An Examination of the Effects of Explicit Language Knowledge on Second Language Online Processing: A Case of Saudi English Language Learners

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Abstract

The study examined the extent to which Saudi second language learners (L2) demonstrate explicit knowledge (EK) of English passive as a result of years of explicit instruction. It further explored the effect of EK on the online processing English passive sentences especially that L2 learners face difficulty in integrating grammatical knowledge in online processing of L2. Participants wereL2of English (n = 127) and native speakers of English (n=50). The participants were tested by using the untimed grammar judgment test and a metalinguistic knowledge test to measure EK and processing of English passives. The results indicated that the L2had a high level of EK of the passive structures. Triangulation of the UGJT and MKT accuracy scores as a measure of EK and the UGJT reading times as a measure of online processing exhibited a significant effect of EK on online processing.

Keywords: Explicit knowledge, passive sentences, explicit instruction, online processing

1. Introduction

There has been renewed interest in online processing of syntactic structures within second language acquisition (SLA) in recent years, especially in connection with language knowledge (explicit and implicit knowledge). Research findings have revealed that L2 learners use different knowledge types to various extents in processing. L2 learners rely on and employ syntactic, semantic, and contextual information even at lower proficiency levels (Hoshino, Dussias, & Kroll, 2010), when processing language input. Native language speakers rapidly integrate syntactic and non-linguistic knowledge to form prediction in language processing (Huettig, Rommers, & Meyer, 2011). However, adult L2 learners usually have difficulty in applying grammatical knowledge in the online processing of L2, such as syntactic structure or derivational and inflectional morphology(Hopp, 2014). Major models of L2 sentence processing in SLA agree on that the difficulties L2 learners face with morphosyntax are problems of integrating morphosyntactic information (i.e., grammatical knowledge) in online processing. Ullman (2001) and Paradis (2009)added that the main difference between native speakers and L2 learners is in the way morphosyntactic and syntactic knowledge is processed and represented. They argue that native speakers' grammatical processing is different from L2 learners because the former relies on IK knowledge which is stored in procedural memory, thus, resulting in a faster parsing that is unconscious and automatic. On the other hand, the procedural memory is less available for processing in adult L2 learners who have to depend on declarative memory (i.e., EK) to store knowledge about L2(Clahsen & Felser, 2006). Therefore, knowledge about L2 is largely conscious EK instead of "an internalized set of computational procedures that apply automatically" (Paradis, 2009, p. 34). Hopp (2014)suggested that adult L2 learners' processing speed depends on the degree to which L2 learners are capable of speeding up what are considered to be controlled processes. Therefore, advanced L2 learners exhibit a high degree of proficiency and fluency in their L2 processing and production. He added that the processes involved in L2 mental processing are qualitatively variant from those employed by native speakers' processing, which even use different brain regions. Therefore, the distinction between explicit and implicit learning and their resulting EK is an important element in the explanation of processing variability in SLA.

This study aims to investigate the extent to which EK play a role in processing of syntactic structures. An exploratory experimental approach was conducted on a sample of participants with the minimum of six years of exposure to explicit learning of English. This is in line with R. DeKeyser (2007)who suggested that "no experiment lasting only a few weeks is representative of the long-term dynamics of real-world language learning" (p. 301). Therefore, this study attempted to examine what is the resulting types of knowledge that exist in non-immersed L2 learners after years of explicit instruction of grammatical structure and how it effects the processing of L2 syntactic structures

2. Literature review

Linguistic knowledge is an "elaborate network of nodes and internode connections of varying strengths that dictate the ease with which specific sequences or rules can be accessed" (R. Ellis, 2005, p. 142).

The resulting knowledge typeinL2 learners is driven mainly from input. Thus, the way input is delivered to learners, whether explicitly through instruction or implicitly through language exposure, affects the way that knowledge is stored and processed in learner minds (R. Ellis, 2005). This view of linguistic knowledge is the one adopted in this study and widely accepted by many SLA researchers such as Godfroid, Loewen, et al. (2015); Loewen (2009, 2020), Akakura (2009, 2012), Bowles (2011), R. M. DeKeyser and Koeth (2011),(N. C. Ellis, 2005; R. Ellis, 2005); R. Ellis (2008); Ellis (2009, 2015); Ellis and Roever (2021), N. C. Ellis (2008), Gutiérrez (2012, 2013), and Zhang (2015), to name a few. Explicit knowledge is defined "as the conscious and declarative knowledge of L2 that is accessed during controlled processing and that is potentially verbalized" (Bowles, 2011, p. 284).

