Iranian Journal of Applied Language Studies (IJALS)
ISSN: 2008-5494 -E-ISSN: 2322-3650 -http://ijals.usb.ac.ir
Published by University of Sistan and Baluchestan

Research Paper, Doi: 10.22111/IJALS.2020.6044 - Vol 12, No, 2, 2020, pp. 115-160
Received: April 2019 Accepted: January 2020

Processing Instruction Revisited in the Iranian EFL Context and the Moderating Role of Grammatical Sensitivity

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Abstract

The present study was primarily aimed at investigating how Processing instruction would affect the Iranian EFL learners' grammatical knowledge and how the effectiveness of this method would be modulated by the learners' individual differences in grammatical sensitivity. To this end, three senior intact high school classes were selected and randomly assigned to two experimental and one control group. Each of the experimental groups was treated with one operationalization of Processing instruction, namely, full PI (n=24), and Structured input (n=24) while the control group (n=20) received traditional output-based instruction (TI) on the English passive structure over three weekly sessions. The results illustrated that Processing instruction was more effective than TI since it improved learners' both interpretation and production while TI only could improve learners' production. Additionally, the results demonstrated that the positive impact of Processing instruction was not affected by the learners' differences in grammatical sensitivity. All in all, this suggests that as long as a grammatical structure is affected by an underlying processing problem, Processing instruction is possibly a more effective pedagogical option compared to traditional output-based instruction. Furthermore, Processing instruction seems to work for all learners irrespective of their differences in terms of grammatical sensitivity.

Keywords: processing instruction, input processing theory, traditional instruction, grammatical sensitivity, LLAMA-F

1. Introduction

Processing instruction (PI) is a comprehension-based approach to teaching grammar which is theoretically based on VanPatten's (1996, 2002, 2004) Input processing model (IP). Being concerned with the initial processes used by learners while acquiring L2, this model attempts to explain why second language learners process some grammatical features of input but not others (Benati, 2019). In fact, the IP model hypothesizes that in their attempt to comprehend and process input, L2 learners utilize a number of default strategies also called principles. The use of these strategies is believed to prevent some features of the input to be processed and consequently learned. One of these strategies is called the *primacy of meaning principle* which states that learners first process input for meaning rather than form, that is, they process content words before grammatical forms especially when the grammatical forms are redundant in the sentence. For sake of illustration, in a sentence like *Jack played chess yesterday*, the notion of pastness is expressed in both the word yesterday and the simple past tense suffixed. Hence, due to the aforementioned default principle, learners are inclined to derive the meaning of pastness through processing the adverb yesterday and consequently skip the redundant grammatical features –ed. To put it simply, learners are likely to fail to make the relevant form-meaning mappings when a particular grammatical point has already been rendered redundant by the presence of another lexical cue conveying the same meaning in the same sentence. This failure in making a form-meaning connection, in turn, is believed to cause a delay in the acquisition of the grammatical feature involved. However, this problem can be avoided through appropriate instruction manipulating input so that learners will process grammar more effectively. This is where processing instruction (PI) as the pedagogical application of input processing comes into the picture. By exposing

L2 learners to meaningful input-based activities, PI encourages learners to process the affected grammatical forms and make the appropriate form-meaning connections (Benati, 2019; Nassaji & Fotos, 2011; VanPatten, 2015). In fact, the main goal of processing instruction (PI) is to alter the default processing strategies used by learners while interpreting and processing input to help them develop correct form-meaning connections and consequently derive richer intake from the input. Furthermore, since processing instruction targets language acquisition at the initial stage of processing, it is expected to not only affect the learners' input processing strategies but eventually facilitate the incorporation of the target form first in their interlanguage and then in their output (VanPatten, 2004).

Interestedly, since the publication of the first paper on processing instruction by VanPatten and Cadierno (1993), it has received a lot of attention from L2 scholars resulting in a multitude of studies addressing its various aspects (Benati, 2005; Benati, 2013; Benati & Lee, 2010, 2015, among others). One of the early lines of research within PI literature was an attempt to compare the PI with other output-based instruction either traditional (TI) or meaning-based output instruction (MOI). This research has consistently and conclusively illustrated that PI is superior to output-based grammar instruction. In fact, in terms of interpretation, PI has been found more effective than both TI and MOI while in terms of production, PI has been found as effective as TI and MOI. These findings, surprisingly, have not been completely supported by a handful of studies conducted in the Iranian context. For example, in terms of interpretation, some Iranian scholars have reportedly found PI as effective as MOI or TI but not more effective (Birjandi & Rahemi 2009; Rahemi, 2018; Younesi & Tajeddin, 2014) while in terms of production, it has been claimed that MOI is more effective than PI (Birjandi et al., 2011; Birjandi & Rahemi, 2009; Younesi

& Tajeddin, 2014). This contradiction between the findings of PI studies conducted in the Iranian context and the mainstream findings of PI research even gets more complex when the findings of two other studies conducted in Iran are considered. The first one supported the general findings of PI literature (Vafaparvar & Kheirzadeh, 2018) and the second one found that in terms of production PI is not as effective as MOI or TI but even more effective (Seyednejad & Gholami, 2017). This last finding contradicts the PI findings in another way since as mentioned above PI research has found that in terms of production, PI is as effective as TI or MOI but not more effective. All in all, the disconfirming findings of some Iranian PI studies compared to the conclusive positive findings of mainstream PI research on one hand and the inconsistency between the Iranian PI studies, on the other hand, indicates that the issue of PI versus output-based instruction is far from being settled in the Iranian context and need to be addressed. Thus, the first objective of the present study is to explore the nature of this inconsistency by investigating the efficacy of Processing instruction compared to a more traditional production-based method of teaching grammar still dominant in Iranian schools.

The necessity for exploring the possible interactions between type of instruction and individual difference variables has been voiced by both form-focused instruction researchers in general (Dekeyser, 2012; Lima et al., 2016; Spada, 2011) and PI scholars in particular (Benati, 2019) on the grounds that discovering such interactions could lead to a better understanding of SLA process, designing more effective instruction, L2 curricula, and materials (Spada, 2011). Therefore, more recently, PI researchers started to examine the possible moderating role of individual difference variables (i.e., age, language background, grammatical sensitivity among others) in processing instruction. Among the individual difference factors addressed by PI research is a

component of language aptitude called grammatical sensitivity which is defined as the learners' ability to detect grammatical relationships among words (Carroll, 1973).

