

L1 Thai Learners' Acquisition of English WH-nominal Clauses

Supakit Thiamtawan

Chulalongkorn University Language Institute, Bangkok, Thailand

*Corresponding author: Supakit.T@chula.ac.th

Article information	
Abstract	This study examined L1 Thai learners' acquisition of English WH-nominal clauses with a focus on three variables: grammaticality, WH-word function, and WH-clause position. The participants were 60 L1 Thai learners divided by their proficiency levels into two groups of 30: higher and lower proficiency. The research instruments comprised a grammaticality judgment test (GJT) and a structured interview. It was hypothesized that the learners' performance would be influenced by the three variables. Mann-Whitney U tests were used to compare the two participant groups' GJT scores, and Wilcoxon Signed Ranks tests were employed to investigate the effects of the three variables on each group's performance. The results revealed that grammaticality affected both participant groups, while WH-word function influenced only the less proficient learners. The grammaticality effect could be attributed to the learners' limited knowledge and transfer of training. The impact of WH-word function appeared to involve the participants' overgeneralization and interlingual factors. The absence of an effect for WH-clause position was assumed to stem from the learners' application of distributional rules for nouns to WH-clauses. These findings contribute to the second language acquisition of English WH-nominal clauses and offer some pedagogical implications.
Keywords	English WH-nominal clauses, interlanguage, error analysis, second language acquisition, L1 Thai learners
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1. Introduction

The acquisition of English WH-nominal clauses,¹ e.g., the embedded clause “What she said” in the sentence “What she said surprised me” (Azar & Hagen, 2009, p. 244), has been

¹ It is worth distinguishing between WH-nominal clauses and free relative clauses, another type of embedded construction that also begins with a WH-element. Free relative clauses are relative clauses without a lexical head noun, e.g., “what pushes Big Bird” in the sentence “Cookie Monster hits what pushes Big Bird” (Vinnitskaya et al., 2003, p. 340). There are two main differences between WH-nominal clauses and free relatives. First, they differ in the meaning expressed by the WH-word. While WH-interrogative clauses convey unspecified information (e.g., “I am not sure who has paid”), the information in free relative clauses may already be known to all the interlocutors; therefore, the WH-element can be rewritten as a noun head modified by a relative clause (e.g., from “Macy's is *where* I buy my clothes” to “Macy's is *the place where* I buy my clothes”) (Quirk et al., 1985). Secondly, the two constructions permit different sets of WH-words. Free relative clauses accept a more restricted range of WH-words, including “what,” “why,” “where,” “when,” “whatever,” and “wherever.” Quirk

considered challenging for second language (L2) learners. These clauses are syntactically related to WH-interrogatives while functioning as embedded nominal constituents, which can occupy noun-phrase positions within sentences. Their structural complexity lies in the need to interpret WH-dependencies across embedded contexts and to distinguish interrogative from embedded clause syntax, particularly with respect to word order. Previous research has indicated that both WH-dependencies (Covey et al., 2024; Hawkins & Chan, 1997; Juffs, 2005) and clause embedding (You, 2025; Zhang, 2022) pose difficulties in L2 acquisition. The combination of these two features in WH-nominal clauses may therefore increase their complexity for L2 English learners.

Numerous studies have addressed the acquisition of L2 English WH-nominal clauses, especially those in reported questions. One major problem among the participants in these studies was the use of the same word order in WH-questions and WH-clauses. Such errors were attributed to overgeneralization and ignorance of rule restrictions, two sources of intralingual errors or errors arising from L2 learning (Jantarit, 2019; Khudhayer, 2013). Lambani (2015) also linked the word order difficulty to L1 negative transfer, i.e., syntactic differences between WH-clauses in English and those in learners' first language (L1). Since the focus of many studies was placed on reported interrogatives, other problems identified involved the components of reported speech, including the misuse of tense, deictic expressions, and pronouns (Jantarit, 2019), as well as the omission of obligatory elements and the confusion between finite and nonfinite clauses (Khudhayer, 2013).

As mentioned, although WH-nominal clauses are generally demanding to master, prior studies have focused primarily on their use in reported speech (e.g., Jantarit, 2019; Lambani, 2015), leaving the clauses in other sentential positions underexplored. This gap highlights the need for a deeper investigation into how L2 learners acquire these clauses across different structural environments.

The present study investigated L1 Thai learners' acquisition of English WH-nominal clauses, focusing on the clauses' grammaticality, the syntactic function of WH-words, and the clausal position. By examining these factors, the study offers an insight into the linguistic and cognitive processes underlying learners' acquisition of the clauses.

2. Literature Review

This section reviews key areas that form the foundations for the present study. The first area involves error analysis and interlanguage theories, which together could account for the sources of errors L2 learners produce. The second part discusses grammaticality judgment as a means of accessing L2 learners' internalized grammatical knowledge and a key research instrument in SLA studies. The next subsection compares WH-nominal clauses in English and Thai, revealing potential sources of difficulties for L1 Thai learners in acquiring English WH-nominal clauses. The last subsection presents a review of previous SLA research on English nominal clauses.

2.1 Sources of Errors in L2 Acquisition

Several studies on L2 learner language have drawn on error analysis (EA) and interlanguage (IL) theories to explain learners' non-target-like productions and linguistic

et al. (1985) note that “who,” “whom,” and “which” may also appear in free relative clauses, but only with a handful of verbs, such as “choose,” “like,” “please,” “want,” and “wish.”

systems. EA emphasizes identifying and categorizing learner errors (Corder, 1974), whereas the IL theory focuses on cognitive and developmental processes underlying learners' language acquisition (Selinker, 1972). Together, these frameworks could provide insights into the sources of errors in L2 acquisition and explain why certain erroneous forms persist in learners' language.

EA investigates the errors L2 learners make. The EA procedure involves gathering learner errors, categorizing them, and determining their possible causes (Corder, 1974). Richards and Schmidt (2002) sorted L2 errors into interlingual and intralingual errors. While the former arises from L1 interference, the latter concerns how learners learn L2 rules (Richards, 1974). Intralingual errors are divided into four categories as follows:

1. Overgeneralization: learners incorrectly overextend simple rules, such as employing the interrogative word order in reported interrogatives, e.g., *"...asked Robert *why did I like you*" (Jantarit, 2019).

2. Ignorance of rule restrictions: learners overlook the limitations of rules, such as marking the past tense for all verbs by adding "-ed" to them, including irregular verbs that do not follow the rule.

3. Incomplete application of rules: learners' simplification of complicated rules causes a lack of necessary components, such as omitting the inflectional morpheme in *"...They have *live* in this neighborhood."

4. False concepts hypothesized: learners form incorrect assumptions about the target language (TL) because of their lack of exposure to it. To illustrate, the speaker may consider "was" a marker of the past tense, saying *"...Jane *was* participated in a seminar."

Although EA has contributed to understanding learner difficulties, it has been criticized for overemphasizing learners' actual errors and overlooking their non-error production (Brown, 1994), which may result in an incomplete understanding of learners' developmental patterns in acquiring an L2. To address this limitation, many SLA researchers have extended their focus to examining learners' unique linguistic systems or interlanguage (IL), attempting to provide a more comprehensive picture of learner language.

Learners' IL is a linguistic system created as learners progress through their TL learning (e.g., Qiaolan, 2022; Richards et al., 1996). It bears no resemblance to learners' L1 and TL but incorporates features of both (Selinker, 1972). ILs have three characteristics. First, ILs have their own distinct systems that can be linguistically analyzed and inferred from learners' observable output. Next, ILs are permeable in that their system remains open to changes that arise from their interactions with multiple cognitive processes operating within learners' psychological structure (Selinker, 1972). Since these processes may operate concurrently, forms derived from various sources may co-occur within a single IL system, which sometimes allows non-target-like forms to co-exist with target-like structures. The final IL phenomenon is fossilization, where learners' L2 development stalls, leading to persistent differences between their IL and the TL norms, regardless of their age or the amount of instruction in the TL they receive. Selinker (1972) identified five cognitive processes forming learners' IL. The first process is *language transfer*, referring to L1 influence on learners' IL. With L1-L2 similarities, the transfer can be positive and aid learning, but differences may lead to negative transfer and errors. Second, *transfer of training* occurs when errors are caused by improper teaching approaches or materials. Third, Selinker mentions *strategies of L2 learning* or learners' conscious use of various strategies to gain mastery of the TL. Fourth, when learners

lack the necessary linguistic forms to convey intended meanings in the TL, they adopt *strategies of L2 communication* to compensate for the missing resources. Finally, *overgeneralization* happens as learners overapply L2 rules, and heavy reliance on this process can cause persistent errors.

Importantly, EA and IL overlap in their recognition of overgeneralization as a major source of learner errors. Within EA, overgeneralization is regarded as an intralingual error, whereas IL considers it one cognitive process that could lead to errors persisting in learners' developing linguistic systems. The occurrence of overgeneralization across both frameworks highlights its importance in accounting for persistent non-target-like forms in L2 acquisition. The shared treatment of overgeneralization in EA and IL could reflect the close relationship between the two theories in viewing learner errors as part of the development of learner language.