Measures of explicit language knowledge

Grammar judgment tests (GJTs) and metalinguistic knowledge tests are widely in used SLA to evaluate EK. Untimed GJT emphasize on form and apply no time pressure, consequently accessing EK. It is hypothesized that EK is accessed when there is a necessity to monitor language that may happen when a grammatical form differs from the internalized knowledge of that form (Akakura, 2012).Thus, ungrammatical sentences provide a better measurement of EK than grammatical ones (Akakura, 2012; Bowles, 2011; R. Ellis, 2005; Ellis, 2009; Gutiérrez, 2013).Ellis (2006) study found that participants scored lower on grammatical items compared to ungrammatical items, supporting the hypothesis that ungrammatical sentences are better indicators of EK. Furthermore, availability of time is an important factor when creating a test to measure EK. Gutiérrez (2013)claimed that removing time constraints in GJT enables learners to engage in the three processes of noticing, reflecting and semantic processing.

Structural knowledge and metalinguistic knowledge are two components of EK. Therefore, Akakura (2009) suggested the empolyment of untimed grammar judgment test (UGJT) and metalinguisticc knowledge test (MKT) to measure EK. Metalinguistic knowledge is evaluated by tests that use error correction and rules stating items (Akakura, 2012; Bowles, 2011; R. Ellis, 2005; Gutiérrez, 2012).The issue MKT measures is that they only measures a part of EK (Akakura, 2009). Therefore, research studies examining EK usually use metalinguistic tests as well as grammar judgment tests (Akakura, 2009, 2012; Bowles, 2011; Gutiérrez, 2012, 2013; Loewen, 2009; McManus & Marsden, 2019a)

Gutiérrez (2012, 2013) conducted two studies to examine efficacy of grammar judgment test in measuring EK and IK separately. Gutiérrez (2012) studied the nature of knowledge representations (IK and EK) developed by two groups of learners of Spanish as a L2 at different levels of proficiency. The study used UGJT and MKT to measure EK, while an oral proficiency test, a written proficiency test and timed GJT were used to measure IK. The study conducted a factor analysis computed on the different measures of implicit and EK revealed that the grammatical items in a timed and untimed GJT constituted a measure of IK whereas the ungrammatical sentences in both GJTs and the metalinguistic knowledge test were measures of EK. Also, Gutiérrez (2013) study investigated the effects of 'time pressure' and 'task stimulus'(grammaticality) on implicit and EK that L2 learners draw from when performing grammar judgment tests. The tests were designed according to R. Ellis (2005) criteria. The results of the metalinguistic knowledge test revealed that the participants did quite poorly and that the scores varied considerably and correlated with ungrammatical sentences in both GJTs. He used factor analysis that confirmed his previous study finding that grammatical sections in both GJTs and those of the ungrammatical ones loaded on two separate factors. In both studies he concluded thatL2 learner processed grammatical and ungrammatical sentences in the GJTs differently.

Explicit Knowledge and online processing

Language knowledge play a significant role in the processing of syntactic structures received little attention within SLA due to lack of valid and separate measures (Batterink & Neville, 2013; Erçetin & Alptekin, 2013; McManus & Marsden, 2017; Morgan-Short, Steinhauer, Sanz, & Ullman, 2012; Morgan- Short, Sanz, Steinhauer, & Ullman, 2010). VanPatten and Rothman (2015) had urged SLA researcher to examine the interface between knowledge and processing rather than only studying the interface between knowledge types.

Furthermore, McManus and Marsden (2017) claimed that L2 knowledge and processing routines have a huge influence on L2 online processing and offline interpretation and production. Recently, however, SLA researchers have developed and validated separate measures of IK and EK (Andringa & Curcic, 2015; McManus & Marsden, 2019b; Suzuki, 2017, 2018; Suzuki & DeKeyser, 2017). As a result, it will be possible to investigate the effect of language knowledge and the interface hypothesis, with Andringa and Curcic (2015) coming the closest to investigating the role of EK on processing, while Suzuki and Sunada (2018) validated measures that distinguish between implicit and EK.

In their study, Andringa and Curcic (2015)suggested that EK does have an impact on online processing of object markings and that L2 learners can learn to process their L2 like natives although they were instructed explicitly for a very short time. This finding was also supported by some neurolinguistic studies that studied the efficacy of explicit instruction or EK on processing by using ERP measures (Andringa & Rebuschat, 2015; Godfroid, 2019; Godfroid, Loewen, et al., 2015; Lim & Godfroid, 2015; Morgan- Short et al., 2010)where they found that L2 learners elicit P600 effect during syntactic violation after being instructed explicitly (i.e., that resulted in EK), which is also found in native speakers. Furthermore, Suzuki and Sunada (2018), Andringa and Curcic (2015)and Suzuki and DeKeyser (2017)suggested that the use of online measures to study L2 acquisition will produce insights that are important to advance the interface debate.