In fact, in PI literature, only a few studies have explored the relationship between grammatical sensitivity and processing instruction. Four of such studies have been conducted by VanPatten and his colleagues and reported in VanPatten et al. (2013). In all these studies except for one (VanPatten & Borst, 2012), no significant correlation has been found between grammatical sensitivity and processing instruction. This has prompted VanPatten et al. to suggest that when instructed SLA is viewed as processing as in PI, a variable like grammatical sensitivity might not have a noticeable role in the instruction. On the other hand, two other studies addressing the same issue came to a different conclusion (i.e., Erlam, 2005; Hanan, 2015). In fact, they have found a positive role for grammatical sensitivity. Given the fact that in the first group of studies conducted by VanPatten and his colleagues, the outcome of instruction has been primarily measured through a process-based measure called *trails to criterion* while both Erlam, and Hanan have utilized knowledge-based outcome measures, one is inclined to hypothesize that grammatical sensitivity might play a role in PI if the impact of the instruction effect is measured through knowledge-based comprehension and production tests predominantly utilized in processing instruction studies. Therefore, to address the aforementioned concern, the present study as its second objective intends to investigate the role of grammatical sensitivity in PI while using sentence-level comprehension and production tests as its learning measures. Additionally, the researchers of this study have utilized a different measure of grammatical sensitivity (i.e., LLAMA-F) in PI studies for the first time to address an observation made by an anonymous reviewer in VanPatten and Borst (2012). The reviewer was of the

opinion that the no role found for grammatical sensitivity in VanPatten and Borst might be due to the nature of the measure of grammatical sensitivity used (i.e., MLAT) which is a global measure and for addressing the detailed aspect of acquisition such as form-meaning mappings at the sentence level, a more appropriate measure might be required. Therefore, the researcher of the present study opted for LLAMA-F as their measure of grammatical sensitivity since it is a grammatical inferencing task that uses visual stimuli and relies more on agreement features than on word order (Artieda & Muñoz, 2016), and is likely to address the aforementioned limitation of MLAT. To sum up, the present investigation is pursuing two objectives. Firstly, it intends to investigate the efficacy of PI within the Iranian context by comparing it to a more traditional production-based method of teaching grammar still dominant in Iranian schools. Secondly, it aims to examine the possible role of grammatical sensitivity in processing instruction utilizing a new measure.

2. Review of Literature

2.1. PI versus Traditional Instruction

The first study exploring the effect of PI was conducted by VanPatten and Cadierno (1993). The importance of this experiment lies not only in its findings but in the fact that it set out the typical design for most of the future studies conducted within this framework (Lee, 2015). VanPatten and Cadierno compared PI to a traditional output-based instruction to explore its impact on the acquisition of the Spanish direct object pronouns. In fact, the researchers chose Spanish direct objects as their target structure to satisfy an important requirement of PI procedure stipulating that to yield positive results, PI must address a processing problem which is expected to occur when a target structure

is affected by an underlying processing strategy or principle (Benati, 2016; VanPatten, 2015). Accordingly, affected by the First Noun Principle of VanPatten's input processing theory (VanPatten, 2015), direct object pronouns in Spanish were expected to be misinterpreted by learners hence making them good candidates for PI which was devised to circumvent such problematic processing strategies in the first place. Given the above, VanPatten and Cadierno recruited six university-level Spanish classes at the University of Illinois and randomly assigned two classes to each of the following three groups: traditional instruction (TI), processing instruction (PI), and a control group who received no instruction. The study adopted a pretest-posttest design and a comprehension and a production sentence-level test was used to measure the impact of instruction. The results showed that the PI group made significant gains in both comprehension and production while the traditional group made significant gains only in production. In fact, PI was found more effective than traditional instruction in terms of comprehension while it was as effective as the traditional instruction in improving learners' production of the target structure.

Additionally, the results were maintained one month later. The findings of this experiment were supported by a multitude of other replication studies examining the same issue with various populations, target forms and L1s and etc. (Benati, 2001; Cadierno, 1995; Cheng, 2004; Lee & Benati, 2007; VanPatten & Wong, 2004, among others). All in all, the findings of this line of research could be summarized as follows: a) PI was more effective than TI in improving the learners' interpretation; b) PI was as effective as TI in improving the learners' production. Furthermore, the fact that PI with its input-based instruction led to the improvement in learners' interpretation and production also called PI double interpretation/production effect (Lee, 2015) presented PI as a more effective approach to teaching grammar than the traditional one.

2.2. PI in the Iranian Context

Inspired by the positive findings of PI research, some Iranian scholars followed suit to examine PI effectiveness in the Iranian context. These studies have primarily compared PI with another output-based instruction primarily traditional. Birjandi and Rahemi (2009) were among the first scholars who set out to investigate PI within the Iranian EFL context. They compared processing instruction (PI) with a meaning-based output instruction (MOI) to examine their relative impact on Iranian L2 learners' interpretation and production of the target structure, namely, English causatives delimited to have and get. To this end, the researchers recruited four intact university classes comprising of 151 students and randomly assigned them to three treatment groups and a control one. In fact, the experimental groups consisted of a) PI group; b) MOI group and c) Explicit information group (EI). The study followed a pretest/immediate and delayed posttest design and the researchers used a sentence-level interpretation test and a sentence-level production test to measure the impact of the treatment. The results of this experiment showed PI and MOI were as effective as each other in terms of improving the learners' interpretation of the target structure both in the short and long run, however, in terms of production, MOI was found more effective than PI. Based on their findings, the researchers hypothesized that the benefits of PI, especially in terms of production, might not be generalized to all grammatical structures or EFL contexts. In fact, these findings, also replicated by other similar studies conducted in Iran (Birjandi et al., 2011, Rahemi, 2018; Younesi & Tajeddin, 2014), have suprizingly contradicted the conclusive findings of a plethora of PI research partly reviewed in the previous section. This PI picture in Iran become even more complicated when one considers the findings of few studies which have supported the mainstream findings of PI research (Rahimzadeh & Ghaemi, 2016; Seyednejad & Gholami,

2017; Vafaparvar & Kheirzadeh, 2018). All in all, the disconfirming findings of some Iranian PI studies compared to the conclusive positive findings of mainstream PI research on one hand and the inconsistency between the Iranian PI studies, on the other hand, have been the motivation beyond the first objective of the present study and has inspired the researches to examine the effectiveness of PI in the Iranian context.

2.3. PI and Grammatical Sensitivity

The first model of foreign language aptitude put forward by Carroll (1962, 1981) conceptualizes the construct of foreign language aptitude as consisting of four components: (a) phonetic coding ability, (b) grammatical sensitivity, (c) rote learning ability for foreign language materials and (d) inductive learning ability. The two components, grammatical sensitivity and inductive language learning ability deal with language analysis (Carroll, 1962). The former is defined as the ability "to recognize the grammatical functions of words in sentences" whereas the latter refers to "the ability to infer or induce the rules governing a set of language materials, given samples of language materials that permit such inferences" (Carroll, 1981). Interestingly, the Modern Language Aptitude Test (Carroll & Sapon, 1959) did not distinguish these two components and only included a test for grammatical sensitivity. Later, Skehan (1989) argued that the two components were really different aspects of the same underlying ability and simplified the model of L2 aptitude by combining the two components into one called *language analytic ability* and defined it as "the capacity to infer rules of language and make linguistic generalizations or extrapolations" (Skehan, 1998).

