

The Effects of Processing Instruction on the Use of English Prepositions: From Input to Output

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Abstract :

The present study aimed to determine the effectiveness of Processing Instruction (PI) in developing EFL learners' ability to produce the English prepositions *in*, *on*, and *at* across temporal, spatial and abstract contexts. A quasi-experimental pretest-posttest design was adopted with forty first-year EFL learners from the university of Skikda, who were assigned to either an instructional group receiving PI or a control group receiving Traditional Instruction (TI). Both groups completed a pretest and an immediate posttest at the sentence and discourse levels. At the sentence level, the PI group significantly outperformed the TI group on the posttest, suggesting an accurate development of form-meaning connections, and a reduced reliance on faulty processing strategies. At discourse level, although the PI group showed higher accuracy than the TI group, the difference was not statistically significant, indicating that sentence-level gains did not consistently transfer to extended discourse. Overall, the findings support the effectiveness of PI in grammar instruction and highlight pedagogical implications for promoting discourse-level development.

Keywords: Processing Instruction, English prepositions, sentence level, discourse level, faulty processing strategies.



Introduction

English prepositions constitute one of the most troublesome areas for non-anglophone learners due to their polysemous, idiomatic, and semantically opaque nature. They function as relational entities, rather than carrying independent meaning, which makes them difficult to notice and process. A preliminary investigation, including a semi-structured interview with six teachers and a questionnaire administered to their students at the university of Skikda, revealed consistent instructional patterns. Analysis of the interview responses reported that English

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prepositions are taught using grammar-based textbooks such as *Longman Advanced Learners' Grammar* and *English Grammar in Use*. This instructional approach emphasizes rule memorization and practice drills, which often promotes surface level accuracy or fluency but does not develop the grammar into their interlanguage system.

To further contextualize the situation in Algerian context, pre-test results have shown persistent errors with the three prepositions. One teacher reported this recurrent error: "*your appointment with the consultant is at 6:30 in the evening of the 11th.*". Both teachers (N=6) and learners (N=62) consistently indicated that learners experience difficulty with the preposition 'at' the most, particularly in the abstract domains. They attributed this difficulty to the context-based and polysemous nature of English prepositions. The results further revealed a frequent use of faulty processing strategies, including L1 translation, overgeneralization, and guessing. Such strategies were also evident in the pre-test results. For example, the learners reported translating directly from their Arabic and transferring L1 spatial logic to English, instead of interpreting the semantic constraints of prepositions. The use of this strategy indicates a lack of form-meaning connections, leading to errors like *in the wrong finger*, *in the third floor* instead of the correct preposition *on*. They also tended to overgeneralize one form in all contexts rather than relying on semantic cues, as illustrated by sentences such as *I just want to focus in my study*, and *the life in high school is different from the life in university*, where *in* is used incorrectly in abstract context. Additionally, they tended to use *at* exclusively for time, and rarely for place leading to errors like *Joe enjoys live music in the café*, or in the sentence: *Jenny is working on her desk*. According to VanPatten (1996), these strategies reflect weak form-meaning connections, which constrains accurate use of prepositions. Such findings highlight the need for instructional approach to restructure learners' processing strategies, thereby supporting the pedagogical rationale for adopting Processing Instruction as instructional approach in the present study.

Despite the clear need for a pedagogical approach that directs learners' attention to the meaning-bearing grammatical cues and build accurate processing strategies, no empirical study has investigated the effectiveness of Processing Instruction on the use of English prepositions, particularly across spatial, temporal and abstract domains at both sentence and discourse levels. Most Processing Instruction studies focused on other grammatical structures, including tenses, pronouns, affixes, subjunctive forms across different languages such as Spanish (Cardiemo, 1995; Collentine, 1998; Farley, 2001; VanPatten & Cardiemo, 1993) and English (Benati & Angelovska, 2015). Most of these studies emphasized controlled sentence level interpretation and production; however, little is known whether sentence-level gains can be transferred to discourse-level production. The present study addresses this significant gap in the literature by examining whether improvements achieved through

sentence-level production extend to learners' ability to produce the target prepositions at the discourse level.

Therefore, the results of the present study hold empirical value for many stakeholders, including EFL teachers and curriculum designers who may benefit from evidence-based guidance beyond rule memorization, as well as EFL learners, who may improve both their production and comprehension skills of problematic prepositions such as *in*, *on*, and *at*. Accordingly, this study aims to answer the following research questions:

Q1. To what extent does Processing Instruction enhance EFL learners' form-meaning mappings of English prepositions (*in*, *on*, *at*)?