McManus and Marsden (2019a) examined the effect of L1 and L2 explicit instruction and L1 and L2 practice on L2 processing. The study had (*n*=53) university students learning French as their FL. Across-linguistic out-come test and UGJTwere used to measure the participants' improvement where the items presented L1 context followed by L2 stimulus (i.e., interpretation). Then, the participants would judge whether the two were a match. The RT and accuracy results were collected. The findings showed that accuracy only improved significantly. RT results indicated that explicit instruction and practice group's speed of performance got significantly faster over time in all testing stages. The L1+ L2 explicit instruction and L1+L2 practice group CV scores showed that RT got faster gradually but remained constant. Therefore, McManus and Marsden (2019a) argued that it showed the participants processing did not only speed up but rather the CV results demonstrated that processing changes were efficient and stable which are indicators of automatization as a result of L1+L2 practice. They concluded that automatization does not only require L1 and L2 explicit instruction but also L1 and L2 practice for long periods of time.

In sum, the reviewed studies have found significant benefits of using explicit instruction and EK on the acquisition and processing of both morphology and morpho-syntactic structures. However, they did not investigate the effect of L2 syntactic knowledge on L2 processing. The reviewed studies can be divided into two categories: SLA studies and neurolinguistics studies. The results of both categories cannot be generalized since most of the reviewed studies have not used valid and separate measures of implicit and EK. Furthermore, neurolinguistics studies such as Morgan- Short et al. (2010) and their follow up study, Morgan-Short et al. (2012) used ERP to measure L2 possessing. These studies suffered from the same issue as SLA studies where only EK has been measured and the other types have been neglected. The sample sizes were very small and the studies examined only the short-term effect of the intervention. The studies did not discuss the fact that their learners were non-immersed L2 learners and how this might affect their outcome. Furthermore, the improvement in L2 learners can be the result of different elements such as the other types of knowledge that might be available for the participants but not detected by the knowledge measures.

3. Methodology

3.1. Research question:

Does explicit knowledge of English passives' in Saudi L2 learners promote online processing of the target structure?

3.2. Target structure

English passives sentences are examined in the current study. Only the be-passives were examined which is the prototypical passive in English. Three tenses of the English passive were targeted in this study which are the present, the past and the present perfect.

3.4. Participants

The participants in the study were (*n*= 127) randomly selected female students from King Saud University enrolled in the College of Language and Translation (L2) and (n=50) native speakers of English (NSs). The L2 of English were native speakers of Arabic and foreign language learners of English. The participants' ages were between 18-24 years. They had learned English in a formal setting in either a school or a language institution for a minimum of 6 years.

3.5. Instruments

3.5.1. Metalinguistic knowledge test (MKT). The three part test had been adopted from Spada, Shiu, and Tomita (2015) to measure EK. It included an error correction section, an error identification section and an error explanation section. The task includes 24 items where 16 items are passive while 8 items are distractors.
All the items in the test include an error where the participants are asked to identify the error, to provide the correction and to sublimate an explanation. The participants were instructed to use English only. The participants took as much time as they need (5-30 min). The MKT tasks were presented via Google form.

3.5.2. Grammaticality judgment test (GJT). The study implemented an untimed written grammar judgment test (UGJT) to measure EK. The UGJT tasks was presented via computer using PsychoPy software package (Peirce, 2007). The test did not have any time pressure implemented where the participants have up to 20 min to complete the task. The items were adopted from Spada et al. (2015) study. The participants in the test were required to press a specific key to signify judgment. Their response times were collected when they respond by pressing the key "m" for grammatical and the key "z" for ungrammatical to measure their processing speed. They were awarded "1 point" for correct responds and "0 points" for incorrect responses. The PsychPy software recorded the participants' accuracy and reaction times.

