THE ACQUISITION OF IMPLICIT KNOWLEDGE BY CHINESE & SPANISH EFL LEARNERS: EXPERIMENTAL STUDIES ON GRAMMATICAL ERRORS IN EGNLISH QUESTIONS AND PEDAGOGICAL IMPLICATIONS

Qiaoling He

UNIVERSITAT ROVIRA i VIRGILI

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DOCTORAL THESIS

Supervised by

Dr. **Isabel Oltra-Massuet**

UNIVERSITAT ROVIRA i VIRGILI

Department of English and German Studies

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FAIG CONSTAR que aquest treball, titulat "L'adquisició del coneixement implícit per part d'aprenents xinesos i espanyols d'anglès com a llengua estrangera: Estudis experimentals sobre errors gramaticals en preguntes en anglès i implicacions pedagògiques", que presenta Qiaoling He per a l'obtenció del títol de Doctor, ha estat realitzat sota la meva direcció al Departament d'Estudis Anglesos i Alemanys d'aquesta universitat.

HAGO CONSTAR que el presente trabajo, titulado "La adquisición del conocimiento implícito por parte de aprendientes chinos y españoles de inglés como lengua extranjera: Estudios experimentales sobre errores gramaticales en preguntas en inglés e implicaciones pedagógicas", que presenta Qiaoling He para la obtención del título de Doctor, ha sido realizado bajo mi dirección en el Departamento de Estudios Ingleses y Alemanes de esta universidad.

I STATE that the present study, entitled "The acquisition of implicit knowledge by Chinese and Spanish EFL learners: Experimental studies on grammatical errors in English questions and pedagogical implications", presented by Qiaoling He for the award of the degree of Doctor, has been carried out under my supervision at the Department of English and German Studies of this university.

Tarragona, 31/01/2023

La directora de la tesi doctoral
La directora de la tesis doctoral
Doctoral Thesis Supervisor

M. Isabel Oltra Massuet

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conversation, which greatly supported me in finishing my thesis.

List of abbreviations

2	2	Second person
3	3	Third person
A	ANOVA	One-way analysis of variance
C	CR	Consciousness-raising
	CEFR	Common European Framework of Reference for Language
	CS/CH	Chinese speaker
	CI	Confidence interval
	CLI	Cross-linguistic influence
E	EFL	English as a Foreign Language
	EA	Error analysis
	EI	Elicited imitation
	ERPs	Event-related potentials
F	FLS	Foreign language secondary
	FFI	Form-focused instruction
	FL	Foreign language
	fMRI	Functional magnetic resonance imaging
G	GJT	Grammaticality test
	GSI	Grammatical Sensitivity Index
	GAUX	Grammar auxiliary
	GAUXC	Grammar auxiliary choice
	GAUXO	Grammar auxiliary order or placement
	GAUXT	Grammar auxiliary tense

	GAUXM	Grammar auxiliary morphology
	GAUXA	Grammar auxiliary subject-verb agreement
	GAUX#	Grammar auxiliary error plus one other error
I	IK	Implicit knowledge
	IL	Interlanguage
	IND	Indicative
L	LSD	Least Significant Difference
	L1	First Language
	L2	Second Language
	L3	Third Language
M	MKT	Metalinguistic knowledge test
	MD	Mean difference
N	NS	Native speaker
O	OIT	Oral imitation test
	ONT	Oral narrative test
	OEIT	Oral elicited imitation test
P	POA	Production-Oriented Approach
	PST	Past
	PL	Plural
	PFV	Perfective
	POSS	Possessive
	PRS	Present
Q	Q	Question article/marker
R	RT	Reaction Time
	RPS	Rural public secondary
	RQ	Research question

S	SLA	Second Language Acquisition
	SPSS	Statistical Package for Social Sciences
	SE	Standard error
	SS	Spanish speaker
	SG	Singular
	SD	Standard deviation
	SVO	Subject-verb-object
T	TGJT	Timed grammaticality judgment test
W	WMT	Word Monitoring Test

List of publications

This part documents papers that provided the basis for writing the current thesis (related papers to thesis), as well as other papers published during PhD study (unrelated papers to thesis).

Related papers to the thesis

1. He, Q., & Oltra-Massuet, I. (2021). Morphosyntactic inconsistency in cross-linguistic transfer: Pedagogical implications for teaching English questions to Chinese EFL learners. Language Teaching Research, 13621688211029430.

2. He Q, Oltra-Massuet I. (2023). Implicit Knowledge Acquisition and Potential Challenges for Advanced Chinese and Spanish EFL Learners: A Word Monitoring Test on English Questions. Behavioral Sciences. 2023; 13(2):99. https://doi.org/10.3390/bs13020099

3. He, Q., & Oltra-Massuet, I. (2023). An experimental study on grammatical sensitivity and production competence in Chinese and Spanish EFL learners and its implications on EFL teaching Methods. Frontiers in Psychology, 2023; 14. doi: 10.3389/fpsyg.2023.1096875 (accepted on 27th, Jan. 2023)

Unrelated papers to the thesis

1. Zhang, M., He, Q.*, Du, J., Liu, F., & Huang, B. (2022). Learners' perceived advantages and social-affective dispositions toward online peer feedback in

academic writing. *Frontiers in Psychology*, *13*, 10.3389/fpsyg.2022.973478.