Q2. Does Processing Instruction improve EFL learners' accuracy in producing English prepositions (*in*, *on*, *at*) at the sentence level?

Q3. Can sentence-level gains in prepositions use achieved through processing instruction transfer to extended discourse production?

It is hypothesized the following:

H1. Processing Instruction will improve EFL learners' accuracy in producing English prepositions (*in*, *on*, *at*) at the sentence level and enhance their form-meaning mappings.

H2. The sentence-level gains in prepositions use achieved through processing instruction will transfer to extended discourse production.

2. Literature Review

2.1. Processing Instruction

VanPatten (1996) criticized traditional approaches to grammar instruction for requiring learners to produce language without first being adequately exposed to comprehensible input that facilitates the development of a mental representation of the target form or structure. Traditional Instruction (TI) typically emphasizes explicit rule explanation and rote memorization, followed by output practice. This practice usually progresses from mechanical drills to more communicative exercises, yet it often lacks a meaningful connection to real language use. TI is characterized by mechanical, meaning-free production tasks that do not necessarily support the internalization of form. Traditional Instruction (TI) typically relies on a three-stage sequence: information, practice, and production. More specifically, it begins with an explicit

explanation of the target form, followed by structured practice activities, and culminates in production tasks where learners are expected to use the form accurately.

However, this model does not provide learners with sufficient exposure to comprehensible input that allows for gradual development of linguistic knowledge—particularly in areas like prepositions, which require nuanced form–meaning associations. As a result, VanPatten (1996) re-evaluated the role of input in second language acquisition and questioned the effectiveness of traditional grammar teaching. This reconsideration led him to propose a fundamentally different instructional approach—Processing Instruction (PI)—which emphasizes the importance of structured input to promote more effective form–meaning connections and accurate mappings between linguistic forms and their communicative functions.

Processing Instruction (PI) is a pedagogical intervention grounded in the principles of the Input Processing model. It was designed to bridge the gap between second language acquisition theory and classroom practice. Central to this approach is the recognition of the essential role of input in language learning—particularly comprehensible input, which refers to language that is slightly beyond the learner’s current level of proficiency, making it understandable yet developmentally challenging (Krashen, 1985).

Processing Instruction emphasizes that language learning can occur naturally through exposure to such input, without requiring formal instruction focused solely on rules. However, this view has faced criticism from some researchers who argued that comprehensible input may be altered or misrepresented in interaction, potentially affecting the reliability of language acquisition through input alone. According to this approach, learners process input for meaning before they focus on form. VanPatten and Cadierno (1993) identified four key stages in the process of language acquisition. When learners are exposed to meaning-bearing input, the comprehended and attended elements become intake. This intake is then incorporated into the developing linguistic system, which gradually enables the learner to produce output- the final stage in acquisition.

Processing Instruction (PI) is concerned with those default strategies by which learners derive intake from input, whose purpose « is to alter how learners process input and to encourage better form meaning mapping that results in grammatically richer intake. This in turn should have a positive effect on the nature of the developing system » (VanPatten 1996, p.8). To put it differently, the goal of this approach is to derive richer intake from the input by helping learners altering “the processing strategies that learners take to the task of comprehension and to encourage them to

make better form-meaning connections than they would if left to their own devices” (VanPatten, 1996, p. 60).

2.2. Processing Instruction Principles

VanPatten (2002) in his theory input processing proposed a number of principles that may describe how learners misprocess some grammatical markers in the input. The principles have been revised later into two main principles with a number of sub-principles. The first principle is the primacy of meaning principle which focuses on how learners process meaning in the input before they process it for form which makes it difficult for learners to notice or learn grammatical markers that do not carry meaningful content like functional morphemes in English. This principle has six sub-principles that try to answer the question about what learners tend to exactly process in the input when they are exposed to and this includes: Primacy of Content Words Principle, and Lexical Preference Principle. According to these principles, learners tend to rely on lexical items as opposed to grammatical form to get meanings when both encode the same semantic information. Besides these principles, there are the Preference for Non-Redundancy Principle, the Meaning-Before-Non-Meaning Principle, the Availability of Resources Principle, and the Sentence Location Principle. The second main principle is called the First Noun Principle which emphasizes how learners tend to acquire the first part of the sentence, mainly the noun or the pronoun, as the subject. Similar to the first principle, this principle includes the following sub-principles: The Lexical Semantics Principle, the Event Probabilities Principle and the Contextual Constraint Principle.