3.6. Data Analysis

The UGJT and MKT were scored in terms of accuracy. They were awarded 1 point for correct responses and 0 point for incorrect answers. The study only analyzed the reaction times of correct responses. The low cutoff value for RT are set at 300 ms and the high cutoff value will be set as 3SD above the group mean for each item, which is in line with Suzuki and Sunada (2018). Prior to conducting the statistical tests on the collected data, normality tests were used to examine whether the data is normally distributed or not. The data's distribution was examined statistically by using the Shapiro-Wilks test which revealed that the data was not normally distributed. Therefore, non- parametric tests were used to analyze the data. Mann Whitney U-test was used to examine the difference between L2 and NSs. Regression simple analysis was employed to examine whether EKas measured by UGJT and MKT accuracy scores could predicate an improvement in online processing as measured by RT. The study used R software package to conduct the statistical analysis.

3.7 Procedure

Due to the ongoing Covid 19 pandemic, the experiment was conducted remotely via Pavlovia platform. The researcher met the participants via zoom where the instructions and the experiment links were shared. The study was conducted during the first semester of 2020-2021 for one month. Two tests (i.e., UGJT and MKT) were used to collect the data. Prior to the experiment, they were asked to fill the consent form and the background questionnaire at home via google form. Afterwards, the participants were asked to complete the tasks that were administered via Pavlovia platform and PsychPy software. The participants we reassessed in one stage for two hours. The participants were asked to complete the tasks during the two hours session through the given links. During the data collection, participants were able to contact the researcher to assist them remotely.

5. Results and Discussion

This study sought to investigate the resulting EK that exist in non-immersed L2 learners after years of explicit instruction of grammatical structure (i.e., English passive structures) and how this resulting EK affected the online processing of L2 sentences. The UGJT was used to measure EK in the current study because it draws attention to form and there was no time limit. UGJT ensured the participants were conscious and aware that their knowledge of the passive structure was examined, thus, tapping into their EK. Bowles (2011), Ellis and Roever (2021), and Gutiérrez (2013) claimed that UGJT allows participants to engage in the three processes of semantic processing, noticing, and reflecting. Consequently, the participants had more opportunity to access their EK.

5.1. *The untimed grammar judgment test (UGJT)*

Both the L2 and NSs speakers took an online computerized version of the UGJT. Table *1* presents the median scores and significance values of the Mann Whitney U-test for the differences between the NSs and the L2 on the UGJT measuring EK. The total accuracy score on the UGJT revealed that the NSs' (*Mdn* = 34) scored significantly higher than L2 learners' (*Mdn* = 28), *U*= 108.5, *p*> 0.000*. Similarly, NSs participants compared to L2 performed significantly better on grammatical items *U*= 479.5, *p*= 0.001*, and on ungrammatical items *U*= 1019, *p*> 0.000*.

Another Mann Whitney U-test is conducted to further examine the items according to structure and grammaticality (see Table 1). On the present passive and the present perfect passive, the NSs' scored significantly higher than L2 on both grammatical (*U*= 42.5, *p*> 0.001*; *U*= 143, *p* = 0.01*, respectively) and ungrammatical items (*U*= 64.5, *p*> 0.000*; *U*= 200, *p* = 0.001*, respectively).
The NSs and L2 performed similarly on past passive grammatical items (*U*= 72, *p* = 0.12). However, there was a significant difference between the two groups in favor of the NSs group on ungrammatical past simple passive items (*U*= 57, *p*> 0.000*).

Table 1. Mann Whitney U-test for the UGJT accuracy scores

Item	Group	*Median*	*Median Diff.*	*U*	*Sig.*
Past simple passive					
Grammatical	NSs	6	0	72	0.12
	L2	6			
Ungrammatical	NSs	6	1	57	0.000**
	L2	4			
Total	NSs	12	2	75.3	0.000**
	L2	10			
Present simplepassive					
Grammatical	NSs	6	0	42.5	0.001**
	L2	5			
Ungrammatical	NSs	6	2	64.5	0.000**
	L2	4			
Total	NSs	12	3	88.14	0.000**
	L2	9			
Present Prefect Passive					
Grammatical	NSs	6	0	143	0.01**
	L2	6			
Ungrammatical	NSs	5	1	200	0.001**
	L2	4			
Total	NSs	11	1	58.8	0.001**
	L2	10			

** The mean difference is significant at the 0.01 level.

Table 2 illustrates the results for the Wilcoxon signed-rank test on the accuracy scores of the UGJT. Both the NSs and L2 performed significantly better on grammatical items than on ungrammatical items (*p*= 0.000*, *p*= 0.0000*, respectively). Moreover, the items were analyzed according to passive structure. The NSs and L2 significantly outperformed on grammatical items compared to ungrammatical items on the past passive items (*p*= 0.004*, *p*= 0.000*, respectively) and on the present perfect passive items (*p*= 0.000*, 0.000*, respectively). The L2 significantly did better on present simple passive grammatical items than on present simple passive ungrammatical items (*p* = 0.0000*). Also, the NSs did better on present simple passive grammatical items than on present simple passive ungrammatical items (*p*= 0.001*).