2.2 Grammaticality Judgment in L2 Acquisition

According to Ellis (2008), learners' knowledge of an L2 can be investigated by asking them to determine whether given sentences are grammatically acceptable. Ellis further points out that this approach taps into learners' intuition, thereby providing access to their internalized linguistic system. According to Gass (1994), grammaticality judgment data are valuable for examining learners' linguistic competence or their underlying knowledge of a language, which is independent from their performance or actual language use in real situations. In other words, such data reveal what learners know about the language rather than how they use it in practice.

A common approach to assessing whether a particular L2 structure is accurate is employing a grammaticality judgment test (GJT) that requires participants to use their intuition to judge the correctness of grammatical constructions in isolated sentences (Rimmer, 2006). Schütze (1996) identified four advantages of GJTs. First, they allow examination of sentence structures that hardly appear in natural production. Second, they provide researchers with negative evidence, i.e., ungrammatical forms, that does not usually occur in natural linguistic data. Next, GJTs separate learners' problems about linguistic production, such as slips, from their true grammatical knowledge. Lastly, since a GJT usually involves an L2 construction in isolated sentences, it minimizes contextual influences, such as the effects of communicative functions of the L2, and thus emphasizes the language's grammatical characteristics.

Many SLA studies using GJTs confirm the grammaticality effect, showing that learners tend to be more accurate on grammatical items than on ungrammatical ones. Tokowicz and MacWhinney (2005) investigated L1 English learners' sensitivity to grammatical violations in Spanish via a GJT, focusing on two linguistic variables: grammaticality (acceptable and unacceptable) and crosslanguage similarity (one target construction resembling English, one different from English, and one unique to Spanish). The participants were less accurate on ungrammatical items, often judging them as grammatical. Also, they were more sensitive to grammatical violations in constructions unique to the L2 than to those in structures conflicting with their L1 equivalents. The difficulty with ungrammatical items was attributable to a response bias toward accepting sentences as grammatical and negative L1 transfer. Hopp (2006) investigated how L1 English and L1 Dutch learners, all of whom had advanced or near-native proficiency in German, processed subject-object ambiguities in German via two experiments: a self-paced reading task and a GJT. The GJT items manipulated word order (Subject-Object vs. Object-Subject), noun position (Noun 1-Noun 2 vs. Noun 2-Noun 1), and

syntactic condition (grammatical, case violation, and agreement violation). The grammaticality effect among the near-native participants was stronger given their performance on case-marked Object-Subject sentences or sentences in which the object precedes the subject, and the grammatical roles of noun phrases are determined through case marking. Specifically, they more successfully distinguished grammatical from ungrammatical case-marked Object-Subject sentences, reflected in their better performance on grammatical items than on ungrammatical ones. These findings highlight that syntactic structure and L2 proficiency may impact grammaticality effects.

To sum up, this subsection discusses grammaticality judgment and the use of GJTs in SLA research. GJTs are employed to investigate L2 learners' underlying grammatical knowledge by asking them to judge the acceptability of sentences. Previous studies have shown that learners are apt to perform better on grammatical items than on ungrammatical ones and suggested that factors, such as L1 transfer and L2 proficiency, may influence grammaticality judgment.

2.3 WH-nominal Clauses in English and Thai

2.3.1 WH-nominal Clauses in English

English clauses contain a subject and a predicate phrase and are categorized into main clauses and subordinate clauses. The former can stand alone, whereas the latter is embedded inside a main clause (Carnie, 2002). For example, the sentence “This boutique has what the women need for the party” (DeCapua, 2017, p. 354) contains the main clause “This boutique has” and the subordinate clause “what the women need for the party.” Huddleston and Pullum (2002) classified English subordinate clauses based on the function they perform in the main sentence into nominal, adjectival, and adverbial types. Nominal clauses can replace nouns or noun phrases (NPs) within sentences (Parrott, 2010). Like NPs, these clauses can fulfil a range of functions, including serving as subjects or as complements of verbs and prepositions. In addition, DeCapua (2017) categorized nominal clauses into that-clauses, whether/if clauses, and WH-clauses.

Huddleston and Pullum (2002) defined WH-clauses as a type of subordinate interrogative clauses or clauses primarily employed to report WH-questions, questions which invite various answers. English WH-questions feature the presence of a WH-word, which involves the information the speaker seeks (DeCapua, 2017). The WH-words are categorized into three groups: interrogative pronouns, which are “what,” “who,” “whom,” “which,” and “whose,” interrogative adverbs, comprising “where,” “why,” “when,” and “how,” and interrogative determiners, including “what,” “which,” and “whose.” The interrogative pronouns and adverbs stand alone at the beginning of WH-questions, whereas the determiners pair with a noun, as in “what movie.”

Since WH-nominal clauses are syntactically related to WH-questions, the formation of such questions is worth mentioning. WH-questions are formed in two ways, depending on the function of the WH-word in the sentence. WH-words serving as the subject stay in their original position, i.e., at the beginning (Foley & Hall, 2003). The word order resembles that of a statement, with the subject preceding the verb, as in “What caused the problem?” However, forming interrogatives with the WH-words serving other functions, such as an object or an adjunct, contains two steps. First, the WH-word is moved from its original position to the beginning of a clause (Radford, 2009). Then, the syntactic operation called subject-auxiliary

inversion applies, inverting the subject and the first auxiliary verb. In auxiliary-free sentences, a tensed “do” is added before the subject-auxiliary inversion.

- (1) A. What are they doing ___?
B. Who did John meet ___?

In (1A), “What,” the object of the verb “doing,” is relocated to the beginning of the clause, and the subject “they” is inverted with the auxiliary “are.” In (1B), “Who” also appears clause-initially; however, the tense-inflected “did” is added before the subject “John” because the sentence lacks auxiliaries.

WH-questions can be embedded as nominal clauses. Unlike direct WH-questions with object WH-words, WH-clauses with object WH-words do not require subject-auxiliary inversion and therefore have a word order similar to that of affirmative sentences (Huddleston & Pullum, 2002). Thus, WH-questions and WH-clauses containing object WH-words syntactically differ. Conversely, neither WH-questions nor WH-clauses with subject WH-words necessitate subject-auxiliary inversion, thereby making the two constructions syntactically identical (Azar & Hagen, 2009).

Table 1

The Word Order of Direct WH-questions and WH-clauses

Grammatical functions of WH-words	Direct question	WH-nominal clause
Subject	Who lives there?	I don't know <i>who lives there</i> . (Azar & Hagen, 2009, p. 244)
Object	What did he say?	I couldn't hear <i>what he said</i> . (Azar & Hagen, 2009, p. 244)

In Table 1, in the question “Who lives there?” “Who” acts as the subject of the verb “lives,” so when the question is embedded, the word order is identical to that of the question. However, “What” in “What did he say?” functions as the object of “say;” consequently, the word order of its WH-clause counterpart does not involve subject-auxiliary inversion.

One common position of WH-nominal clauses is in the object position, specifically in reported speech, e.g., “Sue asked when the kids had eaten” (DeCapua, 2017, p. 358). WH-clauses can also appear at the beginning of sentences, when the writer or speaker aims to highlight the clauses (DeCapua, 2017). In the initial position, WH-clauses generally serve as the subject, e.g., “What she said surprised me” (Azar & Hagen, 2009, p. 244). Other positions of WH-clauses include subject complement, appositive, adjectival complementation, and prepositional complement (Quirk et al., 1985).

One grammatical component relevant to English WH-nominal clauses is resumptive pronouns or pronouns that fill a gap in the subject or object position to resume a moved WH-word. In standard English WH-constructions, a moved WH-word typically leaves a gap in its original syntactic position, and no overt pronoun is required (McKee & McDaniel, 2001). For example, in the WH-clause “Who lives there,” the WH-word itself functions as the subject of

the clause, and no resumptive pronoun is necessitated. Likewise, in “What he said,” “What” functions as the object without an additional pronoun. However, learners sometimes insert a resumptive pronoun in the original position of the WH-word, producing such forms as **“Who he lives there”* or **“What he said it.”* McKee and McDaniel (2001) suggest that a WH-nominal clause with a resumptive pronoun is considered ungrammatical in standard English because the WH-word already fulfills the grammatical function within the clause.

2.3.2 WH-nominal Clauses in Thai

In Thai WH-questions, WH-words appear in the same position as the noun, adjective, or adverb they replace (Iwasaki & Ingkaphirom, 2005). Thai has nominal question-words, containing /khray/ “who” and /aray/ “what,” adjectival question-words, including /nǎy/ “which” and /kii/ “how many,” and adverbial question-words, i.e., /mûarày/ “when,” /thâwrày/ “how much,” /yaŋŋay/ “how,” and /thammay/ “why.”