2.3. Characteristics of Processing Instruction

Learners are provided with an explicit explanation of the target grammatical structure. Then, the learners would be informed about the wrong processing strategies that may negatively affect their learning and processing the target structure. Next, they would be presented with different structured input activities that encourage form-meaning mappings.

2.3.1. Structured Input Activities

The activities in processing instruction are structured in the sense that there should be a structured plan of learning /teaching in order to increase the rate of learning. Structured activities are never disconnected from meaning. In these activities, the input is manipulated in a way to make learners dependent on the form to get meaning. The target structure should be presented in a comprehensible context in which the learner can make form-meaning connection. In these activities, learners are never required to produce the target forms but just to process it (Lee & VanPatten,

1995). There are two types of structured input activities: Referential and affective activities. In the referential activities, the learner should notice the form to get the meaning. it includes examples of right/ wrong activities. While in the affective activities, learners are asked to express their beliefs and opinions

There are a few guidelines that help developing such activities:

- Present one thing at a time
- Keep meaning in focus
- Move from sentences to connected discourse
- Have the learner do something with the input
- Keep the learners' strategies in mind (Lee & VanPatten, 2003, p. 154)

3. Research Methodology

3.1. Research Design

A quasi-experimental design was employed to examine the cause-and-effect relationship between the independent variable, which is Processing Instruction (PI), and the dependent variable, namely the accurate production of English prepositions (*in, on, and at*). The experimental study involved two intact groups: an experimental group that is exposed to Processing Instruction and a control group that did not receive any instruction.

3.2. Participants

Forty (N=40) first-year English major students at the university of skikda were involved in the study during the academic year 2021/2022. The participants were drawn from 11 intact groups as assigned by the department. To avoid any selection bias, intact classes were selected, and these classes were then randomly assigned to two groups: One treatment group (N=20) and a control group (N=20). A cluster assignment design was used due to institutional constraints, as the researcher taught intact groups and did not reorganize them into new groups. The participants had an average age of 18 years old. Concerning their gender, there were more females (N=26), than males (N= 14).

3.3. Procedure

Both groups; the experimental and the control group answered the pre - production test one week before the treatment. The tests were distributed in their regular sessions where the researcher is also the teacher to make sure, they answer all the questions and explain any ambiguous unclear points. The production test consisted of two parts. The first part was conducted at the sentence level and included two

distinct tasks targeting learners' ability to produce prepositions in controlled contexts. The second part was discourse-based and comprised one extended task designed to assess learners' ability to use the target prepositions in connected written discourse.

Then, the experimental group received an extensive treatment of processing instruction (PI) over a period of five weeks, with two consecutive sessions per week, during the first semester of the academic year 2021/2022. The treatment aimed to ascertain that all participants developed a shared knowledge and understanding of the English prepositions. The experiment was conducted in the last week of September, just before the winter vacation. Each session lasted from 60 min to 90 min, depending on students' engagement with the activities and the information given. In alignment with the principles of Processing Instruction, one type of preposition (*in*, *on*, or *at*) was presented per session to give learners ample time, focused practice, and rich, meaning-oriented input on each target item. During the treatment, learners were provided with an explicit instruction of the different types of English preposition and their different usages. They were also informed about the psychological mechanisms that may cause incorrect processing of prepositions. The control group did not receive any treatment; they were asked to answer the test based on what they have studied in class using the traditional approach as they dealt with the different types of prepositions as a part of the syllabus of grammar module. Following the treatment, the participants in both groups were asked to answer a post- test, identical to the pre-test, a week immediately after the treatment to measure gains in the production of the target prepositions.

