

Classroom-oriented research: Processing Instruction (findings and implications)

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Bio

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Abstract

This paper firstly presents and examines the pedagogical intervention called Processing Instruction. Secondly, it reviews and discusses the main findings of the empirical research conducted to measure the relative effects of Processing Instruction. Current research trends with the Processing Instruction research framework will be outlined. Experimental research investigating the effects of this pedagogical intervention to grammar instruction has primarily made use of listening and reading measures (so-called off-line measures) to elicit how learners comprehend and process sentences. On-line measurements such as eye tracking and self-paced reading have now been incorporated into Processing Instruction research to measure language processing more directly. Finally, this paper provides specific guidelines and procedures for teachers on when and how to use Processing Instruction.

What is Processing Instruction?

Processing Instruction is a pedagogical intervention to grammar instruction whose main scope is to facilitate the cognitive processes by which language learners connect a linguistic feature in the input to its meaning. Form-meaning connections are the relationship learners make between referential meaning and the way it is encoded linguistically. For example, when learners hear the sentence *I talked to my teacher* and understand that *talked* means that the action is in the past a form-meaning connection is made. Processing Instruction is predicated on a contemporary theory of second language acquisition called The Input Processing Theory (VanPatten 2004). Input Processing Theory and research attempts to address why L2 learners process some elements in the input and not others when they are exposed to certain linguistic features. The Input Processing Theory consists of two overarching strategies addressing two different aspects of processing

- (a) L2 learners are driven to get meaning first while processing language input
(Primacy of Meaning Principle);
- (b) L2 learners assign the role of subject to the first noun they encounter in a sentence
(First Noun Principle).

To explain these two processing strategies an example is provided.

- (a) In the sentence *Yesterday, I played tennis with John in the park*, in the attempt to make moment-by-moment connection of surface form with meaning, learners would need to tag *played* with the fact that it is a verb (<+V>, <-N>), that its meaning refers to playing a sport, that it is past tense not present (<+present> <-past>), and so on. However, learners would initially process the first element (the lexical item

Yesterday) they encounter to interpret the sentence as a sentence in the past. By doing this, they would skip the form *-ed* as in *played* as it encodes the same semantic information. Learners would initially rely on the lexical item to extract the meaning from the sentence and will not make a form-meaning connection. (This processing strategy is called the Lexical Preference Principle and it is a sub-principle of the Primacy of Meaning Principle).

(b) In the sentence *The police officer was killed by the robber*, learners, in the attempt to make moment-by-moment computation of sentence structure during comprehension, would process the first element they encounter in the sentence as the subject of the sentence. Learners would interpret the sentence as if it were the police officer who killed the robber. This will cause a delay in interpreting the meaning of the sentence and therefore a subsequent delay in acquisition.

The first characteristic of Processing Instruction is to help language learners to process input more accurately and appropriately. In Processing Instruction learners are required to simultaneously focus on form to get meaning to improve their ability to process the right information and make the right form-meaning connections during comprehension. This is a different function from simply noticing a form in the input, which means being consciously aware of something in the input. For example, learners might hear the word 'played' and notice that it is different from either 'plays' or 'playing.' However, they might not connect immediately the ending (verbal inflection) with the concept (e.g. pastness, present) that the action has already taken place, takes place at the moment or is taking place. Processing instruction is fundamentally different from other input-based pedagogical interventions to grammar instruction such as input enhancement. This is because enhancing a feature in the

input might help learners to notice that feature but it does not necessarily mean that learners actually link meaning with form or that it facilitates how they are able to build sentence structure as part of parsing. Processing Instruction facilitates both form-meaning mappings and parsing.

A second characteristic of Processing Instruction is that it focuses on the processing of morpho-phonological units as well as sentences. The measures used to assess 'processing' are interpretation measures. In Processing Instruction research rules are not tested (e.g., grammaticality judgment tasks, fill-in-the-gap, etc.) but the ability to process is. In Processing Instruction research, when production measures are used, they are not meant to show that speaking or writing skills are developing as a result of its beneficial effects.