Accordingly, in the literature, the concepts, grammatical sensitivity and language analytic ability, have been used interchangeably and usually measured through the same tasks. In PI literature, a handful of studies have been

conducted to examine the role of grammatical sensitivity in PI. Erlam (2005), for instance, conducted an experimental study in a high school in New Zealand to examine the possible moderating role of language aptitude in three types of instruction (i.e., deductive, inductive, and processing instruction). With regard to the relationship between processing instruction and aptitude, the researcher found an interaction between two components of language aptitude (i.e., language analytical ability and working memory) and processing instruction. In fact, the result showed that learners with higher language analytical ability benefited more from the instruction in terms of producing the target structure in the written form both in immediate and delayed posttests.

In an empirical study, VanPatten and Borst (2012) set out to examine the role of explicit information and grammatical sensitivity within PI. To this end, they recruited forty-six English native speakers who were taking a college-level German course at Texas Tech and Florida State University. The participants were randomly divided into two experimental groups. The first group received the explicit information plus the structured input treatment on the case marking in masculine nouns while the second one received the structured input treatment but without the explicit component on the same target structure. With respect to the role of grammatical sensitivity, a weak correlation was found between grammatical sensitivity and the scores of one of the groups, that is, the one with the explicit component. The researchers found the result inexplicable and encouraged future researchers to address the issue. This was followed by three other similar studies which consistently found no role between grammatical sensitivity and PI (VanPatten et al., 2013). More recently, Hanan (2015) conducted a study in the UK to explore the role of explicit grammar instruction in young English native speakers learning German as an L2. As a part of the study, the researcher also investigated whether learner differences in terms of

grammatical sensitivity (i.e., a component of aptitude) would affect their performance or not. In this respect, the researcher found a consistent significant relationship between grammatical sensitivity and several outcome measures at both post and delayed post-tests.

To reiterate, this study aims to achieve two objectives. Firstly, it intends to investigate the impact of Processing instruction (both PI and SI operationalization) on the learning of English passive structures compared to a traditional output-based method of teaching grammar within the Iranian EFL context. Secondly, this study also attempts to investigate how grammatical sensitivity as an individual difference factor affects the impact of the processing instruction. Therefore, to achieve the aforementioned objectives, the following research questions are posed:

2.4. Research Questions

RQ 1: What are the relative immediate and delayed effects of PI, SI, and TI on the acquisition of the passive structure by Iranian high school EFL learners as measured by a sentence-level comprehension test?

RQ 2: What are the relative immediate and delayed effects of PI, SI, and TI on the acquisition of passive structure by Iranian high school EFL learners as measured by a sentence level production test?

RQ 3: Does learners' difference in grammatical sensitivity modulate the impact of Processing instruction?

3. Method

3.1. Participants

Three intact EFL classrooms from a high school for girls in Mahshahr, Iran were recruited as the research participants. These senior high school students were speaking Persian as their native language and were between 18 to 19 years of age. The initial number of the students was 83, however, to be included in the final data pool, they had to meet the following criteria: a) they had to attend all the pretests, treatment, immediate posttests, and delayed posttests; b) they should not have received any formal instruction on the passive structures prior to treatment; and c) following a common practice in PI studies, they had to score no more than 60 percent on the pretests (VanPatten & Cadierno, 1993; VanPatten & Wong, 2004). Fifteen students failing to meet all the criteria were removed and this left us with the following numbers in each group: PI (n=24), SI (n=24), Control (n=20).

3.2. Target Structure

English passive structure delimited to the simple present, past, and future tenses were chosen as the target structure in the current study. This choice was primarily motivated by a requirement of the Processing instruction procedure stipulating that for a study to yield positive results, it must first address a target structure that is affected negatively by an underlying processing strategy (i.e., a processing problem). English passive structure meets this condition since it is affected by *the first noun principle* of VanPatten's input processing model (2004). This principle maintains that most L2 learners are likely to process the first noun or pronoun in a sentence as the agent regardless of their first language. Accordingly, L2 learners are likely to encounter a problem while processing an

English passive sentence in which the first noun or pronoun should be processed as the patient rather than the agent. In this case, Processing instruction is deemed useful to push L2 learners away from using this default, inaccurate processing strategy, and lead them to use a more accurate one (Qin, 2008).

3.3. Materials

3.3.1. Instructional Materials

In the literature, Processing instruction is operationalized in two ways: a) PI also called full or complete PI; b) structured input (SI). The former contains an explicit component followed by structured input activities (i.e., referential and affective). The latter, however, only contains the structured input activities hence called SI. Accordingly, and in line with the design of this study, three instructional packets were developed, that is, Processing instruction (PI) packet, the Structured input (SI) packet, and the Traditional instruction (TI).

3.3.1.1. PI and SI Materials

Processing instruction materials (i.e., both PI & SI) were constructed consistent with Wong's (2004) guidelines. In fact, the PI materials started with one-page explicit information explaining the English passive structure and how the First Noun Principle might lead learners to process the first noun in a passive sentence wrongly as the agent of the sentence. This explicit information, then, was followed by three referential activities (i.e., two written activities, a sentence and a discourse-based one plus an aural activity) and one affective.

At this juncture, it must be noted that all the referential activities had right and wrong answers and were developed in a way to make the processing of the passive form necessary for understanding the meaning, hence hindering the

learners' reliance on the First Noun Principle. The affective activity, however, did not have right and wrong answers and was intended to provide the learners with more instances of the target structure and encourage them to process the meaning and form while dealing with real-world situations. Finally, it must be noted that the SI group received the same instructional packet given to the PI group with only one difference that the SI packet did not contain the explicit component.

3.3.3.1.2. TI Packet

Similar to the PI packet, the TI one consisted of a one-page explicit information component followed by four tasks. However, the explicit component only explained the English passive structure to the learners and did not provide them with any information about the processing strategy. Furthermore, unlike those of the PI packet, the four tasks in the TI packet were primarily production-based in nature and were modeled on the practices found in the learners' textbook. Finally, it must be noted that an experienced EFL teacher and a TEFL scholar were asked to review both PI and TI instructional materials. The packets were also piloted on two senior high school classes. This led to the following changes: a) ambiguous instructions were modified; b) some problematic vocabulary items were replaced. For example, in the second referential task in the PI packet, participants faced difficulty processing some foreign names during listening which led the researcher to replace those names with familiar ones.

3.3.2. Assessment Tasks

Following Wong (2010), two versions of the assessment task were developed. Version A was used as the pretest, version B as the immediate

posttest, and version A as the delayed posttest. Each of the tasks consisted of a sentence-level interpretation test and a sentence-level production test. Both were time constraints and meaningful in nature.

3.3.2.1. Sentence-level Interpretation Task

The sentence-level interpretation task was an aural test developed to measure the learners' ability to interpret passive forms in English correctly. This test which consisted of twenty sentences, ten distracters (active sentences), and ten target items (passive sentences) took 10 minutes to administer. During the test administration, each sentence was played once and the participants were required to discover the agent of the actions performed in the sentence and indicate that in their answer sheets. Finally, only the passive sentences were graded and each correct response to the 10 test items was awarded 1 point while no partial credit was given. Thus, the maximum score on the interpretation task was 10.