Table 2. *Wilcoxon signed-rank test for the accuracy scores in the UGJT*

Structure	*Grammatical* (Mdn*)*	*Ungrammatical* (Mdn*)*	*Median difference*	*V*	*p-value*
NSs (*n*=50)					
Past simple passive	6	6	0	396	0.004**
Present simple passive	6	6	0	250	0.001**
Present Perfect passive	6	5	1	1595	0.000**
Total	18	17	1	5184	0.000**
L2 (*n*=127)					
Past simple passive	6	4	2	33565	0.000**
Present simple passive	5	4	1	27234	0.000**
Present Perfect passive	6	4	2	29835	0.000**
Total	17	11	5	261426	0.000**

** The mean difference is significant at the 0.01 level.

The findings of the current study supports Akakura (2012), R. Ellis (2005) and Gutiérrez (2013) that explicit instruction of grammatical structures has a long-term effect on EK. The participants accuracy scores were analyzed according to grammaticality of the sentence in the UGJT. The motivation was that previous studies claimed that L2 learners' performance differed on grammatical sentences compared to ungrammatical sentences in grammar judgment test (Akakura, 2012; Andringa & Curcic, 2015; Ellis & Roever, 2021; Gutiérrez, 2013; Shiu, Yalçın, & Spada, 2018). Previous studies reported split results where some studies had L2 perform better on grammatical sentence (Andringa & Curcic, 2015; R. Ellis, 2005; Shiu et al., 2018), whereas other studies had L2 performing better on ungrammatical sentences (Akakura, 2012). This study indicated that the L2 performed significantly higher on grammatical sentences compared to ungrammatical sentences. A similar trend was also observed in the analysis of NSs' accuracy scores where they scored higher on grammatical sentences compared to ungrammatical sentences across all three passive structures. These findings are in line with (Andringa & Curcic, 2015; R. Ellis, 2005; Shiu et al., 2018). The difference in accuracy between grammatical and ungrammatical sentences could be due to several reasons. First, the difference accuracy scores in favor of grammatical items could be due to the nature of the targeted structure. The English passive structure has a complex syntax semantic mapping where the NP carries the PATIENT in the subject slot while the AGENT role is marked by the proposition "by" and occur after the verb (Street, 2020). Second, the first language interference could be the reason for scoring less on ungrammatical sentences since the Arabic language does not have the copula verb and does not have the past participle form (Alkhuli, 2000). Third, the L2 non-immersed L2 did not have sufficient knowledge of the English passive features, thus, they are unable to detect the grammatical errors in the ungrammatical items. As a result, L2 have a tendency to consider ungrammatical items to be grammatically correct. Gutiérrez (2013) claimed that L2 performing differently on grammatical sentences than on ungrammatical sentences could be an indicator that grammatical sentences are processed differently than ungrammatical sentences.

Reaction times (RT) for the UGJT are presented in Table 3. Mann Whitney U-test was used to examine the differences between the NSs and the L2 on the RT for the UGJT measuring EK processing. The total RT on the UGJT revealed that the NSs' had significantly shorter RT than L2learners' (p =0.000**). Similarly, NSs participants had significantly a shorter RT compared to L2 on grammatical items (p =0.000**) than on ungrammatical items (p =0.000**). An additional Mann Whitney U-test was conducted on the RT to further examine the items according to structure and grammaticality (see Table 3). On the present passive and the present perfect passive, the NSs' had significantly shorter RT than L2 on both grammatical (p =0.000**, p =0.000** and Prefect present p =0.000**, respectively) and ungrammatical items (p =0.000**, p =0.000** and Prefect present p =0.000**, respectively). This suggested that when NSs participants were exposed to grammatical passive sentences they processed them faster than L2 learners. Additionally, when NSs participants were exposed to ungrammatical passive sentences they processed them faster than L2 learners. Also, the RT revealed that both NSs and L2 had a slower RT to complex passive structure (i.e., present perfect passive) compared to simple passive structures (i.e., present simple passive and past simple passive).