A third characteristic is that Processing Instruction alters the way in which the input is processed by learners, which in turn might have an effect on their developing system. Processing Instruction is not an intervention meant to assist in skill development, but it might help learners to access the right information (form or structure) in order to express meaning.

To summarise, Processing Instruction is a pedagogical intervention to grammar instruction that uses a particular type of input to push learners away from non-optimal processing strategies so that they are more likely to make correct form-meaning connections or parse sentences appropriately (compute basic structure in real time) during comprehension. It is mainly concerned with the processing of morpho-phonological units in input strings and the development of underlying linguistic representation.

Processing Instruction consists of two main components:

(1) Learners are given explicit information about a linguistic form and the particular processing strategy that may negatively affect their picking up of the form or structure during language processing;

(2) Learners are pushed to process (not produce) the form or structure during structured input tasks. More information on the actual use of Processing Instruction in the classroom is presented below.

What are the main research findings in Processing Instruction research?

Processing Instruction has been widely investigated (Benati & Lee 2015) on a variety of languages (e.g. Spanish, French, Italian, German, Russian, Japanese, Arabic, Greek), linguistic features (e.g. word order, clitic pronouns, passive and causative constructions, tense markers, aspectual markers, mood with expression of doubt), populations (groups and individuals from eight different L1s) and contexts.

To measure the effects of Processing Instruction, two methodological designs have been used: pre and post-tests (immediate and delayed) experimental design to measure its effects and compare Processing Instruction to other pedagogical interventions; and the so-called 'trials to criterion design'. The latter is a methodological design used to examine the possible effects of the treatment itself (number of trials for learners to correctly process sentences) and learner's reaction times in sentence responses.

The empirical research into the relative effects of Processing Instruction has addressed the following questions:

- Is Processing Instruction more effective than other pedagogical interventions?
- Is Processing Instruction effective across different languages and populations?
- What is the causative factor for its positive effects?
- Is there an effective way to deliver Processing Instruction?
- Can we measure secondary effects for Processing Instruction?
- Can we measure discourse effects for Processing Instruction?

- What are the numbers of trials for learners to correctly process sentences?
- Can we measure long-term effects for Processing Instruction?

Is Processing Instruction more effective than other pedagogical interventions?

Processing Instruction is an effective pedagogical intervention to grammar instruction which has consistently demonstrated significant improvement in learner performance on both interpretation and production tasks. In processing instruction studies have made use of interpretation and production sentence-level tasks. Normally in interpretation tasks, learners were asked to interpret sentences containing the target feature. In the production tasks learners were asked to put verbs in the correct form by completing a short passage or producing a series of sentences containing the target form. The effects of Processing Instruction, investigated in a number of empirical studies, have shown that it is a better instructional intervention than traditional instruction (paradigmatic explanations of rules followed by mechanical drill practice) at improving learners' rate of processing and at increasing learners' accuracy in production (VanPatten & Cadierno 1993; VanPatten & Wong 2004). Its effects have also been compared to other instructional interventions such as meaning-based output instruction (Farley 2001, 2004; Benati 2005), input-based interventions (Lee & Benati 2007a), and dictogloss (Uludag & VanPatten 2012). These comparative studies demonstrate that Processing Instruction is better than other pedagogical interventions at altering learners' processing problems (e.g., Lexical Preference Principle, First Noun Principle). Processing Instruction has a positive effect on learners' ability to process input efficiently and correctly.

Is Processing Instruction effective across different languages and populations?

Processing Instruction can help learners of any target language (romance and non-romance languages) develop an appropriate target-language specific processing strategy to address a target-language specific processing problem. Processing Instruction research has examined native speakers of English learning romance languages (Spanish, French, Italian) and non-romance languages such as Japanese, Russian, German, and English. Other studies (Benati & Lee 2015) have examined native speakers of Chinese, Korean, Turkish, Italian and Greek learning English as an L2. Processing Instruction seems to be effective for instilling target language specific processing strategies, no matter the native language of the learners.