3.3.2.2. Sentence-Level Production Task

The sentence-level production task was a written test developed to measure the learners' ability to produce correct English passive verb forms. This test consisted of 10 incomplete sentences in English. Half of them were passive (i.e., target items) while the rest were active (i.e., distractors). In each sentence, the verb was omitted and replaced by a blank while its base form was given in parenthesis at the end of the sentence. The participants were required to read each sentence and fill the gap with the correct form of the verb given. Finally, to quantify the students' performance on this production task, only the target test items were scored and the maximum score on the production task was 10. Finally,

it must be noted that both interpretation and production assessment tasks were examined by the same Iranian EFL teacher and TEFL scholar who reviewed the instructional packets. As a result, some test items were replaced and the test instructions were modified. Additionally, to examine the internal consistency of the tests, Cronbach alpha was calculated resulting in the indexes of 0.82 and 0.79 for the interpretation and production tasks respectively. Furthermore, the production tasks were also graded by another teacher resulting in the inter-rater reliability indexes of 0.95, 0.96, and 0.94 for the pretest, the immediate posttest, and delayed posttests, respectively.

3.3.3. Grammatical Sensitivity

LLAMA-F component of the LLAMA test was used as the measure of grammatical sensitivity. It is computer software that consisted of a learning and a testing phase. In the learning phase, participants were given 5 minutes to learn a new language by seeing sentences matched with pictures. The testing phase, which was not timed, consisted of 20 items. The score range was between 0 and 100 (Meara, 2005). This measure was given twice to the learners once during the study and once one week after the completion of the study and the test-retest reliability was calculated resulting in a reliability coefficient of 0.81.

3.4. Procedure

Prior to the commencement of the experiment, all the participants were informed of the general purpose of the experiment, however, care was taken not to provide them with many details so as not to endanger the internal validity of the research inadvertently (Clark & Creswell, 2015). Furthermore, in line with the design of the study (i.e., pretest-treatment-posttest), the participants, in their

intact classes, were chosen and randomly assigned to two experimental and a control group: a) Processing instruction (PI); b) Structured input (SI); Traditional instruction (TI). As shown in Table 3.1, the study lasted nine weeks. Each session was held on Monday mornings. In the first week, all the groups took the grammar part of the Oxford Placement Test (Dave, 2004), and a one-way ANOVA was run, the results of which illustrated that there was no significant difference between the groups' mean scores ($F(2, 65)=0.01$ $p=0.98$) hence the homogeneity of the groups can be assumed at least as long as grammatical knowledge is concerned. In the second week, sentence-level interpretation and production tasks were administered to all the groups as a pretest. In the third and fourth weeks, the LLAMA F was administered to the PI and SI groups to measure their level of grammatical sensitivity. Afterward, the treatment was conducted in the three consecutive following weeks (i.e., Week 5, 6, and 7) and in each session, only one tense of the passive structure was instructed (i.e., simple past, present, and future respectively). In the first treatment session, both the experimental groups received their respective instructional packets on simple past passive. During the activities, the learners were never asked to produce the target structure (i.e., passive structure), and consistent with the processing instruction procedure, the feedback was kept to a minimum, that is, after doing each item of the activities, the learners were just told whether their answers were correct or not. In each of the second and third treatment sessions, the PI and SI group received their respective instructional packets which were similar to their first-week treatment with the only difference that in the second week the tasks were in the present tense while in the third one the focus was on the future tense. Moreover, after the completion of each weekly treatment, the students' task sheets were collected and they were not allowed to take notes during the treatments.

The control or traditional (TI) group in the first session of treatment received the first packet of their treatment on the simple past passive structure in English. Having read the one-page explicit component, the learners were given four production-based tasks. In each of the second and third treatment sessions, the TI participants again received the same explicit information about the passive structure followed by the same number of activities as in the first week with only one difference that in the second week the tasks were in present tense while in the third one the focus was on the future tense. After the end of the treatment on the seventh week, all the participants were given an immediate posttest (i.e., sentence-level interpretation and production tests). Finally, in the ninth week after a two-week interval, the delayed posttest was administered to all the groups.

3.1. Overview of the Procedures

Study Time	Treatment		
	PI	SI	TI
1st Week	≠Proficiency Test		
2nd Week	**Pretest** ≠Sentence-level interpretation Task ≠Sentence-level production Task		
3rd Week	≠Grammatical Sensitivity Test (i.e., LLAMA F)		
4th Week			
5th Week	**First Treatment Session: Simple Past Passive**		
	PI Activities (1 hour)	SI Activities (1 hour)	TI Activities (1 hour)

6th Week	**Second Treatment Session: Simple Present Passive**		
	PI Activities (1 hour)	SI Activities (1 hour)	TI Activities (1 hour)
7th Week	**Third Treatment Session: Future Passive**		
	PI Activities (1 hour)	SI Activities (1 hour)	TI Activities (1 hour)
	Immediate Posttest ≠Sentence-level interpretation task ≠Sentence-level production task		
8th Week	**Break**		
9th Week	**Delayed Posttest** ≠ Sentence-level interpretation task ≠ Sentence-level production task		

3.5. Statistical Analyses

First, descriptive statistics for each group's performance on interpretation and production tasks and the grammatical sensitivity test were calculated. Then, to address the first two research questions and examine the impact of PI on learners' gains in English passive structure, a series of ANOVAs were conducted. First, one-way ANOVAs were run on the pretest scores for each assessment task in order to determine any initial group differences. Next, the data was submitted to a series of mixed design repeated measures ANOVAs (also called Split plot ANOVA or SPANOVA). To address the third research question dealing with the possible role of grammatical sensitivity in processing instruction, a series of Pearson bivariate correlations were run. First, correlations were calculated between the PI and SI groups' pretest scores and their learner difference variables in order to detect any relationships between

them at the time of the pretest. Next, the two groups' performance on the interpretation task both in the immediate and delayed posttest scores were correlated with their performance on the grammatical sensitivity measure. All the statistical analyses were conducted using IBM Statistical Package for Social Sciences (SPSS) 21.

4. Results

4.1. Interpretation

To address the first research question investigating the impact of three different types of instruction (i.e., PI, SI, and TI) in terms of improving the learners' interpretation ability, first, a one-way between-groups ANOVA was run on the pretest scores of the interpretation task to examine whether any significant differences existed between the groups before the treatment. The analysis showed that there were no significant differences between the groups before the instruction ($F(2, 66)=.16$, $p=.84$). Table 4.1 displays the descriptive statistics for each groups' performance on the interpretation task across pre/post and delayed posttests.