Table 3. *Mann Whitney U-test results for the RT in the UGJT*

Item	Group	*Mdn*	*U*	*Sig.*
Past Simple passive				
Grammatical	NSs	1536	18.95	0.000**
	L2	3036		
Ungrammatical	NSs	1464	20.28	0.000**
	L2	3129		
Total	NSs	1484	27.74	0.000**
	L2	3079		
Present Simple passive				
Grammatical	NSs	1454	19.04	0.000**
	L2	2964		
Ungrammatical	NSs	1485	19.65	0.000**
	L2	3328		
Total	NSs	1470	27.36	0.000**
	L2	3189		
Present perfect passive				
Grammatical	NSs	1786	30.86	0.000**
	L2	3590		
Ungrammatical	NSs	1697	24.77	0.000**
	L2	1485		
Total	NSs	1729	27.16	0.000**
	L2	3502		

**The mean difference is significant at the 0.01 level.

Table 4 shows the results of the Wilcox on signed-rank test conducted on RTs. The results of the Wilcoxon signed-rank test conducted on the L2 RTs revealed that there was no significant in the three passive structures: the past simple passive (p = 0.2), the present simple passive (p = 0.7) and the present perfect passive (p = 0.12). Notably, the Wilcoxon signed-rank test conducted on NSs RTs found that on both past simple passive and the present perfect passive items, there were significant difference between grammatical and ungrammatical items (p = 0.01** and0.000**, respectively) where they had a shorter RT on ungrammatical items. However, on the present simple passive sentence, there was a difference where they had shorter RT on ungrammatical items but it was not statistically significant (p = 0.12).

Table 4. *The paired samples Wilcoxon signed-rank test for the cleaned RT in the UGJT*

Item	*Grammatical (Mdn)*	*Ungrammatical (Mdn)*	*Median diff.*	*V*	*p-value*
NSs (*n*=50)					
Past passive	1536	1464	267.8	-2.3	0.01**
Present passive	1454	1485	142.1	-1.2	0.24
Present Perfect passive	1786	1697	804.6	5.4	0.000**
Total	1593	1541	-83.4	-1.3	0.198
L2 (*n*=127)					
Past passive	3036	3129	77.7	1.344	0.2
Present passive	2964	3328	27.9	-0.4	0.7
Present Perfect passive	3590	3462	110.1	1.556	0.12
Total	3232	3316	54.8	1.516	0.13

**The mean difference is significant at the 0.01 level.

The UGJT findings replicates the results of many SLA studies that found that native speakers process language differently than L2 such as (Hulstijn, 2002; Lee & Doherty, 2019; McManus & Marsden, 2019a; Street, 2020). This study also examined the effect of sentence grammaticality on online processing by measuring RT during the UGJT. The findings showed NSs had shorter RT on ungrammatical sentences compared to grammatical sentences on all three passive structures. Contrary to the NSs group, the L2 had shorter RTs on grammatical items compared to ungrammatical items in the past simple passive and the present simple passive. On the present prefect passive sentences, the L2 had shorter RT on ungrammatical items compared to grammatical items which is similar to NSs participants. In the Raw RT analysis of the L2 learners, the difference was statistically significant, however, in the Clean RT analysis, the difference was not statistically significant in all three passive structures. These findings are incompatible with Suzuki (2017) and Loewen (2009). Loewen found that L2 responded faster on ungrammatical items compared to grammatical during the UGJT. He argued that on grammatical items leaners make faster judgment than on ungrammatical sentence because participants engage in reflection to decide what is ungrammatical in the sentence. However, in Suzuki (2017) study, the RT for the NSs group and L2 group on grammatical and ungrammatical items was similar. The effect of grammaticality was inconsistent where the length of RT on grammatical and ungrammatical varied according to the grammatical structure targeted in the item. Nevertheless, the results of the current study were compatible with those of Godfroid, Loewen, et al. (2015). The study investigated the types of knowledge native and non-native English speakers draw from during TGJT and UGJT. He employed eye-tracking to measure the participants eye-movement and fixations during the two grammatical judgment tasks. The study found that non-native speakers of English had a shorter RTs on ungrammatical items compared to grammatical ones. Godfroid, Loewen, et al. (2015) claimed that a possible explanation is that the presence of ungrammatical element was enough evidence to make a judgment about the sentence ungrammaticality even before reading the whole sentence. Whereas the absence of the ungrammatical element resulted in the participants reading the sentence again because it might reveal that the item was ungrammatical after all. Therefore, the longer RT on grammatical item is their attempt to confirm their initial impression of the sentence grammaticality by rereading it. Especially, there is no time limit or restriction in the UGJT. The fluctuating findings of RTs on grammatical and ungrammatical items during UGJT in the previously discussed studies could be considered as an indicator that grammatical and ungrammatical items are processed by tapping on two different knowledge resources.