What is the causative factor for its positive effects?

One line of research in the Processing Instruction research agenda has investigated the effects of its components (explicit information and structured input practice). Research teasing out the main factors responsible for its effectiveness have used three experimental groups: one receiving only the explicit information component; the second only the structured input practice component; the third group receiving both components. A number of forms and structures have been investigated (e.g., Italian future tense and noun-adjective agreement, French negative plus indefinite article, Spanish object pronoun, Japanese past forms and affirmative vs. negative present forms, Russian case marking, German case marking and Spanish direct object pronouns. Results from these studies (VanPatten & Oikennon 1996; VanPatten et al. 2013) indicated it is the structured input practice component that is the main factor in the positive results generated by Processing Instruction.

Is there an effective way to deliver Processing Instruction?

Processing Instruction is designed for delivery in the language classroom. Most studies investigating its effect have instructional material as packets for each group investigated. Lee & Benati (2007a) carried out several studies comparing classroom vs. computer delivered Processing Instruction. The results of these studies measuring different linguistic features (e.g., French subjunctive; Spanish negative informal commands, Spanish preterite/imperfect aspectual distinctions) indicated that Processing Instruction is effective no matter the mode of delivery (in class delivered to a group collectively and on computer in a laboratory to individuals).

Can we measure secondary effects for Processing Instruction?

Benati & Lee (2008) examined transfer-of-training effects for Processing Instruction. Transfer-of-training effects was defined as the effects of the Processing Instruction treatment used to help learners to process a particular form affected by a specific processing principle that are transferred to another linguistic form affected by the same processing principle. For instance, we provide Processing Instruction training to L2 learners on Italian noun-adjective gender agreement and found that it transferred to the future tense. Benati & Lee (2008) found that training on the English past tense marker *-ed* is transferred to the third-person singular present tense marker *-s*. They also trained L2 learners to process imperfective verb morphology in French and found that it transferred to subjunctive forms. Processing instruction seems to have primary and secondary effects on similar morphological or syntactic constructions.

Can we measure discourse effects for Processing Instruction?

The positive results of Processing Instruction have been observed on sentence level tasks (interpretation and production). Can we find similar results when we measure Processing Instruction using discourse-level tasks? Benati & Lee (2010) found positive effects for Processing Instruction using discourse-level interpretation tasks (e.g., English past tense, Japanese passive constructions). Benati & Batziou (2017) have demonstrated that Processing Instruction has an effect on discourse-level production tasks (oral and written video-based retellings and oral and written structured interview).

What are the numbers of trials for learners to correctly process sentences?

Processing Instruction research has evaluated the learners' performance based on accuracy scores. How many sentences did the learners interpret correctly? How many forms did they produce correctly? Fernández (2008) shifted the focus from the outcome (accuracy scores) to the learning process by introducing the measure of trials to criterion. She defined trials to criterion as the number of items that participants completed up to the point when they correctly answered three target items and one distracter item in a row. She compared the effects of full Processing Instruction (PI group) to structures input only component (SI group) with Spanish direct object pronouns and the Spanish subjunctive, that is, she addressed the question of the effects of explicit information. She measured four aspects of performance: trials to criterion, response time, accuracy after criterion, and the proportion of participants who reached criterion. She found different results for the two target items. For Spanish direct object pronouns, she found no significant differences between the PI and SI groups on any of the four measures. For the Spanish subjunctive, she found that the PI group significantly outperformed the SI group on all four measures. She concluded that the benefits of explicit information depended on the nature of the task or the aspect of performance measured and

the processing problems presented by specific linguistic items. The effects of Processing Instruction can be approached from a process perspective as well as a product perspective.