Table 4.1

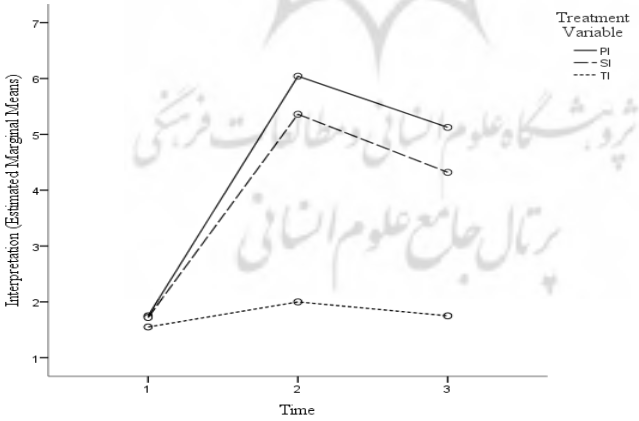
Means and Standard Deviations for all Groups on Sentence-level Interpretation Task

	PI (n=24)		SI (n=24)		TI (n=20)	
	M	SD	M	SD	M	SD
Pretest	1.75	1.189	1.72	1.242	1.55	1.191
Posttest	6.04	2.116	5.36	2.812	2.00	2.428
Delayed Posttest	5.13	2.643	4.32	2.268	1.75	2.049

Then, a mixed between-within subjects analysis of variance was applied for analyzing the gathered data. Between the subjects variable was Group, namely, type of intervention with three levels (i.e., PI, SI, and TI), and within the subjects variable was Time, namely, the learners' performance on interpretation task across three-time points (i.e., pretest, posttest, and delayed posttest). The results of the mixed ANOVA are reported in three categories a) interaction effect, b) treatment effect; and c) the time effect. With regard to the interaction effect, a significant interaction was found between Time and Group (i.e., type of instruction), Wilks' Lambda=.69, $F(4, 132)=6.46$, $p<.001$, multivariate partial eta squared=.16. This interaction is shown graphically in Figure 4.1, in which the three lines are not parallel. This, in turn, suggests that the three types of treatment have functioned differently.

Figure 4.1.

Profile Plot of Performance on Production Task Across Three-Time Points



Additionally, the analysis revealed a significant main effect for Time, Wilks' Lambda=.43, F (2, 65)=42.39, $p<.001$, multivariate partial eta

squared=.56, and also a significant main effect for Groups (i.e., types of instruction), F (2, 66)=13.79, p<.001, partial eta=.29. However, as there was a significant interaction effect, the interpretation of the main effects of Time and Groups is not appropriate (Pallant, 2013), hence, follow-up analysis is required to determine the nature and source of the interaction. Therefore, a follow-up simple effects analysis was conducted. In fact, according to Keenan and Stevens (2016), two types of simple effect are of interest in the mixed design ANOVA: a) simple effect analysis for within-subjects factor comparing the performance of each treatment group separately across time points (i.e., pretest, posttest and delayed posttest) to describe the change across time (See Table 4.2); b) simple effect analysis for between-subjects factor comparing the effect of treatment (PI, SI, and TI) at each time point to show the treatment difference (See Table 4.3).

The Bonferroni adjusted post hoc tests for the within-subjects factor (as shown in Table 4.2) illustrated that on the interpretation task the difference between the pretest and posttest means was significant for PI and SI groups but not TI. This suggests that, unlike TI, both PI and SI were effective in improving learners' interpretation. Furthermore, the difference between the pretest and the delayed posttest means were also found significant for both PI and SI groups. This indicates that the groups could also maintain their gains in the delayed posttest although their gains dropped between the first and second posttests. Furthermore, the Bonferroni adjusted post hoc tests (as shown in Table 4.3) for between-subjects factor revealed that in both immediate and delayed posttests there was no significant difference between and PI and SI groups while a significant difference was found between the two aforementioned groups and the TI group.

Table 4.2

Pairwise Comparisons for Within Subjects Factor

Treatment Variable	(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
PI	1	2	-4.292*	.517	.000	-5.562	-3.021
		3	-3.375*	.501	.000	-4.605	-2.145
	2	1	4.292*	.517	.000	3.021	5.562
		3	.917*	.271	.004	.250	1.583
	3	1	3.375*	.501	.000	2.145	4.605
		2	-.917*	.271	.004	-1.583	-.250
SI	1	2	-3.640*	.507	.000	-4.885	-2.395
		3	-2.600*	.490	.000	-3.805	-1.395
	2	1	3.640*	.507	.000	2.395	4.885
		3	1.040*	.266	.001	.387	1.693
	3	1	2.600*	.490	.000	1.395	3.805
		2	-1.040*	.266	.001	-1.693	-.387
TI	1	2	-.450	.567	1.000	-1.842	.942
		3	-.200	.548	1.000	-1.547	1.147
	2	1	.450	.567	1.000	-.942	1.842
		3	.250	.297	1.000	-.480	.980
	3	1	.200	.548	1.000	-1.147	1.547
		2	-.250	.297	1.000	-.980	.480

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

All in all, the results of the mixed design ANOVA and its follow-up simple effect analysis conducted in this section could be summarized and interpreted as follows: a) both PI and SI treatments effectively improved the learners' interpretation ability in the immediate posttest and the learners could retain

their gains in the delayed posttest; b) both PI and SI treatments were as effective as each other; finally, c) TI was not found effective in terms of improving the learners' interpretation ability

Table 4.3

Pairwise Comparisons for the Between Subjects Factor

time	(I) Treatment Variable	(J) Treatment Variable	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
Pretest	PI	SI	.030	.346	1.000	-.819	.879
		TI	.200	.366	1.000	-.699	1.099
	SI	PI	-.030	.346	1.000	-.879	.819
		TI	.170	.363	1.000	-.721	1.061
	TI	PI	-.200	.366	1.000	-1.099	.699
		SI	-.170	.363	1.000	-1.061	.721
Immediate Posttest	PI	SI	.682	.708	1.000	-1.057	2.420
		TI	4.042*	.750	.000	2.200	5.883
	SI	PI	-.682	.708	1.000	-2.420	1.057
		TI	3.360*	.743	.000	1.535	5.185
	TI	PI	-4.042*	.750	.000	-5.883	-2.200
		SI	-3.360*	.743	.000	-5.185	-1.535
Delayed Posttest	PI	SI	.805	.671	.704	-.843	2.453
		TI	3.375*	.711	.000	1.629	5.121
	SI	PI	-.805	.671	.704	-2.453	.843
		TI	2.570*	.704	.002	.840	4.300
	TI	PI	-3.375*	.711	.000	-5.121	-1.629
		SI	-2.570*	.704	.002	-4.300	-.840

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

4.2. Production

To address the second research question comparing the efficacy of three different types of instruction (i.e., PI, SI, and TI) in terms of improving the learners' production, first, a one way between-groups ANOVA was run on the pretest scores of the production task to examine whether any significant differences existed between the groups before the treatment. The analysis showed that there were no significant differences between the groups before the instruction ($F(2, 66)=.29, p=.74$). The descriptive statistics for all the treatment groups' performance on the production task across pre/post and delayed posttests (Table 4.4.)