2. 张萌，何巧玲， 洪毅. (2019). 初中英语跨学科教学策略探究. *中小学外语教学.*

Contents

Abstract

The implicit knowledge acquired by second language (L2) learners determines their language competence, but it is assumed to be difficult for English as a Foreign Language (EFL) learners to acquire such knowledge, as it is shown in the case of English questions. It is common to see that EFL learners, who are familiar with the grammar rules of English questions and are accurate in writing, still make ungrammatical sentence structures in spontaneous production. As one of the core issues in L2 research, implicit knowledge acquisition attracted great attention from L2 researchers, but many issues, such as whether advanced EFL learners can acquire implicit knowledge, whether EFL learners' different first language (L1) backgrounds influence their acquisition, and whether EFL learners' language production competence develops simultaneously with their acquisition of grammatical knowledge, remain under debate.

The first primary goal of the current dissertation is to identify EFL learners' typical grammatical errors in English questions with fine-grained categorization criteria to lay the foundation for conducting further experiments on implicit knowledge. The second main goal is to introduce effective experimental tools to measure whether EFL learners could acquire native-equivalent implicit knowledge. The dissertation also aims to explore potential challenges that impact Spanish and Chinese EFL learners' implicit knowledge acquisition of English questions and to investigate whether advanced EFL learners' language production competence progresses in line with their level of grammatical knowledge. This dissertation also intends to contribute a principled reflection on the pedagogical implications arising from the theoretical and experimental findings obtained

in this dissertation for practitioners in EFL teaching contexts.

Eighty-one Chinese and fifty-two Spanish EFL participants were recruited to perform a written test for collecting hands-on data on grammatical errors in order to analyze morphosyntactic features of English questions acquired by preliminary EFL learners. Thirty-two Chinese and thirty-seven Spanish participants were involved to conduct a Word Monitoring Test (WMT), aiming at measuring advanced EFL learners' implicit knowledge and explore factors influencing acquisition. The present dissertation also modified an Oral Elicited Imitation Test (OEIT) and recruited thirty-five Chinese and thirty-seven Spanish advanced EFL learners to evaluate advanced EFL learners' grammatical knowledge and language production and measure their implicit knowledge from these two perspectives.

In order to categorize EFL learners' grammatical errors and measure their implicit knowledge, data analyses, including descriptive statistics, independent-sample *t*-test, paired-sample *t*-test, and one-way analysis of variance (ANOVA) with *post-hoc* analysis, were conducted. Error classification criteria were set up, and five types of morphosyntactic errors were categorized. Results confirmed that advanced EFL learners could not acquire implicit knowledge equivalent to native speakers' level and revealed that the development of EFL learners' language production competence lags their grammatical knowledge.

In conclusion, the dissertation demonstrates that morphosyntactic features related to the choice of auxiliary and tense of auxiliary constitute the most prevalent challenges for EFL learners to acquire English questions. Cross-linguistic L1 influence, resulting from the L1-L2 morphosyntactic incongruency, is one major factor that affects EFL learners' acquisition. The experimental finding showing that advanced EFL learners' production

competence does not develop simultaneously with their grammatical knowledge provides

further evidence to reinforce the conclusion that advanced EFL learners do not acquire

native-equivalent implicit knowledge of English questions. Based on these findings,

pedagogical implications related to consciousness-raising, production-oriented approach,

and interactive activities are proposed for improving EFL learners' acquisition of English

questions.

Resum

El coneixement implícit que adquireixen els estudiants d'una segona llengua (L2) determina la seva competència lingüística, però s'assumeix que als estudiants d'anglès com a llengua estrangera (ALE) els resulta difícil adquirir aquest coneixement, com es demostra en el cas de les preguntes en anglès. És habitual veure que els estudiants d'ALE, que estan familiaritzats amb les regles gramaticals de les preguntes en anglès i escriuen amb correcció, continuen formant estructures oracionals agramaticals en la producció espontània. L'adquisició del coneixement implícit és un dels temes centrals de la recerca en L2 i ha atret una gran atenció per part dels investigadors de L2, però queden encara moltes qüestions per resoldre, com ara: si els estudiants avançats d'ALE poden adquirir coneixement implícit, si les diferents primeres llengües (L1) dels estudiants d'ALE influeixen en l'adquisició de L2, i si la competència de producció lingüística dels estudiants d'ALE es desenvolupa simultàniament a la seva adquisició de coneixement gramatical.

El primer objectiu principal d'aquesta tesi és identificar els errors gramaticals típics dels estudiants d'ALE en les preguntes en anglès amb criteris de categorització precisos, amb la finalitat d'establir les bases per a dur a terme experiments sobre el coneixement implícit. El segon objectiu principal és introduir eines experimentals eficaces per a mesurar si els estudiants d'anglès com a llengua estrangera poden adquirir un coneixement implícit equivalent al d'un parlant natiu. La tesi també busca explorar els possibles reptes que afecten l'adquisició del coneixement implícit de les preguntes en anglès per part dels estudiants espanyols i xinesos d'ALE, i investigar

si la competència de producció lingüística dels estudiants avançats d'ALE progressa d'acord amb el seu nivell de coneixement gramatical. Aquesta tesi doctoral també persegueix aportar una reflexió fonamentada sobre les implicacions pedagògiques que es deriven de les troballes teòriques i experimentals obtingudes en aquesta tesi per als professionals de l'ensenyament d'ALE.