Can we measure long-term effects for Processing Instruction?

The original study by VanPatten & Cadierno (1993) demonstrated that the effects of Processing Instruction were retained one month after instruction. Many subsequent studies have included delayed post-testing that show learners retain the benefits of Processing Instruction, be the post-testing one week after instruction (Lee & Benati 2007b), two weeks (Benati 2013), three weeks (Benati 2005), four weeks (Keating & Farley 2008), six weeks (VanPatten, Farmer & Clardy 2009); six months (Benati & Batziou 2018) and eight months (VanPatten & Fernández 2004). The effects of Processing Instruction were measured using a variety of tasks including aural interpretation, oral or written production, form selection, and guided composition.

Overall, the main findings from research measuring the relative effects of Processing Instruction on the interpretation and processing of target forms or structures has revealed that it is an effective pedagogical intervention. Learners from different L1s and backgrounds make consistent gains in interpretation and production tests at sentence and discourse-level. The effects of Processing Instruction are consistent, durative, and measurable on different languages and processing problems. Learners from different L1s seems to equally benefit from Processing Instruction. Primary effects for Processing Instruction are transferable to other linguistic features (so-called secondary effects) affected by similar processing problems (Leeser forthcoming).

Despite the large database, research within this research framework has primarily made use of listening and reading measures (so-called off-line measures) to elicit how learners comprehend and process sentences. On-line measurements such as eye tracking and self-

paced reading have now been incorporated into Processing Instruction research to measure processing more directly (Wong forthcoming; Lee forthcoming).

What are the current research trends in Processing Instruction?

The main goal of Processing Instruction is to alter learners' processing to facilitate more appropriate and accurate moment-by-moment computation of sentence structure (parsing) and connection of surface formal features with meaning (form-meaning connections). To date, experimental studies within this framework have examined the effects of Processing Instruction at sentence and discourse-level using off-line tasks (interpretation and production). Now we are entering a new stage of Processing Instruction research where researchers are turning their attention to other issues and raising other key questions:

- Is there a correlation between this pedagogical intervention and individual differences?
- What are the effects of Processing Instruction when examined using on-line measures?

Is there a correlation between this pedagogical intervention and individual differences?

Benati & Lee with McNulty (2010) examined the role of language background to address whether having one or more languages might have an effect on the positive results generated by processing instruction. They examined native speakers of English who had studied only Spanish as a second language, native speakers of English who were studying Spanish as a third or subsequent language, and non-native speakers of English studying Spanish as a third of subsequent language. The study demonstrated language background did not have an effect on how learners in this study interpret and produce Spanish subjunctive/indicative contrast

after the adverb *cuando*.

VanPatten & Borst (2012) have carried out an empirical study exploring the variable of grammatical sensitivity, a component of language aptitude, in relation to processing instruction. They provided learners with processing instruction on German accusative-case definite articles in OVS word order patterns. Grammatical sensitivity was weakly correlated with trials to criterion and post-test scores and did not reach a level of statistical significance. In a second study, VanPatten et al. (2013) found no effects for grammatical sensitivity on trials to criterion or post-test scores for Spanish object pronouns in OVS word order patterns, German accusative case definite articles in OVS word-order patterns and French causative constructions with *faire*.

The role of age in Processing Instruction has been investigated using different participants. (VanPatten & Oikennon 1996) examined the effects of Processing Instruction on high-school students, aged 15-16 years. Benati (2005) measured the positive effects of processing instruction with 12-13 year old Chinese and Greek children, as did Marsden (2006) with 13-14 year olds native speakers of English. Benati & Lee (2008) examined middle-school-aged Korean children and Benati & Lee (2010) found positive effects for Processing Instruction on English simple past tense with native speakers of Chinese who were primary-school-aged children.