4.2. The Metalinguistic knowledge test (MKT)

MKT was employed in the current study to measure the metalinguistic element of explicit language knowledge. Table 5 presents the Median scores and significance values of *Mann Whitney U-test* for the differences between the NSs and the L2 on the MKT that measures the metalinguistic element of the explicit language knowledge. There was significant difference between NSs and the L2 in the overall score of the MKT (U = 2121.5, p= 0.01**). The MKT scores were collapsed according to the passive structure being targeted. Significant differences were also found between the NSs and the L2 in the past simple passive structure (U = 2032.5, p = 0.005**) and in the present simple passive (U = 1767.5, p = 0.0002**). However, there was no significant difference between the two groups in the present prefect passive structure (U = 2558.5, p = 0.365).

Table 5. *Mann Whitney U-test for the MKT for NSs and L2 learners*

Type	Group	*Mdn*	*U*	*p- value*
Past simple passive	NSs	13	2032.5	0.005**
	L2	12		
Present simple passive	NSs	13	1767.5	0.0002**
	L2	11		
Present Perfect passive	NSs	13	2558.5	0.365
	L2	12		
Total	NSs	38	2121.5	0.01**
	L2	34		

**The mean difference is significant at the 0.01 level.

This study measured both aspects of the EK where the structural knowledge was measured by the UGJT and the metalinguistic knowledge was measured by the MKT. The findings demonstrated that years of explicit instruction had a long-term positive effect on the participants' EK and metalinguistic knowledge. L2 developed the ability to identify the error in ungrammatical sentences, to correct the error and to explain the error in the passive sentence. These findings are in line with the findings of previous studies, such as (Akakura, 2012; Bowles, 2011; R. Ellis, 2005; Spada et al., 2015; Vega, 2018; Zhang, 2015) where they found that L2 had developed sufficient EK and metalinguistic knowledge and that this knowledge was sustained on the long-term.

Explicit knowledge and Online processing

Several simple linear regressions were performed to examine whether EK (as measured by MKT and UGJT Accuracy scores) was a significant predictor of overall improvement in UGJT processing time. A summary of the regression analysis is shown in Table 6. The first linear regression was conducted on UGJT total accuracy scores. The results showed that the model explained 1 % of the variance and was able to predict the improvement in UGJT processing speed to a significant extent, (F (1, 1058) = 15.14, p = 0.0001*). Predicated improvement in the sentence RT was equal to (B= -0.02, t= - 3.9, p= 0.0001*). As EK increased by one point, the model's predicated a shorter RT by 20 ms. A second simple linear regression was conducted on grammatical items in UGJT. The results showed that the model explained 0.5 % of the variance and was able to predict the improvement in the processing speed of UGJT grammatical items to a significant extent, (F (1, 1058) = 5.1, p = 0.02*). Predicated improvement in the grammatical sentence RT was equal to (B= -0.01, t= -2.3, p= 0.02*). As EK increased by one point, the model's predicated a shorter RT by 10 ms. A third simple linear regression was conducted on ungrammatical items in UGJT. The results showed that the model explained 2 % of the variance and was able to predict the improvement in the processing speed of UGJT ungrammatical items to a significant extent, (F (1, 1058) = 22.55, p = 0.00000*). Predicated improvement in the ungrammatical sentence RT was equal to (B= -0.023, t= -4.75, p= 0.00000*). As EK increased by one point, the model's predicated a shorter RT by 23 ms.

Three simple linear regressions were performed to examine whether metalinguistics EK (as measured by MKT) was a significant predictor of overall improvement in UGJT processing time. A summary of the regression analysis is shown in Table 6. The first linear regression was conducted on MKT total accuracy scores. The results indicated that metalinguistic EK was not a significant predictor of improvement in the UGJT reaction time performance (p = 0.5). The model explained 0.0001 % of the variance and was not able to predict the improvement in UGJT reaction time to a significant extent, (F(1, 916) = 1.8, p = 0.1). The second linear regression was conducted on UGJT grammatical RT. The results indicated that metalinguistic EK was not a significant predictor of improvement in the grammatical UGJT item's reaction time (p = 0.12).

The model explained 0.02 % of the variance and was not able to predict the improvement in the grammatical UGJT reaction time to a significant extent, (F(1, 916) = 1.8, p = 0.2). A third linear regression was conducted on UGJT ungrammatical RT. The results indicated that metalinguistic EK was not a significant predictor of improvement in the ungrammatical UGJT item's reaction time (p = 0.3). The model explained 0.01 % of the variance and was not able to predict the improvement in the grammatical UGJT reaction time to a significant extent, (F(1, 916) = 1.18, p = 0.3). Thus, the metalinguistic element of the explicit language knowledge as measured by MKT is not predicator of processing speed during UGJT.