Es van reclutar vuitanta-un participants xinesos i cinquanta-dos espanyols d'ALE per a realitzar una prova escrita per tal de recollir dades reals fiables sobre errors gramaticals, amb la finalitat d'analitzar les característiques morfosintàctiques de les preguntes en anglès adquirides pels estudiants de nivell preliminar d'ALE. Es va involucrar a trenta-dos participants xinesos i trenta-set espanyols per a realitzar una prova de seguiment de paraules (*Word Monitoring Test*, WMT), amb l'objectiu de mesurar el coneixement implícit dels estudiants avançats d'ALE i explorar els factors que influeixen en l'adquisició. Aquesta tesi també va modificar un Test d'Imitació Oral Elicitada (OEIT) i va reclutar trenta-cinc estudiants avançats d'ALE xinesos i trenta-set d'espanyols per a avaluar el coneixement gramatical i la producció lingüística dels estudiants avançats d'ALE i mesurar el seu coneixement implícit des d'aquestes dues perspectives.

Amb la finalitat de categoritzar els errors gramaticals dels estudiants d'ALE i mesurar el seu coneixement implícit, es van realitzar anàlisis de dades que incloïen estadística descriptiva, prova t (*t-test*) de mostres independents, prova t de mostres aparellades i anàlisi de variància d'una via (ANOVA) amb anàlisi *post-hoc*. Es van establir criteris de classificació d'errors i es van categoritzar cinc tipus d'errors morfosintàctics. Els resultats van confirmar que els estudiants avançats d'ALE no podien adquirir un coneixement implícit equivalent al dels parlants natius i van

revelar que el desenvolupament de la competència de producció lingüística dels estudiants d'ALE va per darrere del seu coneixement gramatical.

En conclusió, la tesi demostra que els trets morfosintàctics relacionats amb l'elecció de l'auxiliar i el temps de l'auxiliar constitueixen els reptes més freqüents per als estudiants d'ALE en l'adquisició de les preguntes en anglès. La influència interlingüística de la L1, resultant de la incongruència morfosintàctica L1-L2, és un dels principals factors que afecten els estudiants en l'adquisició d'ALE. La troballa experimental que mostra que la competència de producció dels estudiants avançats d'ALE no es desenvolupa simultàniament amb el seu coneixement gramatical proporciona proves addicionals que reforcen la conclusió que els estudiants avançats d'ALE no adquireixen un coneixement implícit de les preguntes en anglès equivalent al d'un parlant natiu. A partir d'aquests resultats, es proposen una sèrie d'implicacions pedagògiques relacionades amb la conscienciació, l'enfocament orientat a la producció i les activitats interactives per a millorar l'adquisició de les preguntes en anglès en estudiants d'ALE.

Resumen

El conocimiento implícito que adquieren los estudiantes de una segunda lengua (L2) determina su competencia lingüística, pero se asume que a los estudiantes de inglés como lengua extranjera (ILE) les resulta difícil adquirir dicho conocimiento, como se demuestra en el caso de las preguntas en inglés. Es común ver que los estudiantes de ILE, que están familiarizados con las reglas gramaticales de las preguntas en inglés y escriben con corrección, siguen formando estructuras oracionales agramaticales en la producción espontánea. La adquisición del conocimiento implícito es uno de los temas centrales de la investigación en L2 y ha atraído una gran atención por parte de los investigadores de L2, pero quedan aún muchas cuestiones por resolver, como son: si los estudiantes avanzados de ILE pueden adquirir conocimiento implícito, si las diferentes primeras lenguas (L1) de los estudiantes de ILE influyen en la adquisición de L2, y si la competencia de producción lingüística de los estudiantes de ILE se desarrolla simultáneamente a su adquisición de conocimiento gramatical.

El primer objetivo principal de esta tesis es identificar los errores gramaticales típicos de los estudiantes de ILE en las preguntas en inglés con criterios de categorización precisos, con el fin de sentar las bases para llevar a cabo experimentos sobre el conocimiento implícito. El segundo objetivo principal es introducir herramientas experimentales eficaces para medir si los estudiantes de inglés como lengua extranjera pueden adquirir un conocimiento implícito equivalente al de un hablante nativo. La tesis también busca explorar los posibles retos que afectan a la adquisición del conocimiento implícito de las preguntas en

inglés por parte de los estudiantes españoles y chinos de ILE, e investigar si la competencia de producción lingüística de los estudiantes avanzados de ILE progresa en consonancia con su nivel de conocimiento gramatical. Esta tesis doctoral también persigue aportar una reflexión fundamentada sobre las implicaciones pedagógicas que se derivan de los hallazgos teóricos y experimentales obtenidos en esta tesis para los profesionales de la enseñanza de ILE.

Se reclutaron ochenta y un participantes chinos y cincuenta y dos españoles de ILE para realizar una prueba escrita para recoger datos reales fiables sobre errores gramaticales, con el fin de analizar las características morfosintácticas de las preguntas en inglés adquiridas por los estudiantes de nivel preliminar de ILE. Se involucró a treinta y dos participantes chinos y treinta y siete españoles para realizar una prueba de seguimiento de palabras (*Word Monitoring Test*, WMT), con el objetivo de medir el conocimiento implícito de los estudiantes avanzados de ILE y explorar los factores que influyen en la adquisición. Esta tesis también modificó un Test de Imitación Oral Elicitada (OEIT) y reclutó a treinta y cinco estudiantes avanzados de ILE chinos y treinta y siete españoles para evaluar el conocimiento gramatical y la producción lingüística de los estudiantes avanzados de ILE y medir su conocimiento implícito desde estas dos perspectivas.