Table 4.4

Means and Standard Deviations for all Groups on Sentence-level Production Task

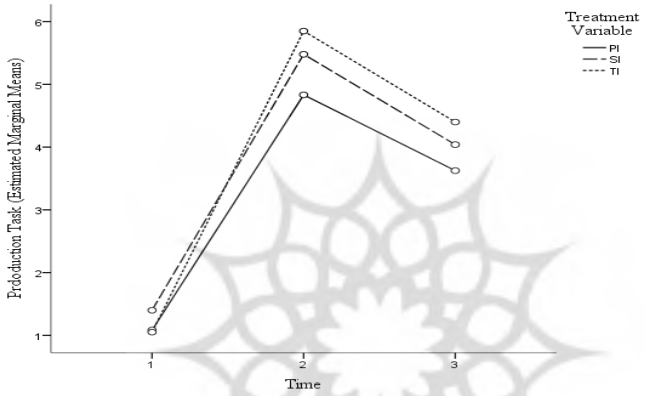
	PI (n=24)		SI (n=24)		TI (n=20)	
	M	SD	M	SD	M	SD
Pretest	1.08	1.586	1.40	2.021	1.05	1.504
Posttest	4.83	3.199	5.48	2.756	5.85	3.048
Delayed Posttest	3.63	3.437	4.04	2.622	4.40	2.780

Then, a mixed between-within subjects analysis of variance was conducted. Between the subjects variable was the type of intervention with three levels (i.e., PI, SI, and TI) and within the subjects variable was the learners 'production performance across three-time points (i.e., pretest, posttest, and delayed posttest). The results of which are presented in three categories a) interaction effect, b) treatment effect; and c) the time effect. The analysis of the interaction effect showed that there was no significant interaction between time and types of instruction, Wilks' Lambda =.97, $F(4, 130)=.51, p=.72$, multivariate partial eta squared=.01. This lack of interaction which is partly shown in Figure 4.2

indicates that the three groups performed similarly which in turn allowed us to proceed to the analysis of the main effects of treatment and time.

Figure 4.2.

Profile Plot of Performance on Production Task across Three-Time Points



The analysis of the main effect of time illustrated a significant effect for time, Wilks' Lambda=.25, $F(2, 65)=96.57$, $P<.001$, partial eta squared=.74. To examine the nature of this effect, a pairwise comparison table using Bonferroni adjustments was consulted (Table 4.5). As shown in Table 4.5, the difference between the learners' performance was significant among all the three pairs: a) between time one (i.e., pretest) and time two (posttest), between time one and time three (i.e., delayed posttest), and between time two and time three. This means that each treatment was effective in improving the learners' production performance in the immediate posttest and the learners also maintained their production gains on the delayed posttest though their gains dropped from immediate to delayed posttest.

Table 4.5

Pairwise Comparisons

(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-4.210*	.305	.000	-4.819	-3.601
	3	-2.844*	.310	.000	-3.462	-2.226
2	1	4.210*	.305	.000	3.601	4.819
	3	1.366*	.207	.000	.953	1.779
3	1	2.844*	.310	.000	2.226	3.462
	2	-1.366*	.207	.000	-1.779	-.953

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

The last part of the analysis dealing with the main effect of treatment was not found significant, $F(2, 66)=.41$, $p=.66$, partial eta squared=.01. This could be interpreted that there was no difference among PI, SI, and TI types of instruction. All in all, the results of mixed ANOVA elaborated above have illustrated that all the three types of instruction (PI, SI, and TI) were effective in terms of improving the learners' production ability in both the short and long run. Furthermore, no treatment was found superior to others.

4.3. Grammatical Sensitivity

The third research question in the present study was posed to investigate whether the impact of processing instruction was related to the learners' individual differences in grammatical sensitivity. To this end, first, a computerized grammatical sensitivity measure (i.e., LLAMA-F) was

administered to the learners of both Processing instruction groups (i.e. PI and SI) as a whole before the treatment. The test consisted of 20 items and its score ranged between 0 and 100. Table 4.6 displays relevant descriptive statistics.

Table 4.6

All Learners Performance on Grammatical Sensitivity Test

	Mean	Std. Deviation	N
PI and SI group	43.47	21.462	49

Then, a series of Pearson correlations were calculated. Initially, a correlation was run between the whole learners' grammatical sensitivity scores and their performance on the pretest of the interpretation task. As shown in Table 4.7, no initial significant correlation was found between the pretest scores and the individual difference factor ($r(47) = .18, p = .21$). This was followed by other correlations computed between the learners' performance in the immediate and delayed posttests of the interpretation task and their grammatical sensitivity scores.

Table 4.7

Pearson Correlations between Grammatical Sensitivity (GS) and Pre-Post-Delayed Posttests

	GS	Pretest	Immediate Posttest	Delayed Posttest
GS	1	.182	.188	-.060
Sig. (2-tailed)		.212	.197	.684
N	49	49	49	49

As illustrated in Table 4.7 above, no significant statistical association was found between grammatical sensitivity and the learners' performance on either the immediate posttest ($r(47)=.2, p=.19$) or the delayed one ($r(47)= -.06, p =$

.68). Even though the results were not significant, we conducted additional correlations for each of the processing instruction treatments separately (i.e., PI and SI) to further examine the relationship of each group's performance on the immediate and delayed posttests on one hand and their respective grammatical sensitivity scores on the other hand. The descriptive statistics and the result for each separate correlation is presented in Tables 4.8 and 4.9 below respectively.

As shown in Table 4.9, the results revealed that there was no significant correlation between each group's performance and their respective grammatical sensitivity scores both in the immediate and post delayed tests hence confirming our initial findings. All in all, the findings indicate that grammatical sensitivity as measured by LLAMA-F in the present study seems not to affect the impact of processing instruction whether operationalized as PI or SI.

Table 4.8

Descriptive Statistics of Performance on Grammatical Sensitivity Test

	Mean	SD	N
PI group	49.17	23.390	24
SI group	38.00	18.257	25

Table 4.9

Pearson Correlations between Each Group's Separate Performance and Grammatical Sensitivity

Groups		GS	Immediate Posttest	Delayed Posttest
PI	GS	1	.053	-.174
	Sig. (2-tailed)	-	.804	.416
	N	24	24	24
SI	GS	1	.266	-.014
	Sig. (2-tailed)	-	.198	.947
	N	25	25	25

5. Discussion

The present study was initiated to achieve two objectives. Firstly, motivated by the fact that PI replication studies conducted in the Iranian context surprisingly failed to support the conclusive positive mainstream findings of PI research, we decided to reexamine the effectiveness of processing instruction (PI) in the Iranian context by comparing it to a traditional output-based instruction (TI). In fact, we were specifically interested to find answers to the following two questions: what are the relative immediate and delayed effects of PI and TI on the acquisition of English passive structure in terms of improving the learners' 1) interpretation and 2) production? The relevant part of the results illustrated that: a) both operationalization of processing instruction (i.e., PI and SI) effectively and equally improved the learners' interpretation ability in the immediate and delayed posttests whereas TI could not improve the learners' interpretation ability; b) all the three types of instruction (PI, SI, and TI) were equally effective in terms of improving the learners' production ability in both short and long run. Taken together, these findings suggest that PI is more effective than TI since a) it has improved learners' interpretation and production while TI has only improved the learners' production; b) it has improved the learners' production ability while its treatment did include any production-based activities. Interestingly, these findings have replicated the positive mainstream findings of extensive PI research on the one hand (Benati, 2001; VanPatten & Cadierno, 1993; VanPatten & Wong, 2004, among others) and have contradicted the findings of PI studies conducted in Iran on the other (Birjandi, Maftoon & Rahemi, 2011; Rahemi, 2018; Younesi & Tajeddin, 2014). Therefore, in what follows first we will discuss the results with the help of mainstream findings of PI research. Then, we are going to discuss and compare our findings with those of previous PI studies conducted in the Iranian context.