Benati (2013) examined secondary students and adults. Mavrontoni & Benati (2013) compared the performance of pre- and post-puberty adolescents. Cox & Sanz (2015) have addressed the age question by going in the other direction and examining older learners. In all these studies older learners are as successful as younger learners at changing their processing strategies in a novel language after being exposed to Processing Instruction.

Benati & Ayah (forthcoming) explored the role of motivation on results generated by Processing Instruction. In particular, this study focuses on measuring the effects of this pedagogical intervention on the acquisition of the Modern Standard Arabic gender agreement. Two experimental groups were formed (high motivated vs. low motivated) by using two motivation questionnaires to capture different variables that determine their motivation (individuals scoring either high or low were selected assigned to the two groups, whereas individuals with 'middle scores' were excluded). Both groups received Processing Instruction and interpretation and production sentence level-tasks were used in a pre-test and post-test design (immediate and delayed effect) to measure instructional effects. The results indicated that both groups improved equally from pre-tests to post-tests in all assessment measures and they both retained the positive effects of the training in the delayed post-tests. Processing instruction was proved to be the main factor for the improvement in performance no matter learners' level of motivation.

What are the effects of Processing Instruction when examined using on-line measures?

The use of online measurements to investigate the effects of Processing Instruction might offer us a better fine-grained analysis information about moment-by-moment sentence comprehension and possibly a way to measure implicit knowledge. In the last few years Processing Instruction studies have included self-paced reading measurements (Dracos 2012; Henry 2015; McManus & Marsden 2016) to investigate how L2 learners interact with input in real time. Henry (2015) compared Processing Instruction and traditional instruction on the acquisition of German accusative case markers, and the main results of this study showed that the Processing Instruction group outperformed the traditional instruction group on an offline comprehension task, but there were no differences between the two groups on the self-paced reading measure.

More recently, eye-tracking has been used in Processing Instruction research to measure the location and duration of eye gazes while speech unfolds. Wong (forthcoming) compared changes in processing patterns between learners receiving Processing Instruction and traditional instruction on the acquisition of French causative. In this pre and post-test experimental study a dichotomous scene selection eye-tracking task was used to measure eye movement patterns and accuracy in picture selection while they were processing auditory sentences. The results from this study indicated that the Processing Instruction group gained higher accuracy scores than the traditional instruction group.

A change in eye movement was also observed in learners after the Processing Instruction training but not for the traditional instruction training.

Lee (forthcoming) is currently investigating bidirectional transfer-of-training effects on the English causative and English passive. The Processing Instruction treatment on one form might influence processing another form among Chinese learners. In this study he is comparing NNS performance to NS performance on a pre-test to post-test design. Eye tracking will be used to measure learners' processing while reading the target sentences, while looking at two pictures (images), and while mouse clicking A or B as the correct answer and clicking finished to move forward.

These are the first two studies using eye-tracking as an online measure of input processing within the Processing Instruction research framework. Further research observing learners' eye movement patterns during real time input processing should attempt to investigate whether Processing Instruction does indeed change the way learners process the target form or structure.

When and how do we employ Processing Instruction?

Processing Instruction is a pedagogical intervention to grammar instruction that uses a particular type of input to push L2 learners away from non-optimal processing strategies so that they are more likely to make form-meaning connections during comprehension.

Processing Instruction tasks should only be designed and used to shift learners away from resorting to processing strategies based on, for example, The Lexical Preference Principle or The First Noun Principle. The first is a strategy used by L2 learners to process lexical items before grammatical items when they both encode the same semantic information. The second is a processing strategy used by L2 learners to assign the role of subject to the first noun they encounter in a sentence.

Wong (2004) has argued that for an activity to be Processing Instruction, that activity must somehow push learners to circumvent an inefficient processing strategy. Language instructors would therefore need to determine first what the processing problem (if any) is.

Processing Instruction consists of two basic components:

- Learners are provided explicit information about a specific form or structure and, in particular, about the processing strategy that may negatively affect their picking up of the form or structure during language processing;
- Learners are pushed to process (not produce!!!) the form or structure during structured input tasks.