Con el fin de categorizar los errores gramaticales de los estudiantes de ILE y medir su conocimiento implícito, se realizaron análisis de datos que incluían estadística descriptiva, prueba t (*t-test*) de muestras independientes, prueba t de muestras emparejadas y análisis de varianza de una vía (ANOVA) con análisis *post-hoc*. Se establecieron criterios de clasificación de errores y se categorizaron cinco tipos de errores morfosintácticos. Los resultados confirmaron que los estudiantes

avanzados de ILE no podían adquirir un conocimiento implícito equivalente al de los hablantes nativos y revelaron que el desarrollo de la competencia de producción lingüística de los estudiantes de ILE va por detrás de su conocimiento gramatical.

En conclusión, la tesis demuestra que los rasgos morfosintácticos relacionados con la elección del auxiliar y el tiempo del auxiliar constituyen los retos más frecuentes para los estudiantes de ILE en la adquisición de las preguntas en inglés. La influencia interlingüística de la L1, resultante de la incongruencia morfosintáctica L1-L2, es uno de los principales factores que afectan a los estudiantes en la adquisición de ILE. El hallazgo experimental que muestra que la competencia de producción de los estudiantes avanzados de ILE no se desarrolla simultáneamente con su conocimiento gramatical proporciona pruebas adicionales que refuerzan la conclusión de que los estudiantes avanzados de ILE no adquieren un conocimiento implícito de las preguntas en inglés equivalente al de un hablante nativo. A partir de estos resultados, se proponen una serie de implicaciones pedagógicas relacionadas con la concienciación, el enfoque orientado a la producción y las actividades interactivas para mejorar la adquisición de las preguntas en inglés en estudiantes de ILE.

摘要

第二语言（后文简称"二语"，L2）学习者隐性知识水平决定了其语言能力，但二语学习者很难习得此类知识。英语作为外语(English foreign learner，EFL)的学习者　（后文简称"EFL 学习者"）对英语疑问句掌握的困难程度就充分体现了隐性知识习得困难这一观点。尽管 EFL 学习者熟练掌握了英语疑问句的语法规则并能在书面表达时准确应用，但在自然交际环境下仍然会出现语法错误。隐性知识的习得作为"二语"研究的核心问题之一，已受到"二语"研究者的广泛关注，但是高水平EFL 学习者能否习得隐性知识、EFL 学习者的母语背景是否影响其习得、以及 EFL 学习者的语言表达能力的形成是否与语法知识的掌握同步等问题仍有争议。

本论文的第一个目标是建立一套精准的错误分类标准，为研究 EFL 学习者在产出英语疑问句时出现的典型语法错误提供方法，为进一步开展隐性知识测量研究奠定基础。同时，本研究将引入词汇检测实验 (Word monitoring test，WMT) 及诱导口头模仿产出实验（Oral Elicited Imitation Test, OEIT），评价 EFL 学习者是否可以习得与英语母语者水平相当的隐性知识。此外，本论文亦将探讨显著影响西班牙及中国 EFL 学习者习得英语疑问句的隐性知识的难点，并评价高水平 EFL 学习者的语言产出能力是否同步于其语法知识的发展。最后，本论文将基于理论和实验结果，提出相应的教学建议，以期为EFL 教学环境中的从业者提供参考。

研究 1 通过招募 81 名中国和 52 名西班牙初中学生参与实验来收集语法错误的第一手数据，以分析初级 EFL 学习者对英语疑问句的形态句法特征习得情况。 研究 2 通过招募 32 名中国和 37 名西班牙达高级水平 的 EFL 学习者

参与词汇检测实验(WMT)，旨在评价高水平 EFL 学习者的隐性知识习得情况并探索影响其习得的因素。研究 3 首先对诱导口头模仿产出实验(OEIT)进行调适，然后招募了 35 名中国和 37 名西班牙达高级水平 的 EFL 学习者，以评估高水平 EFL 学习者的语法知识水平和语言产出能力，并通过评价语言产出能力的形成与语法知识水平的提升是否同步实现对隐形知识习得的评价。

为了对 EFL 学习者的语法错误进行分类并测量其隐性知识水平，本研究采用了描述性统计、独立样本 t 检验、配对样本 t 检验，方差分析 (ANOVA)及 LSD 事后检验等数据分析方法。基于研究 1，我们建立了一套针对英语疑问句语法错误的分类标准，其中归纳出 EFL 学习者在产出疑问句时出现的 5 大典型错误类型。研究 2 与研究 3 证明高水平 EFL 学习者无法习得与母语者水平相当的隐性知识，并证实 EFL 学习者语言产出能力的发展滞后于其语法知识的习得。

总体而言，本研究得到了如下发现：一、助动词的选择和助动词的时态是 EFL 学习者习得英语疑问句的两大难点；二、母语和目标语在形态句法上的不一致是 EFL 学习者难以习得该句法结构的主要影响因素。三、高水平 EFL 学习者的语言产出能力的提升滞后于其语法知识水平的发展，进一步证明了高水平 EFL 学习者难以习得与母语者水平相当的隐性知识。基于这些发现，本研究提出了整合语法意识提升任务、产出导向法以及语言交互活动的教学启示。

Introduction

This chapter presents the initial motivation, research questions and hypotheses, justification of the three consecutive studies, as well as an overview of the general structure of the dissertation.