The nominal /khray/ and /aray/ occur in several positions, most commonly as subjects and objects (Iwasaki & Ingkaphirom, 2005). Questions with subject WH-words and those with object WH-words are illustrated in (2A) and (2B), respectively.²

- (2) A. khay³ cà kâa nâŋ tham
 who CM⁴ dare sit do
 ‘Who would dare to sit and work?’
 (Iwasaki & Ingkaphirom, 2005, p. 291)

- B. phîi tŋkâan cà bòok alay hây khâw sâap
 OS⁵.2⁶ want CM tell what causative 3⁷ know
 ‘What do you want to tell them and let them know?’
 (Iwasaki & Ingkaphirom, 2005, p. 292)

According to Iwasaki and Ingkaphirom, the flexibility of placing a WH-word at the beginning or end of direct questions also applies to embedded questions. Sentences (3A) and (3B) exemplify Thai embedded questions with subject WH-words and those with object WH-words, respectively.

- (3) A. thîi bòok wâa |⁸ [khay yàak khay yàak
 subordinator tell say/COMP⁹ | who want who want
 taay]
 die
 ‘that is, (he questions himself) who wants to die.’

² The Thai sentence examples in (4) and (5) are taken directly from Iwasaki and Ingkaphirom (2005).

³ In everyday conversation, people often pronounce /khray/ and /aray/ as /khay/ and /alay/, respectively (Iwasaki & Ingkaphirom, 2005, p. 291).

⁴ CM = challengeable marker (Iwasaki & Ingkaphirom, 2005, p. XXV)

⁵ OS = older sibling (Iwasaki & Ingkaphirom, 2005, p. XXV)

⁶ 2 = second-person pronoun (Iwasaki & Ingkaphirom, 2005, p. XXV)

⁷ 3 = third-person pronoun (Iwasaki & Ingkaphirom, 2005, p. XXV)

⁸ The symbol “|” is used to mark the boundary between the matrix clause and the embedded clause.

⁹ COMP = complementizer (Iwasaki & Ingkaphirom, 2005, p. XXV)

B.	kô	thăam	wâa		[dây	kii
	linking particle	ask	say/COMP		get	how.many
	khanɛɛn]					
	score					
	‘We asked (all the teachers) what scores she got.’					

(Iwasaki & Ingkaphirom, 2005, p. 298)

L1 Thai learners tend to find English WH-nominal clauses containing object WH-words more problematic than those containing subject WH-words because of two structural differences between Thai and English. The first distinction concerns the sentential positions of both types of WH-words. In English, WH-words in WH-nominal clauses are usually placed at the beginning of the clause regardless of their grammatical function. In Thai WH-nominal clauses, however, the position of the WH-word depends on its function in the clause. That is, object WH-words follow the subject and verb, whereas subject WH-words appear at the beginning of the clause. Thus, the difference between Thai and English in the position of object WH-words should make English WH-clauses with object WH-words more confusing to L1 Thai learners than those with subject WH-words whose syntactic pattern resembles that of their Thai equivalent. Second, the two languages differ in the degree of structural similarity between WH-questions and WH-nominal clauses. L2 English learners often associate WH-nominal clauses with WH-questions due to the occurrence of WH-words in the clause-initial position of both structures (Parrott, 2010). Thai features the same word order for WH-questions and WH-clauses irrespective of the grammatical function of WH-words. However, in English, the same word order applies only to WH-clauses and WH-questions with subject WH-words. The interrogatives with subject WH-words (e.g., “Who lives there?”) are formed without subject-auxiliary inversion, thus having the same word order as their embedded clause counterpart (e.g., “I don’t know who lives there”). The syntactic similarity between Thai and English regarding WH-clauses and WH-questions with subject WH-words could result in positive transfer, facilitating L1 Thai learners’ acquisition of WH-nominal clauses with subject WH-words. In contrast, forming WH-questions with object WH-words requires subject-auxiliary inversion; ergo, the word order of the questions (e.g., “What did he say?”) differs from that of WH-clauses whose formation necessitates no inversion (e.g., “I couldn’t hear what he said”). The syntactic difference between Thai and English concerning WH-clauses and WH-questions with object WH-words is likely to cause negative transfer; therefore, it can be assumed that WH-nominal clauses with object WH-words should be more challenging for L1 Thai learners than those with subject WH-words.

2.4 Previous SLA Research on English Nominal Clauses

Previous SLA studies on L2 learners’ acquisition of English nominal clauses fall into two main groups. The first group investigates L2 learners’ acquisition of many types of English nominal clauses, while the second focuses on nominal clauses in the object position, namely those in reported speech. Overall, studies in the first group suggest that learners experience broad difficulties with identifying, interpreting, and producing nominal clauses, particularly due to the structural complexity and multifunctionality of the clauses. Several studies in the second group report persistent problems with reported questions, especially the misuse of interrogative word order, which has been linked to both interlingual and intralingual factors.

Regarding the first group, Khudhayer (2013) analyzed Iraqi EFL university students' recognition and production of English nominal clauses categorized according to their finiteness: finite nominal clauses (i.e., that-clauses, whether/if clauses, and WH-clauses) and nonfinite nominal clauses (i.e., to-infinitive clauses and gerund clauses). A common production error was using the direct question word order in reported WH-interrogatives (e.g., *"...asked him *how is he*"), which was linked to learners' overgeneralization and ignorance of rule restrictions. Other sources of errors included incomplete application of rules and false concepts hypothesized, as indicated by their responses that missed necessary components and their confusion between finite and nonfinite clauses, respectively. Hanim and Anggraini (2023) explored challenges students faced in learning English nominal clauses and the strategies used to tackle the difficulties. The participants, students taking a grammar course at a university in Indonesia, were interviewed, and three challenges in understanding nominal clauses were noted. First, the participants had difficulty identifying the roles of the clauses, possibly because nominal clauses serve multiple functions. They also reported that constructing nominal clauses with a specific function was challenging, probably because they struggled to determine the functions. The third problem involved correctly identifying the subject and verb in nominal clauses. The participants addressed these challenges by reviewing textbooks, asking classmates for help, and searching online for additional resources.

Numerous studies in the second group have shown that reporting English questions poses persistent challenges for L2 learners. One recurrent problem is the inappropriate retention of the interrogative word order in reported questions. For example, Lambani (2015) analyzed advanced L2 English learners' competence in using nominal clauses in reported speech. The researcher found that many participants misused the interrogative word order for reporting the questions, attributing the errors to L1–L2 syntactic differences. Similar findings were reported by Jantarit (2019), who examined L1 Thai learners' use of English reported yes-no questions and WH-questions. Two participant groups, advanced and intermediate, took a written test manipulating four variables: time reference, pronouns, deixis, and the word order of reported questions. The advanced learners produced fewer errors than their intermediate counterparts across the four factors, indicating an effect of L2 proficiency. Additionally, both participant groups made two word-order errors: maintaining the subject-verb inversion and "do" in direct questions, as in *"...know *how has Kate teased me*" and *"...asked Robert why *did* I like you." Jantarit attributed the errors to the participants' overgeneralization, i.e., applying the same word order for direct and reported questions, and their ignorance of rule restrictions, namely retaining "do" in reported questions. Bajalani and Rassul (2016) examined EFL university students' recognition and production of English reported speech and observed that the learners performed more poorly on their production, especially when changing the tense for reported utterances, due to their reliance on direct speech in communication and direct translation. The researchers associated the errors with learning contexts, interlingual transfer, intralingual transfer, and communication strategies.

Compared to those with object WH-words, WH-clauses with subject WH-words have been less studied; however, they may pose challenges related to resumptive pronouns. Although such pronouns can occur in both clauses with subject WH-words and those with object WH-words, they may be more strongly associated with the former because the WH-word itself, functioning as the subject, leaves no overt lexical subject within the clause. Since WH-words may be perceived as less semantically specific than lexical NPs or pronouns, L2

English learners may interpret such clauses as structurally incomplete and feel a need to have the clauses conform more closely to a canonical English subject-verb structure. Therefore, they may insert a redundant subject, as in **“Who she called me surprised me,”* to avoid ambiguity. Morgan and Ferreira (2022) suggest that learners may use resumptive pronouns to facilitate comprehenders’ processing, as they prioritize clarity over structural correctness. On the contrary, WH-clauses with object WH-words already contain an overt subject and are thus more similar to the familiar subject-verb pattern, which may make them easier to process and reduce learners’ tendency to supply an additional pronoun. Hence, L2 learners may struggle to recognize that English WH-words can function as subjects of embedded clauses without a resumptive pronoun.