The superiority of Processing instruction over traditional output-based instruction (TI) could be justified through a number of arguments. First of all, the fact that, unlike TI, both operationalizations of processing instruction (i.e., PI & SI) improved the learners' interpretation could be accounted for through VanPatten's (1996, 2002, 2015) input processing theory in general and its first noun principle in particular. In fact, the input processing theory hypothesizes that while processing the input for meaning, learners utilize some default processing strategies or principles (e.g. first noun principle in this case). The use of such strategies is believed to hinder a given target structure from getting processed by learners which, in turn, prevents them from making the form-meaning connection required for acquisition. However, as also supported by the findings of this study, through structured input activities especially the referential ones, PI assists learners from the beginning to circumvent the default processing strategies, process the input correctly, and consequently get richer intake. This data, in turn, is believed to affect the learners' developing system and finally what they can access for production (VanPatten & Cadierno, 1993). This partly could explain why Processing instruction can improve the learners' both interpretation and production.

Furthermore, the effectiveness of PI could also be attributed to the fact that PI encourages the learners to process form and meaning simultaneously. The effectiveness of simultaneous processing of form and meaning has been supported by a plethora of Form-focused instruction research. This line of research has illustrated that a type of instruction that combines the focus on form with the focus on meaning is more effective than the one that only focuses on either form or meaning (Nassaji, 2000; Spada, 2011). To put in other words using Long's (2001) terms, Focus on Form is more effective than Focus on forms or Focus on meaning. As a matter of fact, PI is an input-based pedagogical

intervention in which the learners are exposed to a set of structured activities designed in a way to make their successful understanding dependent on the processing of a given target structure. This, in turn, brings us to the task essentialness of structured activities explained below.

The results of the present study also demonstrated that the two operationalization of processing instruction, namely, PI and SI were as effective as each other. This finding, in line with the previous literature (Benati, 2004; VanPatten & Oikkenon, 1996; VanPatten et al., 2013, among others), illustrates that explicit information about the target structure plays little role in Processing instruction. This lack of a role for explicit information could be attributed to the purpose and nature of referential activities utilized in processing instruction. In fact, in terms of their purpose, structured activities in general and referential ones, in particular, are designed in a way to push learners to abandon their inefficient processing strategies for more optimal ones. In terms of nature or structure, they are meaning-form essential, that is, to complete these tasks successfully, one needs to process both the form (i.e., target structure) and meaning simultaneously. The two aforementioned features of PI activities seem to enable learners to make the form-meaning connection automatically and consequently acquire the target structure without requiring any further explicit information. (Benati & Batziou, 2019; Lee, 2015; Marsden, 2006). However, the fact that explicit information has been rendered superfluous by PI structured activities should not be interpreted as an indication that explicit instruction does not have any role in SLA. The role of explicit information as shown by Kasprowicz and Marsden (2017) might depend on the type of activities used in a particular pedagogical intervention.

Despite the consistent findings of a huge amount of research in support of PI including the findings of the present study, and the theoretical underpinning

of PI briefly mentioned above, some Iranian studies have failed to replicate these positive findings. Such contradictions are considered valuable and worthy of further analysis since they might lead to development in terms of explanation and theory. In fact, these challenging results encourage us to reassess the findings of previous research more closely and possibly find the variables and design features affecting the outcomes of a given study (Uludag & VanPatten, 2012). Accordingly, we decided to examine the PI research conducted in Iran more closely with the help of Wong's (2004) list of conditions deemed necessary for PI to yield positive results. Surprisingly, we found that Iranian researchers have not met some of the conditions: a) some of them have not addressed a processing problem in the first place which is considered the defining feature of PI procedure (Ghasemi Torkabad & Fazilatfar, 2014; Rahimzadeh & Ghaemi, 2016; Seyednejad & Gholami, 2017; Vafaparvar & Kheirzadeh, 2017); b) others have included more than one target structures or functions at a time (Baleghizadeh & Saharkhiz, 2014; Fahim & Ghanbar, 2014) while it has been emphasized that PI activities must address one target feature or structure in a treatment session (Wong, 2004); c) one study has failed to include affective activities in its treatment (Jafarigohar et al., 2015). To make the situation even worse, some of the PI studies conducted in Iran also suffer from methodological issues such as a) lacking a control group (Fahim & Ghanbar, 2014); b) not controlling the age variable (Fahim & Ghanbar, 2014); c) having sketchy method/procedure section (Baleghizadeh & Saharkhiz, 2014; Jafarigohar et al., 2015; Rahimzadeh & Ghaemi, 2016).

Among Iranian PI studies, two ones (i.e., Birjandi & Rahemi, 2009; Rahemi, 2018) need to be singled out since these studies seem to have followed PI procedures more closely compared to other Iranian studies mentioned above and yet they have not supported the mainstream findings of PI. In fact, they also

failed to demonstrate the superiority of Processing instruction over output-based instruction. With regard to the first study conducted by Birjandi and Rahemi, a close examination revealed the following as possible explanations for their contradictory results: a) the PI activities utilized were only sentence-based, namely, there were no discourse-based tasks in the PI instructional packet; b) PI packet consisting of only 30 sentences (20 referential plus 10 affective); c) although the researchers mentioned that they tried to observe one of the requirements of PI, namely, forms or functions must be taught each at a time, they seemed to have neglected that by teaching both active and passive causative sentences in one session with only using thirty sentences; d) two of the referential activities used by the researchers based on the sample provided by them in the appendix seem not to have observed a PI requirement, that is, instead of focusing on processing meaning they have encouraged the learners to pay attention to form through their use of active and passive. Finally, the main finding of this study was that production practice led to the improvement of the interpretation, however, the question of how production improved the learners' interpretation is left unanswered. In the second study, Rahemi (2018) also did not support the mainstream findings of PI and showed that in terms of interpretation, Processing instruction was as effective as output-based instruction, and in terms of production, the output-based instruction was more effective than Processing instruction. This finding was not supported by our study although addressing the same target structure (i.e., English passive structure). Reviewing the method section of this study, we have found the following points as potential explanations: a) lack of discourse-based tasks in the PI packets; b) the interpretation task consisted of a part which was a recognition test rather than a processing test used in PI studies. Furthermore, there are some issues that need to be addressed to be able to unravel the contradiction between the findings of

Rahemi and our study. For example, the nature of PI tasks utilized in her study is not known since the researcher has not provided the tasks. Hence, one cannot examine them and find whether they have truly followed the PI procedure or not. Besides, one cannot determine whether the explicit part of the PI packet was repeated in each treatment session or not. However, it must be noted that the two aforementioned studies were conducted at the university level while our study focused on high school students. A potential issue that needs to be addressed by future researchers before one can generalize the findings of the present study.