Motivation

The acquisition of a language is about the development of implicit knowledge rather than explicit knowledge (VanPatten et al., 2020: p237). In EFL teaching and learning context, implicit knowledge is the final goal and ideal outcome of language learning (Dekeyser, 2008; Ellis & Roever, 2018; Krashen, 1982; Nezakat-alhossaini et al., 2014, and etc.). Therefore, it is significant to study implicit knowledge acquired by EFL learners, which reveals their level of language acquisition.

Studies have investigated the acquisition of implicit knowledge on different language structures such as relative clauses and declarative sentences. Morgan & Ferreira (2021), Nezakat-alhossaini et al. (2014), Sami Alsalmi (2017), and L. Zhang, (2021), among others, found that the type of input, explicit instruction, and syntactic features affected EFL learners' implicit knowledge acquisition of relative clauses. Research also reported the role of developmental stages, incidental exposure, and explicit

and implicit instruction played on the acquisition of tenses in declarative sentences (Mourssi, 2012; Rebuschat & Williams, 2012a; Soleimani et al., 2015; Yang & Lyster, 2010). Compared to sentence structures such as relative clauses and declarative sentences, English questions have special syntactic features, such as *do*-support, *wh*-word fronting, or auxiliary inversion (Dyson, 2008; Karttunen, 1977; Stein, 1986). Research on English questions has mainly focused on aspects related to the developmental stages of acquisition (Rod Ellis, 1984; Eskildsen, 2015; Pienemann et al., 1988; Spada & Lightbown, 1999) or on diversified errors in English questions produced by EFL learners from different L1s (Lee, 2016; Pozzan & Quirk, 2014; Trofimovich & Mcdonough, 2011). However, the acquisition of implicit knowledge in the domain of English questions is largely understudied, and many issues are still to be settled. This dissertation seeks to investigate the acquisition of English questions, both from the perspective of theories of implicit knowledge and the experimental application of implicit knowledge measurement. Additional aims of this dissertation are to explore major challenges and influential factors involved in the acquisition of English questions by EFL learners, and to provide EFL-learners-oriented pedagogical implications for practitioners on the basis of the experimental results obtained.

Research questions and hypotheses

The primary goal of this thesis is to test the degree of implicit knowledge

of English questions acquired by advanced EFL learners. Unlike explicit knowledge, the accurate measurement of implicit knowledge has been proved to be complex (Erlam, 2006; Rebuschat & Williams, 2012). For this reason, this research starts with a classification of grammatical errors in different types of English questions based on hands-on data collected from preliminary Chinese and Spanish EFL learners. These data provide reliable experimental materials for implicit knowledge measurement on advanced EFL Chinese and Spanish learners in two follow-up studies, in the sense that experimental items designed on the basis of errors produced by learners with the same L1 ensure homogeneity of their L2 features. The data enable the researcher to precisely test implicit knowledge of advanced EFL learners from these two L1s and probe the potential sources of their erroneous production. Specifically, two behavioral experiments are conducted to test EFL learners' degree of implicit knowledge and to explore potential influential factors on their acquisition of English questions.

The first study identifies categories of errors in English questions produced by preliminary EFL learners and then analyzes the cross-linguistic L1 influence, with the following two research questions proposed.

RQ 1. What are typical errors in English questions produced by preliminary Chinese and Spanish EFL learners?

RQ 2. How does cross-linguistic transfer from learners' L1s influence their

production of English questions?

To answer the first research question, a refined-error classification that is grounded on Thewissen's (2013) grammatical error categorization framework and Corder's (1975) obligatory occasion criteria is conducted to address RQ1. The following three hypotheses based on Jarvis' (2000) methodological framework are formulated to answer RQ2.

H 1.   Learners from an identical L1 background show a similar degree of difficulty in formulating the English questions under investigation.

H 2.   Learners' errors in questions parallel the corresponding feature of the same type of question in Chinese and Spanish.

H 3.   Equivalent-level English learners from two different L1s (Chinese and Spanish) display distinct degrees of difficulty building English questions, and there are differences in the errors they produce.

The thesis continues with the second and the third study, designed to measure advanced EFL learners' implicit knowledge. A common core research question is raised in the two studies.

RQ 3. Do advanced EFL learners acquire implicit knowledge equivalent to native speakers' level?

To answer this research question, two different experiments are conducted in the second and third study to test the following hypothesis:

H 4. Advanced EFL learners cannot acquire implicit knowledge equivalent to native speakers' level.

A reaction-time monitoring experiment is introduced in the second study to evaluate learners' implicit knowledge through their responses to ungrammatical sentences, while an imitated production experiment is employed to assess their implicit knowledge by their production data in the third study.

The second study also explores potential challenges in the acquisition of English questions, RQ4 is raised in the second study.

RQ 4. What may potentially impact Spanish and Chinese EFL learners' implicit knowledge acquisition of English question formation?