3.3.1. Instructional Treatment

The instructional packet for PI involved three stages including an explicit information about the target items, and the faulty processing strategies used in learning prepositions, followed by structured input activities.

a. Phase one. Explicit Instruction

An explicit instruction in Processing Instruction introduces the learners to the grammatical use, form and meaning of the target prepositions- in this case the prepositions: *in*, *on*, *at*. inductively using examples without being involved in any kind of production or practice. The core meaning of each preposition across the spatial, temporal and abstract domain was explained, using meaning contrast between the prepositions for better comprehension. The explicit instruction included first the meaning of prepositions as relational functional entities that are used to relate two words together, mainly a noun or pronoun with another word. Then, the learners have explicitly been taught the polysemous nature of *in*, *on*, *at* and how they are used to show time, place and abstract relationships. Then, they were introduced to the core

meaning of each preposition per domain and how processing the meaning of each preposition is the key to grasp the multiple contextual uses.

b. Phase Two. Default Processing Strategies

Following the explicit instruction, learners were informed about the faulty strategies used in the acquisition of English prepositions like L1 interference, and overgeneralization. According to VanPatten's (2004) Primacy of Meaning Principle, language learners tend to prioritize meaning over form during input processing. This presents a particular challenge in acquiring English prepositions, which are functional words that do not carry lexical meaning independently. Prepositions are highly idiomatic and context-dependent, and are often used as part of collocations, which further complicates their acquisition. Because learners focus primarily on content words that carry the core meaning of a sentence, they often fail to notice or process prepositions, whose main role is to indicate relationships between words rather than convey new semantic content. In addition, learners frequently apply L1-based word order strategies, which leads to inappropriate use of English prepositions. This issue is further exacerbated by a general lack of rich and varied input that exposes learners to the many uses and domains of English prepositions. To help the participants avoid these faulty strategies, during the intervention, they were made aware of this principle and were pushed to notice the prepositions in the sentences by manipulating the input to draw learners' attention to these forms. We also helped them to recognize the interference between their first language (Arabic) with English word order and prepositional uses. The different domains of the prepositions were also introduced gradually to the learners in a manageable chunk, allowing them to build the necessary linguistic knowledge of the selected prepositions.

c. Phase Three. Structured Input Activities

The goal of PI activities to restructure learning strategies by helping learners attend to meaningful cues, using contextual realistic examples. By using such example, the learners would be able to notice and interpret the meaning conveyed by the prepositions, leading to more accurate usage, without relying solely on word patterns or rote memorization of the rules. The activities were carefully designed by the researcher to align with the objectives of the research and were fully consistent with the principles of Processing Instruction. Two types of structured input activities were involved in the instructional intervention: referential activities and affective activities. A total number of four input activities were designed for each target preposition per domain. This included two referential tasks and one affective task at sentence level. The fourth task was a discourse-based, which involved questions of

comprehension and reflection, allowing learners to process the prepositions in extended contexts.

In the referential activities, which are more interpretation based, the participants were asked to choose between alternatives, match a picture with the correct preposition, match some statements together, or choose the correct preposition depending on the context. In affective activities, the participants were asked to express their beliefs towards statements related to their personal experience and life. The activities were sequenced from sentence level input to discourse level one. In each activity, the learners were exposed to a rich and meaningful input featuring the target forms. Consistent with PI principles, learners were not involved in any kind of output. The participants were given meaning-based feedback regarding the correct answer of each question without justification or discussion or directly teaching the grammatical rule but just comments on their comprehension of the given input.

- **Sample of Structured Input Activities**

- **Referential Activities:**

Focus : The preposition *in* in Abstract domain.

Task one. Multiple choice

Instructions: Read carefully the questions, then try to choose the correct option

Which sentence describes the person as always being irritated or angry?

- My father is always in good temper
- My father is always in a bad temper.
- My father is always on a good temper

- **Affective Activities:**

Task one. Personal Reflection

Instructions: State whether you can personally relate to these statements.

Yes / no

- I have been in trouble at school before
- I have been physically in pain before

- I like being in long-term relationships

3.3.2. Assessment Materials

A production-based test was used to assess the effectiveness of Processing Instruction in enhancing EFL learners' ability to produce spatial, temporal and abstract prepositions (*in, on, at*). The production sentence test included 18 sentences per two tasks with different designs. Each task focused on a specific domain. The first task was designed to assess the learners' knowledge and gains of spatial prepositions, while the second task focused on the temporal prepositions. The last task, which was a controlled paragraph production task, focused on the abstract prepositions.