All in all, the contradictory findings of Iranian PI research compared with mainstream findings of PI research, as shown above, could most likely be attributed to the way their instructional, as well as assessment tasks, have been operationalized. In fact, the researchers seem to have inadvertently not followed PI procedures fully especially in terms of their instruction materials. This might be due to the fact that researchers especially young ones being under pressure to publish to be able to graduate rush to conduct a study in a new and vibrant domain in the field without prior thorough examination and grasp of the given domain. This could lead to failure to meet the required conditions and possibly explains their inconsistent findings. However, it must be cautioned that since the present study is almost the first one contradicting the findings of other PI Iranian studies, its findings must be taken with care until other researchers replicate them.

As our second objective, we focused on the moderating role of grammatical sensitivity in processing instruction. In fact, the following research question was pursued: Does the learners' difference in grammatical sensitivity modulate the impact of Processing instruction? The results illustrated that grammatical sensitivity as measured by LLAMA-F in the present study did not

affect the impact of processing instruction no matter how it was operationalized. In other words, in both PI and SI groups, the learners' performance on the immediate and delayed posttests was not related to their level of grammatical sensitivity. This finding has supported the results of a handful of studies conducted by VanPatten and his colleagues (See VanPatten et al., 2013) while it has been inconsistent with Erlam (2005) who found a positive relationship between grammatical sensitivity and processing instruction, namely, students with a higher level of grammatical sensitivity performed better on the written production test. Erlam's inconsistent finding compared to those of the studies reported in VanPatten et al. and also to the finding of the present study might be due to two limitations of her study: a) conducting the measure of grammatical sensitivity six months after the treatment; b) loosely following processing instruction procedure as mentioned by her in the introduction section of her paper. Furthermore, the fact that participants in the four studies reported in VanPatten et al. were university students while Erlam's participants were high school students might be interpreted that grammatical sensitivity could have a moderating role in the performance of younger learners. This interpretation, however, has been ruled out by the present study's finding which has replicated VanPatten et al. findings with high school students.

Additionally, with regard to the role of grammatical sensitivity in PI, the present study has also addressed an issue raised by an anonymous reviewer in VanPatten and Borst (2012). The reviewer has warned that the lack of relationship between grammatical sensitivity and processing instruction found in the VanPatten and Borst's study might be due to the measure of grammatical sensitivity used (i.e., MLAT) which is of global nature and might not be appropriate for assessing the detailed level of acquisition such as form-meaning mapping in the processing of sentences. This concern also seems not relevant

since the present study has replicated VanPatten and Borst's finding while using a different measure of grammatical sensitivity (i.e., LAMMA). To sum up, the present study has contributed to the debate of the role of grammatical sensitivity in processing instruction through utilizing a new measure and targeting different age groups while supporting the findings of those studies which have found no necessary role for grammatical sensitivity in processing instruction (VanPatten & Borst, 2012; VanPatten et al., 2013).

At this juncture, an important question that needs to be answered is why processing instruction seems not to be affected by the learners' differences in grammatical sensitivity while SLA research has shown a positive relationship between aptitude (grammatical sensitivity) and instructed SLA (e.g., Robinson, 1995). In fact, this imperviousness of PI to grammatical sensitivity has been attributed to its unique characteristics compared to other pedagogical interventions such as a) its emphasis on correct sentence processing rather than rule learning and viewing acquisition as developing form-meaning connections during sentence comprehension b) relating the instruction to how learners process sentences by focusing on an underlying processing problem affecting a given target structure and its final acquisition by learners. Therefore, PI as defined in preceding lines seems not to be related to aptitude in general or grammatical sensitivity in particular (VanPatten et al., 2013). However, this should not be interpreted that PI's impact is impervious to all other individual difference factors although with regard to some factors such as age there is enough research illustrating that PI is not affected by the learners' age factor (Angelovska & Benati, 2013; Benati & Angelovska, 2015 among others).

Recently, Farhat and Benati (2018) explored the relationship between the learners' level of motivation and PI. Interestingly, they have found that motivation like grammatical sensitivity, age seems not to have a role in PI,

however, since Farhat and Benati's study is the only published one addressing the role of motivation in PI, their finding needs to be replicated by others. All in all, the findings of studies addressing the interaction between PI and individual difference factors such as age (Angelovska & Benati, 2013; Benati & Angelovska, 2015), grammatical sensitivity (VanPatten et al., 2013) and more recently motivation (Farhat & Benati, 2018) have led some PI researchers to the conclusion that the positive impact of PI on language development seems not to be affected much by individual difference variables (Farhat & Benati, 2018). However, it might be still early to draw such a conclusion until future researchers explore how other important individual differences factors might affect the impact of PI.

6. Conclusion

The present piece of research has illustrated the superiority of PI over TI and has also demonstrated that the positive impact of PI is not affected by the learners' differences in grammatical sensitivity. These findings have both theoretical and pedagogical implications. Theoretically, the results of these studies have shed light on the contradictory findings of PI research conducted in Iran and have illustrated that the reason why some Iranian scholars could not support the conclusive findings of PI research might reside in the way PI has been operationalized by these researchers. Furthermore, with regard to the role of grammatical sensitivity, the present study for the first time has used a different grammatical sensitivity measure (i.e., LLAMA F) hence addressing a previous criticism that the no role of grammatical sensitivity in previous PI research might be due to the nature of the measures used in those studies (VanPatten & Borst, 2012). In fact, the present study has demonstrated that grammatical sensitivity appears to have no role in PI supporting VanPatten et al (2013) findings with not

only a new measure of grammatical sensitivity but also with different age groups (i.e., high school students). In short, the conclusive positive findings of PI research in general and the findings of this study, in particular, might be attributable to the close connection between this pedagogical intervention and SLA research. As a pedagogical intervention, PI is directly premised on VanPatten's (2002, 2015) Input processing theory, and it is also indirectly supported by other SLA research such as form-focused instruction and comprehensible input. With regard to classroom application, one might say, that as long as a given target structure is affected by a processing problem, PI seems a more effective option in the hands of teachers compared to other traditional output-based instruction. Furthermore, the findings of the present study have shown that PI could also be tailored to teaching complex grammatical structures such as passive in English presented in three tenses (present, past, and future). This was achieved in the present study by spreading the treatment to three consecutive weeks each of which focused on one tense. This is believed to have led the teaching of such complex related aspects of grammar possible on the one hand and to more consolidation of the learners' processing of the given target structure on the other.

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