To answer RQ4, building on Jiang et al. 's(2011) congruency hypothesis, we formulate the following hypothesis:

H 5. The L1-L2 morphosyntactic congruency impacts Spanish and Chinese EFL learners' implicit knowledge acquisition of English questions.

Based on this hypothesis, three predictions (P) are formulated to analyze the acquisition of implicit knowledge.

P1. Advanced EFL learners confront great difficulty in the acquisition of native-like implicit knowledge of morpho-syntactic features in English question formation that do not instantiate in their L1.

P2. Spanish EFL learners outperform Chinese EFL learners in acquiring morphosyntactic features in English question formation because more morphological inflectional features are instantiated in Spanish than in Chinese.

P3. In acquiring morpho-syntactic features in English questions, Spanish EFL learners perform better on morpho-syntactic features that are congruent with Spanish than those that are incongruent.

To investigate the development of grammatical sensitivity and their corrective production competence, the RQ5 is addressed in the third study.

RQ 5. Does advanced EFL learners' language production competence develop simultaneously with their grammatical knowledge of English questions?

To address this research question, the third study formulate the following hypothesis:

H 6. Advanced EFL learners' grammatical sensitivity and production competence develop simultaneously.

This will be tested with data obtained from the production experiment.

This thesis also contributes pedagogical implications for practitioners in EFL teaching contexts. An integrated design of Production Oriented Approach (POA) and Consciousness-Raising (CR) tasks is proposed for preliminary EFL learners in EFL teaching contexts to raise learners' grammatical consciousness and create communicative contexts. Besides, Interaction-based POA tasks are suggested to facilitate EFL learners' acquisition of target structures and thus promote their production competence.

In sum, this dissertation provides a series of studies on the acquisition of English questions by EFL learners that bring together learner error analysis, second language acquisition (SLA) experimentation tools, and a pedagogical perspective, in an attempt to explore the nature of learner

errors in acquisition with SLA research methods, and subsequently provide possible pedagogical solutions to the EFL acquisition problem. This hybrid study tries to offer an exploratory model to probe the acquisition of a particular sentence structure, which takes data gathered on the basis of practical accuracy problems displayed by learners and brings the experimental findings onto the pedagogical application in EFL teaching and learning.

Justification

This section justifies the hybrid methodological approach developed in this thesis project that brings together error classification, implicit knowledge measurements and the analysis of production competence.

The necessity of error classification

In L2 or Foreign language (FL) acquisition, learners' linguistic errors cannot be neglected; instead, they are valuable language sources for L2 research. Grammatical errors, as an important part of learners' interlanguage (IL) (Selinker, 1972), reveal L2 learners' mental process of language learning and development, and thus, they facilitate language teaching for practitioners. Typical learner errors of a specific grammatical structure are useful for targeted teaching design and class activities, as

specified in the following paragraph by Richards et al. (2014).

Students' errors might be both at the level of the sentence as well as the text, and teaching activities can be developed both around a collection of typical errors students have made in the past as well as through addressing errors that arise in ongoing classroom work. ……Working with students from different language backgrounds can benefit from trying to identify patterns of errors found in student texts. These patterns of errors can then be used to inform instruction.

(Richards et al., 2014: p.18)

Corder (1975) also emphasized that, in the given learning context, an adequate linguistic explanation is necessary for explicating the nature of linguistic errors learners produced.

Until we are able to give a linguistic account of the nature of learners' errors we can neither propose pedagogical measures to deal with them nor infer from them anything about the processes of learning.

(Corder, 1975: p. 205)

Therefore, learner error identification and classification are of great importance for initiating an in-depth study on the acquisition of a targeted

language structure. However, no unanimous criteria for categorizing learner errors have been established. After reviewing a series of previous research (Bardovi-Harlig & Bofman, 1989; Corder, 1975; Dulay & Burt, 1973; Lennon, 1991; Thewissen, 2013) on error classification, the first study of the thesis has established criteria on error classification based on morpho-syntactic features of English questions. This error classification constitutes an indispensable part for the two follow-up experimental studies testing implicit knowledge of English questions acquired by EFL learners.

The necessity of measuring implicit knowledge

Pioneer studies on implicit knowledge conducted by Ellis & Roever, (2018) and Suzuki (2017) emphasized the importance of further studies. Ellis & Roever (2018) pointed out that figuring out how to efficiently measure implicit language knowledge is of crucial significance in three central inquiries in applied linguistics. To be specific, measuring implicit knowledge enables: (i) SLA researchers to assess whether learning through exposure to specific linguistic structures results in the acquisition of implicit knowledge, (ii) language instructors to know whether some types of instructions are more likely to lead to implicit or explicit knowledge, and (iii) language testers to evaluate what aspects of learners' language proficiency are measured in their tests. Also Suzuki (2017) underscored that further studies are needed on measuring implicit knowledge with

different language structures and L2 learner populations. In validating tools for implicit knowledge measurement, Suzuki (2017) specifies that:

"Further research is clearly needed in other L2 learner populations, different first language-second language combinations, other linguistic structures tested and so on."

(Suzuki, 2017: p.28)

In order to investigate the acquisition of English questions by EFL learners, the present thesis measures the implicit knowledge level of EFL learners from two L1-L2 combinations, namely, Spanish-English and Chinese-English. The thesis targets at morpho-syntactic structures of English questions, bringing in implicit knowledge measurement tools that have been designed and validated in previous implicit knowledge studies on a variety of other structures by Ellis (2005), Kim & Nam (2016), Suzuki (2015) & (2017b), Tokowicz & MacWhinney (2005), and R. Zhang (2015).