One factor that might influence L2 learners’ acquisition of English WH-nominal clauses is WH-clause positions. English embedded clauses can appear at the beginning, in the middle, or at the end of their main clause. Quirk et al. (1985) suggest that final clauses are usually easier to understand than initial clauses. This is probably because initial clauses demand that readers retain information before encountering the main clauses, which is important for grasping the sentence’s core meaning. This observation is particularly relevant to L2 learners whose first language follows an SVO or SOV word order pattern, including Thai, where sentence-initial constituents tend to be processed before the main predicate. Kim and Christianson (2017) and Hsin (2012) found that English subject-modifying relative clauses and subject-position complement clauses, i.e., clauses at the sentence-initial position, caused higher L2 processing difficulty than clauses at the sentence-final position due to the higher number of words between the subject and verb and the less familiar clausal position, respectively. Despite a lack of previous studies investigating the effects of the embedded clause position on L2 acquisition of English WH-nominal clauses, such processing difficulties may also apply to these clauses. For L1 Thai learners of English, sentence-initial WH-clauses that function as sentential subjects are expected to be more demanding than sentence-final WH-clauses functioning as objects. Sentence-initial WH-clauses precede the main clauses, requiring readers to carry information of the embedded clauses until the main clauses are reached. Conversely, sentence-final WH-clauses follow the main clauses. They allow readers to process the main clauses first, reducing the processing difficulty associated with increased memory load and subject-verb distance (Kim & Christianson, 2017).

Previous studies place greater emphasis on English WH-nominal clauses with object WH-words, despite the challenges linked to those with subject WH-words. Additionally, although WH-clauses commonly appear in the subject and object positions, these clauses have never been explored regarding their sentential position. Lastly, while the grammaticality effect in various syntactic structures has been studied (e.g., Bian et al., 2021; Hopp, 2006; Tokowicz & MacWhinney, 2005), no research has examined how grammaticality influences the acquisition of English WH-nominal clauses. This omission is noteworthy, given that WH-clauses could pose difficulties for L2 learners. To address this research gap, this study investigates how WH-word function, clause position, and grammaticality affect L1 Thai learners’ acquisition of English WH-nominal clauses.

3. Research Questions and Hypotheses

This study addresses three questions. First, which grammaticality status of WH-nominal clauses (grammatical or ungrammatical) will be more problematic for L1 Thai

learners? Second, which function of the WH-word in WH-clauses (subject or object) will the learners have more problems with? Third, which sentential position of the clauses (subject or object) will the learners find more difficult?

The formulated hypotheses are as follows:

(1) The participants will have more difficulty with ungrammatical WH-nominal clauses than grammatical ones.

(2) The participants will have more problems with WH-clauses with object WH-words (e.g., I couldn't hear *what* he said.) than those with subject WH-words (e.g., I don't know *who* lives there.).

(3) The participants will find WH-clauses in the object position more problematic than those in the subject position.

4. Research Methodology

4.1 Research Participants

This study recruited two participant groups: a native control group and an L1 Thai group. The control group encompassed five native English speakers who were undergraduates, graduate students or faculty members at Chulalongkorn University, Thailand, and provided baseline data on the use of English WH-nominal clauses. The L1 Thai group contained 60 Thai undergraduates studying in various faculties at Chulalongkorn University. The learners were categorized according to their English proficiency: higher (HP) and lower proficiency (LP), and there were 30 participants in each category. Their proficiency was based on their scores from one of three English proficiency tests: the International English Language Testing System (IELTS), the Test of English as a Foreign Language Internet-based Test (TOEFL iBT), and the Chulalongkorn University Test of English Proficiency (CU-TEP). The HP group incorporated the learners whose score corresponded to either C1 or B2 level of the Common European Framework of Reference for Languages (CEFR), while the LP group comprised those at B1 or A2 level (See details of the mapping between CU-TEP, IELTS, and TOEFL iBT scores and CEFR levels in Appendix B). The findings of this study are intended to be generalizable to L1 Thai learners with English proficiency levels and educational backgrounds comparable to those of the participants in the present study. Participants were recruited through online poster advertisements and participated voluntarily. Informed consent was obtained from all participants before data collection, and compensation was provided for their participation. All the research participants had to be at least 18 years of age at the time of participation.

Structured interviews were also conducted with some participants. Ahmed (2025) claims that the number of interviews in studies varies according to their objectives and methodological approach. For the present study, eight learners, four from each proficiency group, were interviewed. Interviewing four participants per proficiency group was considered sufficient as the interview data served to support the interpretation of the GJT results rather than to generalize findings to all L1 Thai learners.

4.2 Research Instruments

The instruments in this study incorporated a grammaticality judgment test (GJT) and structured interviews.

The GJT was employed because the present study aimed to investigate learners' underlying grammatical knowledge of English WH-nominal clauses, which can be assessed by

examining their sensitivity to both grammatical and ungrammatical forms (Ellis, 2008). Apart from judging the test items' grammaticality, participants were asked to identify errors and correct them, which could provide insights into their interlanguage representations and possible sources of their errors.

Since the present study focused on how WH-word functions, WH-clause positions, and grammaticality affected participants' acquisition of WH-nominal clauses, the GJT was designed to manipulate the three variables across the test items. The WH-words serve one of two functions in the clauses: subject, e.g., "*Who* will lead the team," or object, e.g., "*What* the machine can produce." The test items included only clauses with either "who" or "what," as these WH-words can function as the subject or object (Foley & Hall, 2003). Regarding clausal position, the WH-clauses were placed either as the subject, e.g., "*What the doctor recommended* surprised me," or object, e.g., "The victim did not know *who had attacked him*." Concerning grammaticality, half the items were grammatical; the rest were ungrammatical, containing one error each. Ungrammatical clauses comprising subject WH-words included unnecessary subjects (e.g., "it" in "*What it caused the misunderstanding* remains unknown"), while those with object WH-words misused the question word order (e.g., "I don't know *what did he do*").

The manipulation created 8 test conditions, with 4 items for each condition. Accordingly, the test consists of 32 items (See all items in the GJT of the present study in Appendix A). The components in each condition are tabulated in Table 2.

Table 2

The Test Conditions from the Manipulation of the Three Variables

Test condition	Grammaticality + Function of the WH-word + WH-clause position
1) GSS	Grammatical-Subject-Subject
2) GSO	Grammatical-Subject-Object
3) GOS	Grammatical-Object-Subject
4) GOO	Grammatical-Object-Object
5) USS	Ungrammatical-Subject-Subject
6) USO	Ungrammatical-Subject-Object
7) UOS	Ungrammatical-Object-Subject
8) UOO	Ungrammatical-Object-Object

The test items were uploaded to a Google Form, each accompanied by two choices: (a) "Grammatical" and (b) "Ungrammatical," and two blanks for participants to identify errors and suggest corrections. To prevent the familiarity effect, no items in the same test condition were consecutively placed. Moreover, the items were presented one at a time to prevent the participants from revisiting answers to items they had previously completed.

The GJT included no distractors for two reasons. Firstly, omitting distractors allowed more test items per each of the 8 test conditions, enhancing statistical power. Secondly, since

participants were given one hour to complete the 32-item task, adding distractors could have unnecessarily increased participants' task completion time.

To investigate the errors further, structured interviews were conducted with four L1 Thai participants from each proficiency group. In each proficiency group, two participants were selected for producing the highest number of incorrect revisions for ungrammatical items, while the other two were chosen for most frequently rating ungrammatical sentences as grammatical. Two sets of Thai questions were formulated for the two participant groups. The first set contained one question for those who correctly judged ungrammatical sentences but provided incorrect revisions: "Why did you make such corrections?" The second set comprised two questions for participants rating ungrammatical sentences as grammatical: "What part of this sentence makes you think that it is grammatical, and why?" and "Actually, this sentence is ungrammatical. How would you correct it to make it grammatical, and why did you choose such corrections?"

Three native English lecturers at Chulalongkorn University Language Institute, Thailand, confirmed that the GJT items were linguistically natural and accurate. Then, three L1 Thai teachers with expertise in applied linguistics or language assessment evaluated the validity of the GJT and interview questions using the Index of Item-Objective Congruence. The instruments were rated as appropriate for their intended purposes.

4.3 Data Collection

In separate ZOOM sessions, each participant completed the GJT online via the Google Form emailed to them on the experiment day. They were instructed to read each item and select (a) "Grammatical" if they believed the sentence was grammatical or (b) "Ungrammatical" if they considered it ungrammatical. Concerning the items deemed ungrammatical, they were asked to pinpoint and correct the error(s) in the blanks provided in the Google Form. The task had to be completed within 60 minutes. The researcher remained in the ZOOM meetings to ensure the participants correctly followed the procedure.

Moreover, eight learners were interviewed via ZOOM. Conducted in Thai for clarity, each interview occurred within two weeks after all the GJT sessions. The interviews lasted no more than 10 minutes and were recorded for analysis. Participants were shown their responses to help them recall their answers.