The production test consisted of three tasks. Each type was evenly represented per task to ensure a balanced input type. Each domain received equal attention and focus to ensure reliability. The test content was aligned with PI principles. The first task was a sentence completion task, in which the learners were asked to complete a given number of sentences (N= 9) using the target prepositions (*in, on, at*) based on learned form-function mappings in PI instruction. In the second task, the learners were asked to correct the wrong prepositions (N = 9) and this helped them recognize and fix the form-function mismatch. The third task, in which learners were asked to write a short paragraph from five to ten lines about their life in high school compared to their life at university, elicits more communicative use of temporal, spatial and abstract prepositions in a meaningful discourse.

3.3.2.1. Scoring Procedure

The total possible score of the production test is 27 points. In the sentence-level production section, which consisted of two tasks, the responses were scored on right-wrong basis. Accordingly, one point was given to every correct answer of the preposition and zero for the incorrect one or blank answer, allowing for a maximum of 18 points per task. On the other hand, the production-based task was assessed differently based on three criteria: The correct use of three prepositions in the abstract domain, sentence accuracy, and the length of the paragraph. Each criterion was rated on 3-point scale (excellent= 3 points, good= 2 points, average= 1 point) for a total of 9 points on this task.

4. Research Findings

To examine the effects of PI on the use of English prepositions, independent-samples t-tests were used to compare the performance of PI and TI groups on the pre- and post-tests, while paired-samples t-tests were used to compare pretest with posttest scores within each group.

4.1. Independent Samples T-Test at Sentence Level (Pre-test Comparison)

To ensure that both groups (TI and PI) are equivalent prior the instruction, an independent t-test was conducted to compare the pre-test scores using SPSS software. The independent t-test was used because it evaluates whether the mean scores of both groups differ on a continuous outcome, under the assumption of normality and homogeneity of variance. The following table shows the results of the independent t-test.

Table.1

Independent Samples t-Test Results for Pretest Scores at Sentence Level

Group	N	Mean	SD	T	Df	P	Mean diff	95% CI (lower-upper)
Control	20	6.90	3.02					
Experimental	20	7.75	3.90	-0.77	38	>.05 (p = .446)	-0.85	[-3.09, 1.39].

As shown in table 1, the control group scored higher on average in the pre-test (mean= 7.75, SD= 3.90) than the experimental group (mean= 6.90, SD= 3.02). The difference is 0.85. Additionally, the control group displayed slightly more variability in scores. Before interpreting the t-test, Levene 's Test for Equality of Variances was used to determine whether the assumption of equal variances could be made. The test yielded an $F(1,38) = 2.658$, $p = .111$, which is greater than the standard alpha level of (.05). Therefore, equal variances were assumed. The analysis revealed no statistically significant difference between the experimental and control groups on the pre-test, $t(38) = -0.77$, $p = .446$. Additionally, the 95% confidence interval for the mean difference ranged from $[-3.09, 1.39]$. These results indicate that both groups were relatively equivalent in their knowledge of English prepositions before the intervention which is ideal for the establishment of an unbiased and fair comparison when analyzing the effect of Processing Instruction. Since both groups were tested under identical conditions to control the effects of extraneous variables, and the only difference between them was the instructional materials and method (PI vs TI), any observed change in learners' performance can be attributed to the instructional approach.

4.2. Independent Samples T-Test at Sentence Level (Post-test Comparison)

Table.2.

Independent Samples T-Test Results for Post-test Scores at Sentence Level

Group	N	Mean	SD	T	Df	p	Cohen's d	Mean diff	95% CI (lower-upper)
Control	20	6.30	2.34						
Experimental	20	8.15	3.19	-2.09	38	< .05 (p = .044)	0.66	-1.85	-3.64, -0.06

From the table above, it can be noticed that the experimental group, which received the Processing Instruction scored higher in the post test ($M = 8.15$, $SD = 3.20$) than the control group ($M = 6.30$, $SD = 2.34$), which did not receive any treatment. An independent samples t -test was conducted to compare the post-test performance between the two groups. Levene's Test for Equality of Variances showed that the assumption of equality was met, $F(1, 38) = [4.010]$, $p = [.052]$. The results revealed significant statistical difference in scores $t(38) = -2.09$, $p = .044$, with a mean difference of -1.85 ($SE = 0.89$), and a medium-to-large effect size (Cohen's $d = 0.66$). The 95% confidence interval ranged from -3.64 to -0.06 . These results suggest that Processing Instruction was effective in developing EFL learners' ability to produce the target prepositions at sentence level.