During structured input tasks, learners are pushed to process the targeted form or structure through tasks in which the input is manipulated in particular ways to push learners to become dependent on the form or the structure to get meaning.

VanPatten & Sanz (1995) have developed the following guidelines that guide the construction of structured input tasks:

- 1. Present one thing at a time
- 2. Keep meaning in focus
- 3. Move from sentences to connected discourse
- 4. Use both oral and written input
- 5. Have the learner do something with the input
- 6. Keep the learner's processing strategies in mind

I now describe the six main components for developing effective structured input tasks.

1. There is a temptation for teachers to teach as much as possible and as early as possible. In structured input tasks, rules are broken down into smaller parts and taught one at the time during the lesson. Learners have limited capacity for processing information, and presenting them with a smaller and more focused amount of information would clearly enhance the opportunity for learners to pay more focused attention. Focusing on one form at the time will help learners to map one form to one meaning or parse syntactic structures correctly.

2. Structured input tasks are not only to practice grammar. Through these, learners are encouraged to make form-meaning connections. Keeping meaning in focus is crucial when we develop structured input activities. A good structured input task is where students can extract the meaning of the sentence from the form or the structure in the input. In the example below, learners must listen to a number of sentences and indicate whether the action occurred last weekend or is part of a series of actions oriented toward the present (in this case the

processing problem is the so-called ‘Lexical Preference Principle’, which states that if grammatical forms express a meaning that can also be encoded lexically (i.e., that grammatical marker is redundant), then learners will not initially process those grammatical forms until they have lexical forms to which they can match them).

Step 1. Listen to each statement about your teachers and decide whether he/she does them now or last weekend.

Now	Last weekend
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Sentences heard by learners

- 1.....played tennis in the park with his friends
2. corrects exams
3. cooked Italian food
4. watched the football match
5. teaches a class

(The task continues in a similar fashion)

Step 2. Now decide in pairs whether your teacher’s weekend was an interesting or a boring weekend.

3. Learners are first exposed to sentences. However, at a later stage we should be able to move from providing learners with short sentences to exposing them to connected discourse.

This should happen only when learners have already had opportunities to process the new form or structure. In the example below learners must listen to a story that a student told about his first day in London and decide which statements accurately describe what happened.

Step 1. Listen to the following story that a student told about his first day in London and decide which statements accurately described what happened.

(Instructor's script)

I really wanted to see Madame Tussaud's, so early in the morning I took a quick shower and got washed, and traveled by train to Baker Street station. I had my picture taken with David Beckham, well the wax model that is. I also visited Trafalgar Square and saw Nelson's Column. There were so many pigeons there I think they owned the place! In the afternoon I waited for ages for a train to take me to Covent Garden. I really hated London trains; they are awful. Covent Garden was fantastic, I watched the different street performers, and I really enjoyed listening to the musicians. I finished my exploration and sunbathed for a bit in Hyde Park – London's most famous and largest open space. I arrived home quite late and called my parents back in China and talked about my day. All in all, I had a wonderful time today.

The student....	True	False
1...wanted to see Buckingham Palace	<input type="checkbox"/>	<input type="checkbox"/>
2...showed pictures of Hyde Park to his parents	<input type="checkbox"/>	<input type="checkbox"/>
3...stayed in bed most of the morning	<input type="checkbox"/>	<input type="checkbox"/>
4...liked Covent Garden	<input type="checkbox"/>	<input type="checkbox"/>
5...phoned his parents	<input type="checkbox"/>	<input type="checkbox"/>
6...liked English trains	<input type="checkbox"/>	<input type="checkbox"/>
7...visited Madame Tussaud's	<input type="checkbox"/>	<input type="checkbox"/>
8...travelled on the bus	<input type="checkbox"/>	<input type="checkbox"/>
9...really liked the clowns in Oxford Circus	<input type="checkbox"/>	<input type="checkbox"/>
10...arrived home early	<input type="checkbox"/>	<input type="checkbox"/>

Step 2. Now read the text you have listened to and check your answers. Would you like to change any of your answers? Then ask your teacher to give you answers.