4.4 Data Analysis

Participants earned one point for correctly identifying each grammatical sentence. When they judged grammatical items as ungrammatical, one point was given only if the identified error did not involve the WH-clause word order. Ungrammatical items judged as grammatical earned no points. For correctly identified ungrammatical items, points depended on the identified error and revision: one point was awarded for each correct revision of a WH-clause word order error, and each revision changing the ungrammatical word order into another acceptable construction (e.g., relative clauses). WH-clause errors with incorrect revisions and other error types received no points.

Participant responses were classified into six types: three for grammatical items (CG, IGNU, IGWH) and three for ungrammatical items (CUCR, CUIR, IU). Table 3 provides definitions for each type, with examples given only for revision-related responses.

Table 3*Definitions and Examples of Possible Response Types in the GJT*

Item type	Response title	Definition	Correctness of the response	Example
Grammatical	CG	Correct judgment of a grammatical item	Correct	N/A
	IGNW	Incorrect judgment of a grammatical item with a revision unrelated to the word order of the WH-clause	Correct	“What the machine <i>can</i> produce” to “What the machine <i>could</i> produce”
	IGWH	Incorrect judgment of a grammatical item with a revision related to the word order of the WH-clause	Incorrect	“ <i>Who Matt visited</i> ” to “ <i>Who did Matt visit</i> ”
Ungrammatical	CUCR	Correct judgment of an ungrammatical item with a correct revision	Correct	“Who <i>had</i> Laura mentioned” to “Who <i>Laura had</i> mentioned”
	CUIR	Correct judgment of an ungrammatical item with an incorrect revision	Incorrect	“What did the sales manager <i>do</i> ” to “What did the sales manager <i>does</i> ”
	IU	Incorrect judgment of an ungrammatical item	Incorrect	N/A

Participants were expected to correct only ungrammatical WH-clauses. Since the WH-clauses in grammatical items were correct, any IGWH alterations, although well-formed, were considered erroneous.

Descriptive statistics were used to calculate mean scores and frequencies of participants' response types. The mean scores represented the participants' overall performance on the GJT, while the frequencies of the response types reflected how often the learners correctly or incorrectly judged and revised the WH-nominal clauses.

The normality test, specifically a Kolmogorov–Smirnov test, showed non-normality across several subvariables ($p < .05$); consequently, non-parametric Mann-Whitney U tests and Wilcoxon Signed Ranks tests were employed for further analyses. Mann-Whitney U tests were used to compare the GJT scores of the HP and LP groups across the three variables (i.e., grammaticality, WH-word function, and WH-clause position) and the eight test conditions, that

is, GSS, GSO, GOS, GOO, USS, USO, UOS, and UOO. The scores for each condition represented the participants' accuracy regarding the test items resulting from a specific manipulation of the three variables. The results of the Mann-Whitney U tests determined whether the participants' proficiency level influenced their performance under different subvariables and test conditions. To answer Research Questions 1–3, Wilcoxon Signed Ranks tests were used to examine the effects of the three variables. The tests calculated the mean ranks for each proficiency group, representing the average ranks of the within-participant differences between the two subvariables compared (e.g., Grammatical vs. Ungrammatical).

5. Findings

5.1 GJT Results

The native controls obtained a mean GJT score of 31.2 and a standard deviation of 0.84. Each scored between 30 and 32 out of 32. They made four errors, all involving judging ungrammatical object WH-clauses as grammatical. The results showed that the native speakers could accurately judge and revise the WH-clauses as intended, providing a robust baseline for interpreting the L2 learners' performance.

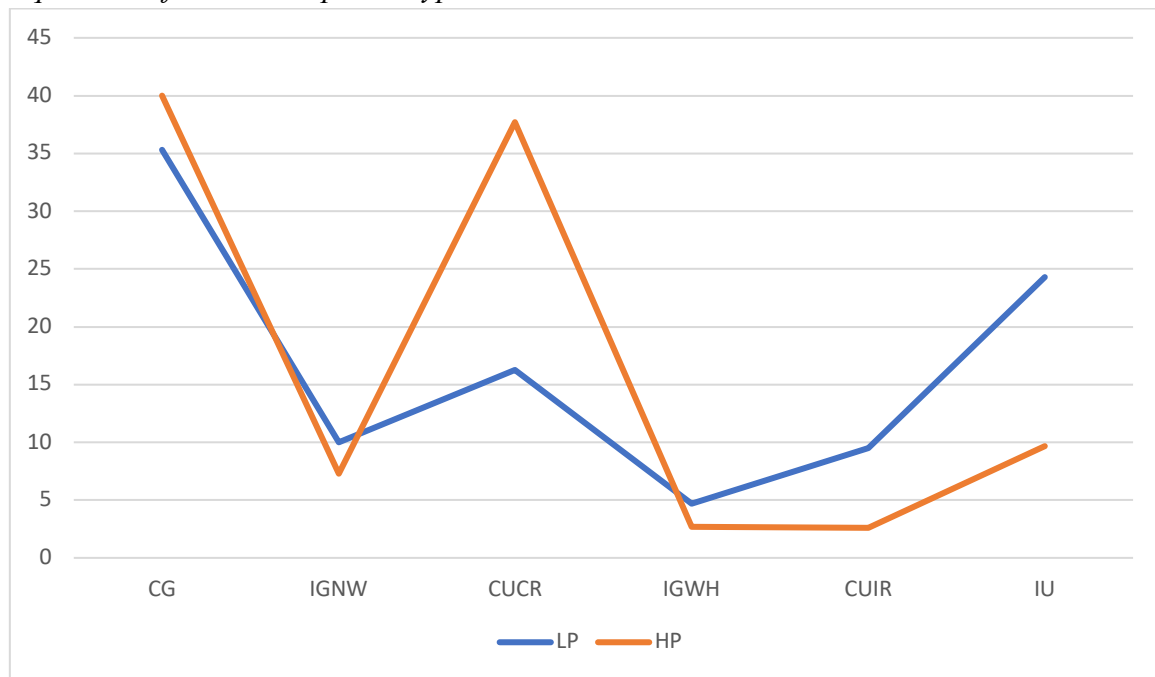
The two L1 Thai groups' data are presented in two sections: descriptive and inferential statistics. Descriptive statistics were used to calculate the mean scores and the frequencies of all possible response types the two groups produced. The HP group produced 816 correct responses and 144 incorrect ones, whereas the LP group produced 591 correct responses and 369 incorrect ones. The HP group achieved a higher mean score ($M = 27.20$, $SD = 3.80$) than the LP group ($M = 19.70$, $SD = 4.62$).

Furthermore, the frequencies of all possible response types in the GJT are presented in Table 4 and Figure 1.

Table 4

Frequencies of the Six Response Types in the GJT

Response title	LP: Frequency (%)	HP: Frequency (%)	Total frequency (%)
CG	339 (35.31%)	384 (40%)	723 (37.66%)
IGNW	96 (10%)	70 (7.29%)	166 (8.65%)
CUCR	156 (16.25%)	362 (37.71%)	518 (26.98%)
IGWH	45 (4.69%)	26 (2.71%)	71 (3.70%)
CUIR	91 (9.48%)	25 (2.60%)	116 (6.04%)
IU	233 (24.27%)	93 (9.69%)	326 (16.98%)
Total	960 (100%)	960 (100%)	1920 (100%)

Figure 1*Frequencies of the Six Response Types in the GJT*

Among the correct response types, the HP group produced more CUCR (37.71%) and CG (40%) responses than the LP group (16.25% and 35.31%). In contrast, the LP group made more erroneous responses, especially IU (24.27%) and CUIR (9.48%), whereas these accounted for only 9.69% and 2.60% in the HP group, respectively.

Then, a Kolmogorov–Smirnov test was used to determine whether the data were normally distributed. The normality test revealed non-normality in many subvariables ($p < .05$) (See the normality test results in Appendix C). Therefore, further analyses were conducted via non-parametric Mann–Whitney U tests and Wilcoxon Signed Ranks tests.

Mann–Whitney U tests were conducted to examine between-group comparisons. The HP group had a significantly higher mean rank of 42.53 than that of the LP group, i.e., 18.47 ($U = 89.00, p < .001$). This finding indicated that the HP group outperformed the LP group overall. Table 5 provides the mean ranks of the two participant groups by variables.

Table 5*Mann–Whitney U Results regarding the Between-group Comparisons by Variables*

Variable	Group	Mean rank	Mann–Whitney U	P-value
Grammatical	HP	33.42	362.50	0.160
	LP	27.58		
Ungrammatical	HP	43.05	73.50	<0.001*
	LP	17.95		
Object WH-word	HP	40.93	137.00	<0.001*
	LP	20.07		

Subject WH-word	HP	41.73	113.00	<0.001*
	LP	19.27		
Object position	HP	41.88	108.50	<0.001*
	LP	19.12		
Subject position	HP	40.98	135.50	<0.001*
	LP	20.02		

* $p < .05$.

The results highlight significant differences across most subvariables, with the HP group outperforming the LP group ($p < .001$). However, no significant difference was observed in the grammatical items ($p = .160$).