4.3. Paired Samples T-Test (Sentence Level).

To check the assumption of normality for the paired t -test at the sentence level, the distribution of the difference scores was assessed using a Q-Q plot. The data points formed straight line, suggesting that the difference between pre- and post- test scores were normally distributed. Therefore, the paired t -test was valid and the normality assumption was met.

Table.3.

Paired Samples T-Test Results for Experimental Group at Sentence Level

Pair	N	Mean	SD	T	df	Cohen's d	Mean diff	95% CI (lower-upper)
Pretest	20	7.75	3.90					
Posttest	20	10.55	3.11	-4.92	19	1.10	< .001	[-3.99, -1.61]

A- paired sample test was performed to evaluate whether there would be changes in the participants' ability to produce English prepositions at sentence level before and after the treatment. The results of the t -test are reported in table.3. As shown in the table, there was a significant difference between the students' scores in the pre -test ($M = 7.75$, $SD = 3.90$) and their scores in the post test ($M = 10.55$, D

=3.11). The paired sample t-test also revealed a significant improvement in scores from the pre-test: $t(19) = -4.92, p < .001$, with a mean difference of -2.80 (95% CI $[-3.99, -1.61]$). The 95% confidence interval does not include zero, which further confirms the statistical significance of the difference. Again, the large between-group effect size (Cohen's $d = 1.10$) indicates that PI led to significant improvement in learners' production of English prepositions at the sentence level.

Since the computed p -value is less than .001 and statistically beyond the predetermined alpha value ($\alpha = 0.05$) threshold. Hence, there is less than a 0.1% probability that the results are random. In other words, the variation between the pre-test and post-results did not occur by chance, assuming that there is a relationship between the dependent and independent variables of the study.

4.4. Independent Samples T-Test at Discourse Level (Pre-test Comparison)

Table.4.

Independent Samples T-Test Results for Pretest Scores at Discourse Level

	N	Mean	SD	T	Df	P	Cohen's d	Mean diff	95% CI
control	20	5.30	5.30						
experimental	20	4.90	1.19	-3.43	38	< .001	-0.34	-1.10	[-1.75, -0.45]

An Independent t-test was performed to investigate if there is any significant difference between both groups in their ability to produce the English prepositions (in, on, at) in extended discourse, the results of the tests are presented in table. It seems that there was **no statistically significant difference** in discourse -level production scores between the control group ($M = 5.15, SD = 1.26$) and the experimental group ($M = 4.75, SD = 1.06$), $t(38) = 1.08, p = .288$. The mean difference was 0.40 (95% CI: -0.351 to 1.151). The experimental group scored **0.40 points higher** than the control group **on average** in the pre-test. However, since the calculated (p -value = **0.288**) is **greater than the alpha level .05**, this difference is **not statistically significant**. Therefore, it is fair to say that both groups were at the same baseline at their discourse- level production performance before the treatment.

4.5. Independent Samples T-Test at Discourse Level (Post-test Comparison)

Table .5.

Independent Samples T-Test Results for Post-test Scores at Discourse Level

Pair	N	Mean	SD	t	Df	Cohen's d	Mean diff	95% CI (lower-upper)
Pretest	20	5.15	1.26					
Posttest	20	6.25	1.25	-2.73	19	0.87	< .05 (p= .013)	[-1.94, -0.26]

An independent samples t-test was conducted to compare the mean test scores in discourse level-based test between the control group and the experimental group after the treatment. Based on the results of the Levene's Test for Equality of Variances, $F(1, 38) = 3.51, p = .069$, the assumption of equal variances was met. The results showed that the experimental group ($M = 6.40, SD = 1.19$) scored significantly higher than the control group ($M = 5.30, SD = 0.80$) with a statistically significant difference between the two groups: $t(38) = -3.43, p < .001$ (two-tailed). The 95% confidence interval ranging from -1.75 to -0.45 and the mean difference -1.10 ($SE = 0.32$), which further supports the obtained data. However, the findings illustrated a small effect size (Cohen's $d = -0.34$), suggesting that the difference was not educationally negligible.

4.6. Paired Samples T-Test at Discourse Level

The paired t-test assumes that the difference scores between pre- and post-test in production test at discourse level were normally distributed. In order to check the validity of this test, a normality distribution was conducted using a Q-Q plot. The results revealed that the Q-Q plots are close to the diagonal line, supporting the assumption of normal distribution.

Table.6.