The necessity of measuring production competence

In measuring implicit knowledge, studies generally examined learners' awareness of grammar knowledge, giving little attention to their production because it is challenging to create a task that would accurately assess learners' language production (VanPatten & Williams, 2015). However, to measure EFL learners' implicit knowledge by studying their

production is significant and necessary, as it helps to reveal the process of how their language production competence comes into being in EFL contexts (MacDonald, 2013). The importance of measuring learners' production has been emphasized by second language researchers (Ellis & Roever, 2018; Gass & Mackey, 2015; MacDonald, 2013).

For instance, Ellis & Roever (2018) stated the importance of both intuitive awareness and language output in the definition of implicit language knowledge.

"Implicit knowledge is most clearly defined as knowledge that the learner has no subjective awareness of, can access for spontaneous language use through automatic processing, and it's unable to verbalize."

(R. Ellis & Roever, 2018: p.2)

MacDonald (2013) further specified the significance of studying language production for understanding the language acquisition process.

"Understanding production becomes essential to explaining why language is the way it is, and why language comprehension works the way it does."

(MacDonald, 2013: p.2)

The key role of production in acquisition was also emphasized in

VanPatten & Williams (2015).

> *"According to Monitor Theory, production is the result of acquisition and cannot contribute in any direct way to it."*
>
> (VanPatten & Williams, 2015: p.30)

To determine if advanced EFL learners' production competence develops concurrently with their grammar knowledge at sentence level, it is essential to examine the development of learners' grammatical awareness and their production competence. In sum, to probe whether advanced learners' awareness of grammar knowledge and production competence develop simultaneously can shed light to their process of implicit knowledge acquisition.

Organization of the Dissertation

This dissertation is structured in three main parts.

Part I introduces objectives, literature review, and methodology of the whole project. After providing an overall background that motivates the selection of English questions as the empirical base to conduct research on implicit knowledge and justifies the hybrid methodological approach taken in this thesis in this introductory chapter. *The Objectives section* specifies the research objectives of all three studies included in the whole

thesis. *The Literature review section* contributes a literature review that provides the framework for understanding the various phenomena involved in this project. First, it summarizes research findings that have been reported on English questions in previous studies and specifies the methodological frameworks of error classification and L1 influence. The chapter continues to introduce the concept of implicit language knowledge and its seven key constructs, and then reviews the tools of implicit knowledge measurement and the two key constructs of grammatical sensitivity and production competence. *The Methodology section* depicts the research methodology of this thesis project, introducing the research tools, participants, and statistical analysis methods.

Part II presents the research results, including three published articles. Each chapter in this part consists of an independent study, where the experiments reported in article 2 and 3 build on the data obtained in article 1. They constitute a logical and coherent investigation that reports different perspectives on the acquisition of English questions by EFL learners.

Article 1 (study 1) works as a preparatory study on the acquisition of English questions that the project is based on. It sorts out five types of grammatical morphosyntactic errors produced by preliminary EFL learners and analyzes what are typical errors for Chinese and Spanish EFL learners. This chapter provides grounding data and criteria for the experimental material design in article 2 and 3 discussed in the next two chapters. At the same time, it is also an independent study, analyzing cross-

linguistic L1 influence on the acquisition of English questions, from both intra- and inter- language perspectives. This chapter further offers a discussion of pedagogical implications targeting at morphosyntactic problems emerging in question formation by preliminary EFL learners.

Article 2 (study 2) answers the key research question of whether advanced EFL learners acquire implicit knowledge equivalent to that of native speakers. It adopts a Word Monitoring Test method to collect EFL learners' reaction-times, which reveal their grammatical sensitivity to errors in English questions. The findings show the level of implicit knowledge of English questions acquired by advanced EFL learners. This study also analyzes potential challenges advanced Chinese and Spanish EFL learners face in acquiring English questions and discusses factors that influence EFL learners' acquisition of morpho-syntactic inflections in English question formation.

Article 3 (study 3) further investigates advanced EFL learners' implicit knowledge of English questions by means of an Elicited Oral Imitation Test experiment. This study adopts a new approach to the analysis of participants' data, by evaluating their implicit knowledge using two indexes, (i) grammatical sensitivity and (ii) accuracy rate of production. Moreover, the chapter also discusses the participants' development of grammar knowledge and production competence. Based on the findings, this study further provides pedagogical implications for improving EFL learners' language production competence.

Part III concludes the whole dissertation. *The Conclusion section*

summarizes the main contributions and limitations of the project. It also

points out related directions for future studies.

Objectives

Based on five research questions proposed for the three studies, this dissertation aims to achieve the following research goals.

The primary goal of this dissertation is to test the level of EFL learners' implicit knowledge in the domain of English questions, which must be formulated in the form of the following two main research objectives.

1. To identify categories of errors in English question formation from EFL learners at the preliminary language learning stage.
2. To test the level of implicit knowledge acquired by advanced EFL learners.

To achieve these research objectives, three different experiments are conducted, a first preliminary study to identify a typology of morphosyntactic errors in question formation by preliminary EFL learners, and two additional behavioral experiments to test implicit knowledge in advanced EFL learners. All studies are conducted on a population of both Chinese and Spanish EFL learners.