Group differences across the eight item conditions were also analyzed and are presented in Table 6.

Table 6

Mann-Whitney U Results regarding the Between-group Comparisons by Item Conditions

Item condition	Group	Mean rank	Mann-Whitney U	P-value
GSS	HP	29.87	431.00	0.651
	LP	31.13		
GSO	HP	32.42	392.50	0.102
	LP	28.58		
GOS	HP	33.68	354.50	0.056
	LP	27.32		
GOO	HP	33.15	370.50	0.121
	LP	27.85		
USS	HP	39.52	179.50	<0.001*
	LP	21.48		
USO	HP	41.45	121.50	<0.001*
	LP	19.55		
UOS	HP	40.63	146.00	<0.001*
	LP	20.37		
UOO	HP	39.72	173.50	<0.001*
	LP	21.28		

* $p < .05$.

The findings showed significant differences across all ungrammatical conditions, with the HP group outperforming the LP group ($p < .001$).

Wilcoxon Signed Ranks tests addressed the hypotheses by exploring the effects of grammaticality, WH-word function, and WH-clause position on the participants' performance. Tables 7 and 8 report the statistical results for the HP and LP learners, respectively.

Table 7

Wilcoxon Signed Ranks Results regarding Effects of the Three Variables on the HP Participants

Variable	Subvariable	Mean rank	Wilcoxon Signed Ranks	P-value
Grammaticality	Grammatical	9.00	-4.015	<0.001*
	Ungrammatical	13.88		
WH-word function	Subject	11.11	-0.542	0.588
	Object	10.92		
WH-clause position	Subject	12.30	-0.463	0.643
	Object	11.77		

* $p < .05$.

Table 8

Wilcoxon Signed Ranks Results regarding Effects of the Three Variables on the LP Participants

Variable	Subvariable	Mean rank	Wilcoxon Signed Ranks	P-value
Grammaticality	Grammatical	0.00	-4.790	<0.001*
	Ungrammatical	15.50		
WH-word function	Subject	10.39	-2.306	0.021*
	Object	15.81		
WH-clause position	Subject	13.50	-1.214	0.225
	Object	12.00		

* $p < .05$.

The results revealed grammaticality effects on both proficiency groups ($p < .001$). Regarding WH-word function, only the LP group showed a significant difference ($Z = -2.306$, $p = .021$). For clause position, neither group showed a significant difference ($p > .05$). However, the Wilcoxon Signed Ranks tests did not clearly indicate the direction of the differences between the subvariables compared. Therefore, descriptive statistics were also considered to facilitate the interpretation of performance patterns across the paired subvariables. Table 9 presents the means and standard deviations of the two participant groups by variables.

Table 9*The Means and Standard Deviations of the Two Participant Groups by Variables*

Group	Variable	Subvariable	Mean	SD
LP	Grammaticality	Grammatical	14.50	2.10
		Ungrammatical	5.20	3.65
	WH-word function	Subject	10.50	2.30
		Object	9.20	3.21
	WH-clause position	Subject	10.10	2.70
		Object	9.60	2.36
HP	Grammaticality	Grammatical	15.13	1.63
		Ungrammatical	12.07	3.11
	WH-word function	Subject	13.67	2.99
		Object	13.53	2.53
	WH-clause position	Subject	13.70	2.15
		Object	13.50	2.19

According to Table 9, both proficiency groups performed better on the grammatical items, confirming Hypothesis 1. The results also indicate that the LP group had more difficulty with WH-clauses containing object WH-words than with those containing subject WH-words. The effects of WH-word function were observed only among the LP learners, partially supporting Hypothesis 2. Finally, clause position did not affect either group, rejecting Hypothesis 3.

Both participant groups performed more poorly on ungrammatical items than grammatical ones. Given that ungrammatical items posed greater difficulty for them, a Chi-square test was conducted to examine how three categories of responses (CUCR, CUIR, and IU) were distributed when they encountered ungrammatical items. The findings exhibited significant differences in the distribution of the three response types within the LP group, $\chi^2(2, N = 480) = 63.16, p < .001$, and the HP group, $\chi^2(2, N = 480) = 396.99, p < .001$. To determine the causes of the errors, pairwise comparisons of the three response types were investigated via binomial tests. The results are provided in Table 10.

Table 10

Binomial Results regarding Pairwise Comparisons of the Response Types for Ungrammatical Items

Group	Category 1- Category 2	Frequency (Category 1)	Frequency (Category 2)	P-value
LP	CUIR-CUCR	91 (37%)	156 (63%)	<0.001*
	IU-CUCR	233 (60%)	156 (40%)	<0.001*
	IU-CUIR	233 (72%)	91 (28%)	<0.001*
HP	CUIR-CUCR	25 (6%)	362 (94%)	<0.001*
	IU-CUCR	93 (20%)	362 (80%)	<0.001*
	IU-CUIR	93 (79%)	25 (21%)	<0.001*

* $p < .05$.

All pairwise comparisons yielded significant differences in the distributions of the three response types within both groups ($p < .001$). Among the LP group, IU responses outnumbered CUCR responses (60% vs. 40%) and CUIR responses (72% vs. 28%). Additionally, CUCR responses (63%) exceeded CUIR responses (37%). Conversely, the HP group showed more CUCR responses than both CUIR (94% vs. 6%) and IU responses (80% vs. 20%). IU responses also exceeded CUIR responses (79% vs. 21%). Importantly, both groups produced more IU errors than CUIR errors, indicating that detecting ungrammaticality was more challenging than revising the items.

It was also shown that the LP participants made more errors on the items with object WH-words than on those with subject WH-words. A Chi-square test was conducted to investigate the LP participants' distribution of three error types for WH-clauses with object WH-words: IGWH, CUIR, and IU. The results showed a significant difference in the distribution of the error types, $\chi^2(2) = 87.735, p < .001$. Further Chi-square tests were performed to examine pairwise comparisons of the frequencies of the three error types. The results are shown in Table 11.

Table 11

Chi-square Results regarding Pairwise Comparisons of the Error Types for Items with Object WH-words among the LP Participants

Error type comparison	Category	Frequency	Percent	Chi-square, P-value
IGWH vs. CUIR	IGWH	34	46.60%	$\chi^2 = 0.34,$
	CUIR	39	53.40%	.558
IGWH vs. IU	IGWH	34	20.60%	$\chi^2 = 57.02,$
	IU	131	79.40%	<0.001*

CUIR vs. IU	CUIR	39	22.90%	$\chi^2 = 49.79,$
	IU	131	77.10%	$<0.001^*$

* $p < .05$.

The tests yielded significant differences in the IGWH vs. IU comparison, $\chi^2(1) = 57.02$, $p < .001$, and the CUIR vs. IU comparison, $\chi^2(1) = 49.79$, $p < .001$, with IU outnumbering both IGWH and CUIR.

5.2 Summary of the Interview Results

Structured interviews were conducted with four participants from each proficiency group: two who produced the highest number of CUIR errors (i.e., providing incorrect revisions for ungrammatical sentences) and two who most frequently produced IU errors (i.e., rating ungrammatical sentences as grammatical). Regarding the CUIR errors, the first and second HP interviewees made 6 and 4 errors, respectively, and both LP interviewees made 8 such errors. They answered Question 1 below. For the IU errors, the first and second HP interviewees made 9 and 7 errors, respectively, while the first and second LP interviewees made 11 and 13 such errors. They answered Questions 2 and 3 below.

Question 1: Why did you make such corrections?

The HP interviewees frequently changed WH-words, mostly from “who” to “whom.” They explained that the pronoun should serve as the object of the clause. They also replaced auxiliaries, e.g., “had” with “does,” explaining that the sentences referred to the present and should therefore use the present tense. The LP interviewees often altered the word order of the clauses containing subject WH-words from affirmative to interrogative, for example, changing “who he had canceled...” to “who had he canceled...” They stated that the clauses were questions and should follow the interrogative word order. Other revisions involved verb tense. They emphasized the need to align the tense of the auxiliary and main verbs for consistency.

Question 2: What part of this sentence makes you think that it is grammatical, and why?

Both groups often judged ungrammatical items as correct for two tense-related reasons: either the verb tenses within the sentence appeared consistent, or the tense matched the time frame they believed was appropriate.

Question 3: Actually, this sentence is ungrammatical. How would you correct it to make it grammatical, and why did you choose such corrections?

The HP interviewees accurately revised a few items but made tense-related revisions for the rest. The first LP interviewee emphasized tense and verb form, whereas the second was often unable to identify any errors.

6. Discussion

6.1 Proficiency Effects

The HP participants showed significantly better performance than their LP counterparts in two respects. Firstly, the HP group obtained a higher mean rank than the LP group, regardless

of WH-clause position and WH-word function. The HP participants also outperformed the LP ones across all the ungrammatical conditions, indicating that the more proficient participants were more adept at tackling ungrammatical items. These significant differences suggest that L2 proficiency contributed to the overall performance differences between the two groups. The L2 proficiency effect has been well-documented (Jantarit, 2019; Li & Chen, 2024; Manchón et al., 2023). Interestingly, the participant groups differed significantly in performance on ungrammatical items, but not on grammatical items. This contrast highlighted the effects of task complexity and learners' working memory capacity.