Table 6. *The simple regression analysis of the UGJT and MKT accuracy and RTs*

	Unstandardized coefficient								
	B	*SE*	*t*	*P- value*	*F*	*P*	R	Multiple R^2	Adjusted R^2
UGJT Accuracy scores ~									
UGJT Ungrammatical RT	-0.01	0.003	-2.3	0.02*	5.1	0.02*	0.005	0.004	-0.01
UGJT Grammatical RT	-0.02	0.005	-4.75	0.000*	22.55	0.000*	0.02	0.02	-0.02
UGJT Total RTs	-0.02	0.004	- 3.9	0.0001*	15.14	0.0001*	0.014	0.013	-0.017
MKT Accuracy scores ~									
UGJT Ungrammatical RT	-0.002	0.0022	-1.34	0.18	1.80	0.18	0.000	0.0018	0.0007
UGJT Grammatical RTs	-0.002	0.0021	-1.09	0.278	1.18	0.278	0.000	0.001	0.0002
UGJT Total RTs	-0.03	0.042	-0.60	0.54	0.360	0.54	0.000	0.0003	-0.001

This study investigated the EK of English passive effect on the online processing of these structures as reflected in the changes in sentence reading times during the UGJT. A regression analysis was conducted on the accuracy scores of the UGJT and MKT as measures of EK and the reading times (RT) during the UGJT as a measure of online processing. The regression analysis revealed that the UGJT accuracy scores were a significant predicator of processing speeding during the UGJT, unlike the MKT which was not a significant predictor of improvement in RT. This is a notable finding since the UGJT measures a different element of the explicit language knowledge than the MKT. As mentioned previously, the UGJT measures the structural knowledge element of the EK(Akakura, 2012) which is about "the uses to which language can be put" (R. Ellis, 2005, p. 114) while the MKT measures the knowledge of technical terminology required to describe language (R. Ellis, 2008).

A possible explanation of the UGJT findings is that the L2 were using controlled language processing where they employed their EK of the passive structures consciously and with deliberate effort. This resulted in an increase the processing speed as reflected by the L2 shorter reading times. However, when the L2 lacked the EK of the targeted structure, their reading times increased which resulted in longer reading times. This can be considered as an indicator of the positive role that explicit language knowledge plays in online processing of syntactic structures. This finding is consensus with previous neurolinguistic research (Andringa & Curcic, 2015; Davidson & Indefrey, 2009; Godfroid, Winke, & Rebuschat, 2015) that found a positive effect EK on online processing as measured by ERP. Furthermore, this finding is incompatible with some previous SLA studies (Andringa & Curcic, 2015; Marsden, Williams, & Liu, 2013) that argued that explicit instruction and EK did not promote online processing as measured by eye-tracking and reading times. On the other hand, the results of the current study supported Loewen (2009); McManus and Marsden (2019a, 2019b) findings and conclusions. They claimed that EK positively affected online processing. McManus and Marsden (2019a, 2019b) claimed that L2 practice combined with explicit instruction significantly facilitated L2 speed (i.e., online processing) and accuracy (i.e., explicit language knowledge).

5. Conclusion

The main motive for conducting this study was to examine the claim that explicit instruction had a facilitative role in developing long term effect on EK of English passives. Results illustrated that the Saudi L2 developed long-term knowledge of explicit language knowledge as a result of years of explicit instruction. Results also showed that EK had a positive effect on L2 online processing of English passive sentences. The findings of this study provided support for the effect of EK on online processing as proposed by and that UGJT and MKT are measurement of EK rather than IK.EK of English passives in this study helped students' better processes English passive structures as a result of years of explicit instruction. Teachers of Arab learners of English could, thus, employ explicit instruction to reduce non-target like tendencies. The findings of the study could benefit further by obtaining more empirical evidence with a larger sample size. Thus, in future studies, it is recommended that such studies and research have larger sample sizes to avoid the low power dilemma that this study suffered from.

Future studies would benefit from investigating the impact of EK on online processing by using eye-tracking measures or ERP measures to deliver more fine-grained evidence. This study has made some theoretical and pedagogical contribution to the SLA and TESL fields, in connection to the role that explicit instruction and EKpaly in online processing of syntactic structures.

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