Step 3. Read the text again. Do you know any of the famous places mentioned above? Would you like to go to any of them?

4. Structured input tasks should combine oral and written input as some L2 learners respond better to one mode of input than to the other. Hearing the forms allows for sound-meaning connections, whereas written form-meaning connections are made via reading.

5. Structured input tasks should be designed to make learners do something with the input they receive (i.e. agreeing or disagreeing; false or true; likely or unlikely). Nothing is more meaningless than listening or reading language simply because it is required. During these

tasks L2 learners should be encouraged to make form-meaning connections. Learners must be engaged in processing the input (having a specific reason for processing input) and they must respond to the input sentence in some way (see example below where the structured input task is used to process the third person singular –s- in English). This form is affected by the The Preference for Nonredundancy Principle (Learners are more likely to process nonredundant meaningful grammatical markers before they process redundant meaningful markers).

Step 1. Read each sentence and then decide whether or not it is right about your class teacher. Indicate your answer with an ‘X’.

My teacher...

	Right	Wrong
1.arrives to school early.	<input type="checkbox"/>	<input type="checkbox"/>
2. wears colourful clothes.	<input type="checkbox"/>	<input type="checkbox"/>
3.drinks coffee before each lesson.	<input type="checkbox"/>	<input type="checkbox"/>

(The tasks continues in a similar fashion. Adapted from Lee & VanPatten 2003)

Step 2. Do you think your teacher is different from other teachers in your school? Why?

6. Learners’ attention should be guided so as not to rely on natural processing strategies.

Tasks in which the input is structured to alter learner’s reliance on one particular processing principle should be created. This is the main goal for structured input tasks: correcting inefficient processing strategies and instilling in L2 learners more efficient ones. In the example below learners hear a sentence containing the passive construction (affected by the First Noun Principle) and are asked to circle the picture which they think represent the meaning of the sentence heard (*The car was chased by the cow*).



(The activity continues in a similar fashion)

Structured input tasks are of two types: referential and affective. Referential activities are those for which there is a right or wrong answer and for which the learner must rely on the targeted grammatical form to obtain the meaning. In the following sentence '*I walked with John in the park*' learners must decide whether this even refers to the past or the present. In the example below, learners are asked to listen to each sentence and select the appropriate time-related adverbials that can be added to the sentence they hear.

Model: Learners hear 'John deposited money in the bank'

- Last Monday
- Later this week
- Right now
- Not Sure

Affective structured input activities are those in which learners express an opinion, belief, or some other affective response and are engaged in processing information about the real world. In the following sentence '*I visited Rome with my friends*' learners might be asked what they think about this event and express an opinion on whether they think it is interesting or boring, for example. Affective activities reinforce form-meaning connections established during referential structured input activities. In the example below, learners first read a list of

activities and they need to indicate whether they did similar or different things at the last New Year celebrations (Step 1). In Steps 2 and 3, learners use the input data to establish whether they spend this event in a similar or different way and who had the most interesting and enjoyable celebration.

Step 1. Read the following statements and establish whether you did the same or not.

	Yes	No
1. I visited my relatives		
2. I celebrated in the street with friends	<input type="checkbox"/>	<input type="checkbox"/>
3. I danced at a club	<input type="checkbox"/>	<input type="checkbox"/>
4. I watched TV all night	<input type="checkbox"/>	<input type="checkbox"/>
5. I decided on a New Year resolution	<input type="checkbox"/>	<input type="checkbox"/>

Step 2. Compare your results with your partner to find out how many similar things you did.

Step 3. Decide who had the most interesting and enjoyable New Year celebrations.