First, the two participant groups exhibited distinct performance on the ungrammatical items, possibly because the grammatical and ungrammatical items differed in their cognitive burden level. The grammatical items required only correct judgments; consequently, the items could be considered simple for both groups, which explains why they performed similarly on the items. Conversely, the ungrammatical items, requiring correct judgments and revisions, should be more capacity-taxing, which may have amplified the between-group gap. The higher cognitive demand may have made the ungrammatical items more challenging for the LP learners, who had limited grammatical knowledge to detect and correct the errors. The burden, however, seemed less problematic to the HP learners, who had a better command of English grammar. This aligns with Manchón et al. (2023), who found that the writing accuracy gap between participants with different proficiency levels becomes more striking under more demanding tasks. The between-group finding suggests that while L2 proficiency influenced overall performance, the given task's cognitive load may modulate proficiency effects.

One possible explanation for the difference in how well the two participant groups tackled the ungrammatical items is related to a working memory capacity perspective. Working memory (WM) is a restricted capacity system in which information is temporarily stored and manipulated. According to Hofmann et al. (2008), WM involves the allocation of attention and resistance to distraction. Differences in WM have been linked to individuals' ability to control attention while performing cognitive tasks, with higher WM individuals being more successful in handling complex tasks than lower WM individuals (Unsworth et al., 2004). In some psycholinguistics research, a language learner's WM level can be indicated by many factors, including L2 proficiency. Coughlin and Tremblay (2013) observed a correlation between learners' L2 proficiency and WM level. Specifically, the higher a learner's L2 proficiency is, the larger their WM pool tends to be. Accordingly, the HP learners in the present study were likely to have a higher level of WM than the LP learners. Just and Carpenter (1992) propose that WM effects are likely to be more apparent in the more challenging tasks. The HP learners' greater cognitive capacity may have allowed them to store more grammatical knowledge and allocate attention more effectively, which could enable them to identify the ungrammatical items and revise them more successfully than the LP learners. On the contrary, the grammatical items might require fewer attentional resources; therefore, the WM levels of both participant groups could be adequate for handling them.

6.2 Effects of Grammaticality, WH-word Function, and WH-clause Position

According to Tables 7 and 8, grammaticality influenced both participant groups, while the function of WH-words affected only the LP group.

Both participant groups showed lower accuracy on ungrammatical items than grammatical ones, thereby substantiating Hypothesis 1. At first glance, this distinction could

be attributed to the differing cognitive demands of the two item types. However, a closer examination of the response categories for ungrammatical items, namely CUCR, CUIR, and IU, reveals an underlying cause.

Both participant groups were found to make numerous IU errors. The LP group's most frequent response was IU, outnumbering both CUCR and CUIR, and the HP group also produced more IU errors than CUIR errors. Making IU errors required minimal cognitive effort, as it involved only selecting the "Grammatical" choice from the two options provided in the GJT. Therefore, the high frequency of IU errors suggests that the participants' main difficulty was not with revising errors and managing cognitive load, but rather with simply recognizing errors in the first place. This response pattern seemed consistent with the YES-bias phenomenon observed by Tokowicz and MacWhinney (2005), whereby L2 learners tend to judge sentences as acceptable when they are uncertain about a particular L2 structure. The uncertainty that causes the bias could result from learners' incomplete knowledge about unfamiliar L2 structures, specifically knowing what correct WH-nominal clauses look like. Their partial understanding of WH-clauses was reinforced by the interviewees being asked to identify errors in the IU items. Although a few items were revised correctly, most interviewees focused on tense and verb form alteration. This indicated that the participants tended to focus on more surface-level and easily interpretable features, such as verb tense, rather than engage with the more structurally complex nature of WH-clauses, reflecting their limited grammatical knowledge of the latter construction.

The learners' limited knowledge is possibly associated with the phenomenon of transfer of training, where errors result from certain L2 instruction approaches or materials (Selinker, 1972). In the present study, this is attributed to the lack of references to common errors involving WH-nominal clauses in grammar textbooks. Many commonly used textbooks showcase grammatical forms of WH-nominal clauses and emphasize rules for correct formation. As a result, teachers using such materials are less likely to draw students' attention to recurring errors and may inadvertently limit learners' opportunities to develop sensitivity to syntactic violations. Given these instructional limitations, many learners, including several participants of the present study, may develop a partial understanding of WH-clauses and struggle to recognize ungrammatical forms. It is worth noting that a few textbooks (e.g., DeCapua, 2017; Parrott, 2010) provide remarks on frequent errors, including the misuse of question word order in WH-clauses, an error type included in the ungrammatical items of this study. Had grammar textbooks provided more examples of these errors and highlighted them to learners, the participants might have been better equipped to identify the ungrammatical forms in the GJT, resulting in fewer errors. Moreover, the failure to recall ungrammatical forms may eventually lead learners to produce these errors, as evidenced by the interview data regarding Question 1. The LP interviewees oftentimes inverted the subject and auxiliary in clauses containing subject WH-words because they mistook WH-clauses for WH-questions. In sum, the participants' strong IU tendency may stem from their limited knowledge of WH-nominal clauses, which, in turn, seemed linked to the absence of acknowledgment of common errors regarding the construction in grammar materials.

Regarding WH-word function, the effects localized to the LP learners partially confirm Hypothesis 2. They exhibited a higher error rate on items with object-function WH-words than on those with subject-function WH-words, producing more IU errors than all other error types. This finding suggests that the learners had considerable difficulty recognizing ungrammatical

WH-clauses with object-function WH-words, which featured the misuse of the direct question word order. The influence of WH-word function could be ascribed to two factors. First, the differing levels of success in identifying the ungrammatical items containing subject versus object WH-words could reflect distinct types of language transfer involving the extent of Thai-English structural similarity between WH-questions and WH-clauses across WH-word functions. Thai and English share a similar word order between WH-questions and WH-clauses with subject WH-words. Moreover, the word order of these two structures with subject WH-words in the two languages, namely subjects (WH-word) preceding verbs, represents a basic syntactic pattern for learners and tends to be less complex. As a result, the Thai-English similarities between WH-questions and WH-clauses with subject WH-words could lead to positive transfer and facilitate the LP learners' recognition of ungrammaticality in this type of WH-clause. However, the syntactic similarities between the two constructions with object WH-words in Thai and those in English are different. In Thai, WH-questions and WH-clauses with object WH-words share the same word order, whereas in English these two structures syntactically differ. The structural similarity between the two structures in Thai may cause negative transfer, leading the learners to assume that WH-clauses in English can also follow the same interrogative word order as WH-questions. Secondly, the LP learners' acceptance of the direct question word order may result from their overgeneralization (Selinker, 1972). The participants who made IU errors may have assumed that the interrogative word order of WH-questions also applied to WH-clauses because both constructions begin with the same set of WH-words, including "who" and "what" incorporated in the GJT of this study (Parrott, 2010). WH-questions are a prevalent English construction and are usually taught earlier than complex nominal clauses (North et al., 2010); therefore, learners are likely to be more familiar with the question formation and overextend the word order of WH-questions to WH-clauses. This tendency is likely among less proficient learners, whose syntactic awareness is still developing and who may rely on surface features to construct sentences.

The asymmetric performance of the LP learners across WH-word functions can be explained from an interlanguage perspective. Their vulnerability to WH-clauses with object WH-words supports the view that IL grammars are systematic yet constrained by certain cognitive processes, including language transfer and overgeneralization (Selinker, 1972). WH-clauses with subject WH-words align with a subject-verb word order pattern, a configuration shared by Thai and English in both WH-questions and WH-nominal clauses. Such clauses were thus likely to be represented more strongly in the learners' linguistic system. Therefore, the violations involving the clauses with subject WH-words tended to be more detectable, possibly because they conflicted with L1–L2 similarities and the learners' existing L2 grammatical knowledge. In contrast, WH-clauses with object WH-words required the participants to recognize the syntactic difference between direct questions and embedded clauses in English, a distinction absent in Thai. As a result, this type of WH-clause is more vulnerable to non-target-like representations, including those resulting from overextending the interrogative word order. The LP learners' markedly higher IU rate for such clauses indicates that the ungrammatical forms were likely compatible with their internalized grammatical representations and licensed within their linguistic system. Consistent with Jantarit (2019), Khudhayer (2013), and Lambani (2015), the learners' acceptance of the direct question word order in WH-clauses with object WH-words can be interpreted as a systematic and persistent

error arising from stable, rule-governed representations, thus constituting part of their IL system (Selinker, 1992).

