syntactic complexity were increased to a great extent except only one index i.e., coordinate phrases per clause (CP/C) whose increment was of medium level. The third finding of the study was that logical metafunction was an applicable theory from which learners and ESL educators could take advantage. Although it was a preliminary study, it succeeded in establishing a positive cause-effect relationship between syntactic complexity and logical metafunction.

## Recommendations

The following recommendations have been made for future researchers

1. Future researchers may conduct the study with a diverse population of ESL learners, not confined to only secondary-level learners in Pakistan. Generalizability of the findings can be made then, and potential variations in the effect of logical metafunction on syntactic complexity across different learner groups can also be established.
2. Future researchers can also think of conducting a longitudinal study to gain insights into the long-term impacts of teaching writing through the resources of a

logical metafunction. This will help researchers track learners' progress over an extended time and understand the sustainability of enhancement in syntactic complexity in writing.

3. Future researchers can also conduct comparative studies to compare the effectiveness of improving syntactic complexity through logical metafunction with other writing instruction approaches. This will help in the identification of the most efficient and beneficial methodologies for improving syntactic complexity in the writing of ESL learners.
4. Future researchers can include interviews and surveys as qualitative analysis. This will help in exploring learners' perceptions and attitudes towards improving syntactic complexity through logical metafunction. Based on learners' experiences, the effectiveness and acceptance of this approach can be decided.
5. Future researchers can conduct this study by including various writing genres in the analysis. If syntactic complexity is analyzed across diverse writing genres, it can reveal insights into how logical metafunction affects different types of writing.
6. Future researchers can utilize a true-experimental research design with a control group and an experimental group. This will strengthen the causal claims about the effect of logical metafunction on improving syntactic complexity in writing.
7. Future researchers can conduct the study with a large sample size. This study had sample size of 30, which was very small to make generalized claims about the findings. A larger sample size can strengthen the statistical power; also, it can represent the whole population.
8. Future researchers can conduct this study across various language proficiency levels i.e., beginner, intermediate, and advanced-level ESL learners. This will help in understanding the effect of teaching writing through logical metafunction at different proficiency levels; and based on it, differentiated instructions can be applied.
9. Future researchers can explore if the development in syntactic complexity in writing through logical metafunction transfers to other language skills i.e., reading or speaking. This can make potential transfer effects clear and highlight the broader impact of this approach on language development as a whole.

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