Paired Samples T-Test Results for Experimental Group at Discourse Level

Pair	N	Mean	SD	t	Df	Mean diff	95% CI (lower-upper)
Pretest	20	5.15	1.26				
Posttest	20	6.25	1.25	-2.73	19	< .05 (p= .013)	[-1.94, -0.26]

According to the descriptive statistics provided by SPSS analysis, the mean score of learners' performance at discourse level after the intervention is ($M = 6.25, SD = 1.25$) which is slightly higher than their scores before the intervention ($M = 5.15, SD = 1.26$); $t(19) = -2.73, p = .013$. The mean difference of **1.10 points** indicates that PI had also a positive effect on EFL learners' ability to produce English prepositions

at the **discourse level**. Since the p-value is less than alpha level ($p = .013 < .05$), the observed improvement is unlikely to have occurred by chance. The 95% confidence interval for the mean difference ranged from -1.94 to -0.26 , indicating a reliable change in learners' performance from pretest to posttest. To support this, the data revealed a large within-group effect size (Cohen's $d = 0.87$), indicating a meaningful improvement in learners' performance over time.

5. Discussion

The findings of the present study provide empirical evidence for the effectiveness of Processing Instruction (PI) in enhancing EFL learners' ability to accurately produce English prepositions *in*, *on*, and *at* across spatial, temporal, and abstract contexts. Results revealed that learners in the PI group outperformed those in the control group on the sentence-level production test, despite the absence of explicit output practice during the instructional treatment. This improvement was accompanied by a moderate-to-large effect size, suggesting that PI facilitated more effective prepositional learning of form-meaning mappings than rule-based instructional approaches (TI). Within PI framework, these findings can be attributed to the use of structured input activities, in which input containing the target prepositions was systematically manipulated to help them attend to the target form in order to get the meaning. Through repeated exposure to a rich structured input featuring the target prepositions, learners were able to internalize more effective processing strategies. Once these strategies were correctly processed, the learners were able to accurately use the target forms when producing the language, without engaging in explicit output practice.

In contrast, the difference between the two groups on the discourse-level production test was less pronounced and was associated with a small between-group effect size. This suggests that learners' gains over time cannot be attributed to PI alone. One possible explanation for this outcome is that prepositions are complex morphosyntactic features that require learners to integrate semantic, contextual and pragmatic cues during real-life communication, which makes their use in extended discourse especially demanding. Accordingly, extended discourse production requires additional cognitive and linguistic demands, such as planning, coherence, and syntactic organizations that cannot be solely realized through input-based tasks. In addition, learners' poor written skills and the absence of sustainable opportunities for output practice may have constrained learners' ability to transfer the sentence-level processing gains to discourse level production.

Concerning pedagogical implications, the findings of the present study may provide guidance for EFL teachers in addressing not only English prepositions but

also other grammatical forms that are difficult for learners. EFL teachers are encouraged to integrate PI into their classes' practices, particularly through the use of structured input activities that draw learners' attention to the grammatical forms in meaningful contexts and help them avoid the faulty processing strategies. Once effective form-meaning connection is established through structured input activities, learners need to be engaged in output-based tasks that encourage the use of the target features in extended discourse. One of the limitations of the present study that needs to be reconsidered in the future research is the small sample (40) that may limit the generalizability of the findings beyond the context of the study. Future studies also need to extend these research findings by comparing Processing Instruction to different types of instructions and approaches, conducting larger scale studies and testing the effectiveness of this approach not only in the context of grammar instruction but in other language domains.

6.Conclusion

The present study replicated previous research on the effectiveness of processing instruction (PI) in grammar instruction, aiming to contribute to the ongoing research regarding the efficacy of structured input activities in language acquisition/learning. The study highlighted the pivotal role of input- specifically how the grammatical form is presented in the input- in developing the learners' grammatical competence and promoting form-meaning connections. Once this connection is firmly established, learners are better equipped to convert input into output. In other words, presenting the target grammatical structure in a meaningful context enhances EFL learners' language skills. Although the difference in discourse level production between the control and the experimental group was less marked, it remained significant, suggesting a positive effect of PI on the production of both isolated sentences and extended written texts. These findings support the integration of PI into grammar instruction to promote comprehension and production skills. Overall, further research is needed investigate the topic under-study in greater depth by exploring the broader applications of PI over different instructional contexts and linguistic domains.

7.References.

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