WH-clause positions did not affect the participants, contradicting Hypothesis 3. They performed similarly on both subject WH-clause items and object WH-clause items. One explanation for the lack of position effects is that learners may have applied the same syntactic rule governing noun and NP distribution to WH-clauses. Nominal clauses can replace nouns or NPs within sentences (Parrott, 2010), including serving as a subject or an object (Azar & Hagen, 2009; DeCapua, 2017). Since these clauses serve nominal functions, their placement in subject and object positions, mirroring the positions of common nouns, may not have posed structural challenges to learners. If the participants had internalized that nouns can appear in these positions, they may have overgeneralized that same distributional rule to WH-nominal clauses, leading to comparable performance across subject and object WH-clauses. This reflects their partial knowledge of the structure, specifically an understanding that such clauses can function like nouns and occur in nominal positions.

7. Limitations and Recommendations

This research has some limitations and recommendations for future studies. First, the primary data source in this study was a GJT, which might not fully reflect the participants' productive performance of WH-nominal clauses nor capture their real-time processing of the clauses. Future studies may incorporate multiple data sources, including written production tasks or time-sensitive instruments, such as self-paced reading tasks, to gain a more comprehensive understanding of learners' acquisition of the construction. Second, although the absence of distractors in the GJT allowed the participants to emphasize the target structure, the instrument design may have made the experimental purpose noticeable to them and enabled them to realize response patterns. Future research is therefore encouraged to include distractors to minimize pattern detection and response bias. Third, the GJT includes WH-clauses with "who" and "what." Future research might incorporate more WH-words to obtain a more complete result. The last limitation involves the WH-clause position. Apart from the subject and object positions, WH-nominal clauses can occur in other sentential positions, such as appositive and adjectival complementation. Future studies might explore L2 learners' acquisition of WH-clauses in those positions.

8. Conclusion

This study explored the effects of grammaticality, WH-word function, and WH-clause position on how English WH-nominal clauses were acquired by two groups of L1 Thai learners: HP and LP. Both groups performed more poorly on ungrammatical items, which was tied to transfer of training. Additionally, WH-word function significantly affected the LP learners, who often deemed ungrammatical WH-clauses containing object WH-words as grammatical, likely due to their overgeneralization and L1-L2 differences. Nevertheless, WH-clause position did not impact either group, probably because the participants applied the distributional rules for nouns to WH-clauses.

The findings resulted in two pedagogical implications. The first implication concerns the participants' strong IU tendency. They tended to judge ungrammatical sentences as grammatical, due to the limited examples of common errors in English grammar textbooks. Accordingly, it is recommended that textbook developers incorporate frequent errors related to

L2 structures into teaching materials and that teachers integrate such errors into their grammar instructions and practice activities. For example, alongside correct sentences, materials could include error samples with clear explanations as to why they are ungrammatical and how to correct them. Teachers can further reinforce learners' awareness of ungrammatical forms by designing classroom activities that encourage learners to notice and discuss such errors, for example, error-spotting exercises or peer correction tasks. These practices could help learners become more sensitive to syntactic violations and reduce the likelihood of accepting incorrect forms as correct. The second implication addresses the difficulty of the LP learners in distinguishing between WH-nominal clauses and WH-questions. The LP learners were likely to judge ungrammatical WH-clauses with interrogative word order as correct, and producing WH-clauses with question word order is a persistent error among L2 English learners. To mitigate this problem, teachers should explicitly contrast the two structures in instruction. This can be done through guided comparisons, where learners analyze pairs of sentences (e.g., *Who the dog had bitten* recovered quickly vs. *Who had the dog bitten?*) and identify the syntactic functions of each clause type. In addition, teachers can provide focused practices where learners transform WH-questions into nominal clauses and vice versa, making the structural differences more salient. Classroom emphasis on word order patterns in relation to clause functions would not only prevent fossilization of this error but also enhance syntactic flexibility when learners encounter WH-clauses in other possible contexts, such as subject complement, appositive, and prepositional complement. Subsequently, increased comprehensive knowledge of the grammatical structure would strengthen students' writing skills and improve their sentence variety.

9. About the Author

Supakit Thiamtawan is a lecturer in the Division of English for Science and Technology, Chulalongkorn University Language Institute, Thailand. His research interests include second language acquisition and psycholinguistics.

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11. Declaration of AI Use

The author declares that no AI tools were used in preparation of the manuscript.

The author takes full responsibility for the content.

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13. Appendix A: The Grammaticality Judgment Test Items

Directions: This test includes 32 items. Below each sentence are two choices: (a) Grammatical and (b) Ungrammatical. If you think a sentence is grammatical, choose (a). If you think the sentence is ungrammatical, choose (b), identify the error(s), and provide a correction in the space provided. After answering the question(s) about a sentence and clicking "Next" to proceed, you will not be able to go back and change your previous answers.

You have 60 minutes to complete the test.

- (1) Daniel did not realize who had Laura mentioned in the discussion.
- (2) What makes the solution effective is its simplicity.
- (3) Who I saw on the bus this morning was a former teacher of mine.
- (4) The staff asked who he had canceled the meeting.
- (5) The technician is explaining what the machine can produce.
- (6) What did the sales manager do was completely unfair.
- (7) Who she won the singing contest will be revealed tonight.
- (8) The authorities are investigating what caused the accident.
- (9) I cannot believe who Matt visited.
- (10) Fred forgot who they had made him successful.
- (11) What led to the discovery is still being investigated.
- (12) The victim did not know who had attacked him.
- (13) What it caused the misunderstanding remains unknown.
- (14) What the author wrote upset many people.
- (15) Harold and Jay wondered who had John hired.
- (16) Who had the thief attacked was admitted to hospital.
- (17) The research examined what improved patients' health.
- (18) The policeman inquired what did the witnesses see.
- (19) Who he had caused the flight delay has not been identified.
- (20) His parents could not imagine what he experienced during his studies.
- (21) What did the scientist discover was amazing.
- (22) Who will lead the team is yet to be confirmed.
- (23) Who the man attacked turned out to be a well-known celebrity.
- (24) They do not remember what it led Sandra to make the tragic movie.

- (25) Who had the dog bitten recovered quickly.
- (26) What they confused the students was the technical terms used in the lecture.
- (27) Ben knows who Anne met yesterday.
- (28) The children did not understand what did their parents say.
- (29) What the doctor recommended surprised me.
- (30) The committee will soon decide who will be the next leader.
- (31) Jeff did not reveal what it made him change his mind.
- (32) Who will take charge of the project has not been decided.

Appendix B: The CU-TEP, IELTS, and TOEFL iBT Score Ranges Mapped to the CEFR Levels

CU-TEP cut-off score ranges (max. 120 points)	CEFR levels
14-34	A2
35-69	B1
70-98	B2
99-120	C1

(Wudthayagorn, 2018, p. 174)

Common European Framework (CEFR)	IELTS (0-9.0)	TOEFL iBT (0-120)
C2	8.5-9.0	n/a
C1	7.0-8.0	95
B2	5.5-6.5	72
B1	4.0-5.0	42
A2	n/a	n/a
A1	n/a	n/a

(Meniado, 2019, p. 57)

Appendix C: The Results of the Kolmogorov–Smirnov and Shapiro–Wilk Tests of Normality

	Group	Kolmogorov–Smirnov			Shapiro–Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Grammatical	L	.294	30	<.001	.736	30	<.001
	H	.302	30	<.001	.581	30	<.001
Ungrammatical	L	.123	30	.200*	.941	30	.095
	H	.185	30	.010	.902	30	.010
Object WH-word	L	.113	30	.200*	.979	30	.786
	H	.240	30	<.001	.843	30	<.001
Subject WH-word	L	.176	30	.018	.961	30	.326
	H	.245	30	<.001	.636	30	<.001
Object position	L	.146	30	.104	.944	30	.114
	H	.223	30	<.001	.873	30	.002
Subject position	L	.152	30	.075	.957	30	.264
	H	.227	30	<.001	.876	30	.002
Correct answers	L	.124	30	.200*	.956	30	.237
	H	.217	30	<.001	.890	30	.005
GSS	L	.508	30	<.001	.416	30	<.001
	H	.480	30	<.001	.444	30	<.001
GSO	L	.494	30	<.001	.471	30	<.001
	H	.539	30	<.001	.180	30	<.001
USS	L	.190	30	.007	.868	30	.002
	H	.271	30	<.001	.810	30	<.001
USO	L	.209	30	.002	.889	30	.005
	H	.261	30	<.001	.793	30	<.001
GOS	L	.399	30	<.001	.667	30	<.001
	H	.508	30	<.001	.416	30	<.001
GOO	L	.385	30	<.001	.649	30	<.001

	H	.493	30	<.001	.466	30	<.001
UOS	L	.206	30	.002	.833	30	<.001
	H	.312	30	<.001	.686	30	<.001
UOO	L	.269	30	<.001	.806	30	<.001
	H	.256	30	<.001	.830	30	<.001