Referential and affective activities have different functions. The main role of referential activities is to push L2 learners to pay attention to form and make decisions (for example like or wrong, present or past, likely or unlikely). These activities should precede affective activities in terms of practice. This is to allow L2 learners to become aware of the target form through the referential activity first.

The input in these activities is structured and manipulated in particular ways to push learners to become dependent on form and structure to obtain the meaning and/or privilege the form or structure in the input so that learners have a better chance of processing it. With Processing Instruction learners get two-for-one. That is, learners not only improve in interpreting sentences or discourse correctly but also get the benefit of being able to produce correct sentence or discourse containing the target linguistic features. As previously said, research findings have also shown that Processing Instruction is effective no matter the mode

of delivery (computer, instructor and on paper). Most computer assisted learning programmes provide a web platform to deliver and evaluate structured input activities.

Research in instructed second language acquisition has addressed, among other things, the question whether certain types of pedagogical interventions are better than others, and whether they could be incorporated successfully into a more communicative framework of language teaching. Processing Instruction is a pedagogical intervention to grammar instruction that can in certain cases and conditions (such as features affected by specific processing problems) enhance and speed up the way certain linguistic features and structures are learned. The input in structured input tasks is "structured" or manipulated in particular ways to push learners to become dependent on form and structure to get meaning and/or privilege the form or structure in the input so that learners have a better chance of processing it. However, Processing Instruction is not the only effective type of grammar instruction available for teachers. Input flood for example is an alternative pedagogical intervention to grammar instruction that assumes that frequency of appearance in the input is a facilitative factor in acquiring a form. Input enhancement is another effective intervention to grammar instruction which involves changing the appearance of a written form so that it is perceptually more salient. Input enhancement provides learners with access to comprehensible input and helps them to notice grammatical forms in the input. Because acquisition is 'input-dependent' and classroom teaching should be 'communicative rich', input-based pedagogical interventions to grammar instruction are effective ways to ensure L2 learners attend to grammatical features in the input. However, we are not suggesting that L2 learners should not engage with output practice and should not produce grammatical items.

Benati and Schwieter (forthcoming) have suggested some principles that language instructors might consider when developing grammar tasks:

- Grammar tasks should be developed to ensure that learners process input correctly and efficiently;
- Grammar tasks should be designed for learners to notice and process forms in the input and eventually make correct form-meaning connections;
- Grammar tasks should include both a focus on form and on meaning;
- Grammar tasks should move from input to output practice. Structured input tasks, for instance, should be followed by structured-output tasks used to promote language production. Structured-output tasks enable L2 learners to access forms and structures in their internal system to communicate an idea.

Concluding remarks

Processing Instruction is predicated on a model of input processing. This theory attempts to identify the main strategies responsible for how learners connect grammatical forms with their meanings as well as how they interpret the roles of nouns in relationship to verbs during real-time comprehension. Processing Instruction is about helping learners with the processing of morpho-phonological units in input strings. It does not aim to develop learners' skills, but it is concerned with the development of underlying linguistic representation.

Empirical research has demonstrated that the effects of Processing Instruction are consistent, long-lasting, measurable on different languages, different linguistic features affected by processing problems, with learners of different ages and background, and its positive effects seem to be transferable. Current research trends within this research framework are examining the effects of Processing Instruction using online measurements (e.g., self-paced reading, self-paced listening, eye-tracking) to examine moment-by-moment processing. Future studies would also need to continue to consider the individual characteristics of the learner and the language under investigation. Are the benefits of

Processing Instruction in L2 learning confined to the L2 or are they extendable to the learning of other languages (e.g., L3, L4)? Does the target L2 modulate the effectiveness of

Processing Instruction in an L3?

Processing Instruction is not the only effective approach to grammar instruction, but it is the most effective pedagogical intervention to use a particular type of input to push learners away from non-optimal processing strategies and to facilitate form-meaning connections during comprehension.

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