This thesis also aims to achieve the following two secondary objectives

(SO):

SO 1. To explore potential challenges that impact Spanish and Chinese EFL learners' implicit knowledge acquisition of English question formation.

SO 2. To measure advanced EFL learners' grammatical sensitivity and their language production competence.

The dissertation also intends to provide well-grounded pedagogical solutions to EFL acquisition problems, on the basis of the theoretical and experimental findings arising from the studies conducted.

Literature Review

The chapter provides grounding information on the dissertation by reviewing closely related studies of the research topic. After evaluating the core concepts, as well as theoretical and empirical frameworks involved in the topic, this chapter presents research rationales and gaps for the three critical studies of the dissertation.

This chapter critically reviews the main topics and issues underlying the three studies presented in chapters three to five. More specifically, in this chapter:

i. A series of previous studies on grammatical errors in English questions will be examined to lay an overall background for taking English questions as the empirical research base of this thesis. To be specific, methodological frameworks for classifying learners' grammatical errors will be assessed, to provide the research foundation that grants the application of appropriate error classification criteria for this thesis.

ii. Studies on cross-linguistic L1 influence will be reviewed, and theoretical and methodological frameworks for assessing L1 influence will be evaluated. This will provide a research basis for

the thesis to analyze whether L1 influence affects the acquisition of English question structures by preliminary and advanced EFL learners.

iii. The concept of implicit knowledge, experimental tools for measuring implicit knowledge, and key measurable constructs (grammatical sensitivity and production competence) of implicit language knowledge will be critically reviewed. This part of the literature review will offer the theoretical and experimental foundation for examining implicit knowledge of English questions acquired by advanced EFL learners.

In sum, this literature review will lay the groundwork for investigating the acquisition of implicit knowledge in the light of L1 influence, grammatical sensitivity, and language production competence.

English questions are the research media of all three studies of the thesis, and thus grammatical errors appearing in English questions produced by EFL learners are of great importance in the whole dissertation. This chapter starts with a brief comparison of the grammatical differences, essentially in word order and verbal morphological inflections in question formation in the three languages involved. It then continues with the categorization of grammatical errors in English questions produced by Chinese and Spanish preliminary EFL learners, which is the subject matter of the first study. The categorized grammatical errors in study 1 provide the research basis for measuring learners' implicit knowledge in studies 2

and 3, which examine EFL learners' grammatical sensitivity and production, respectively.

Grammatical differences among questions in English, Chinese, and Spanish

This dissertation focuses on English question formation by Chinese and Spanish EFL learners; therefore, a brief description of grammatical properties in question formation in these three languages will shed light on the discussion of EFL learners' acquisition of English questions. In English, question formation involves verb inversion (1), *do*-support (2) or auxiliary insertion (3) in *yes-no* questions, in addition to *wh*-movement (4) in *wh*-questions. The following examples of English questions illustrate the properties in English question formation.

(1) verb inversion	a. You <u>have</u> got your new books. b. <u>Have</u> you got your new books?
(2) *do*-support	a. I <u>like</u> watching TV. b. <u>Do</u> you like watching TV?
(3) auxiliary insertion	a. They <u>enjoyed</u> the birthday party. b. <u>Did</u> they enjoy the birthday party?
(4) *wh*-movement	a. The boy received <u>a toy car</u>. b. <u>What</u> did the boy receive?

But Chinese, a Sino-Tibetan language, is characterized as a *wh*-in-situ language (J. C. Huang, 1982). This means that in Chinese, word order is stable, that is, there is no *wh*-movement, nor subject-verb inversion or auxiliary insertion in questions. Chinese *yes/no*-questions are formed by adding particles such as *ma* or *ba*, which are grammatical question markers added at the end of a declarative sentence (as shown in (5c)), with no morphological inflection on verbs (Chunshen Zhu & Wu, 2011). Meanwhile, Spanish, a Romance language, despite belonging to the Indo-European language family like English[1], significantly differs from English. In Spanish, verbs inflect for tense, aspect, and mood, and show morphosyntactic agreement (person and number) features in all forms, so that pronoun subjects are generally left unexpressed. Simplifying things a lot, while Spanish *wh*-questions do show *wh*-movement, like English, but without auxiliary *do*-support or subject-auxiliary inversion, basic Spanish *yes/no* questions are built by just changing intonation in sentences, as exemplified in (5b) and (6b). Although Spanish does have auxiliaries like *haber* 'have or *ser* 'be' for perfective and passive, respectively, their syntactic behavior differs from English (Noels, 2003).[2] The following example questions in English, Chinese, and Spanish illustrate basic morphosyntactic differences in question structures in these three languages.

[1]It is important to note that while Spanish is a Romance language and English is a Germanic language, the morphosyntactic differences discussed in this dissertation are unrelated to their classification.
[2]To illustrate the syntactic differences between English and Spanish auxiliaries, see the contrast in (i)-(ii), where examples can be said to be word-by-word translations.
(i)   English: John has gone to Tarragona. - Has John gone to Tarragona? *vs*. *John has gone to Tarragona?
(ii)   Spanish: Juan ha ido a Tarragona. - *Ha Juan ido a Tarragona? *vs*. Juan ha ido a Tarragona?

(5) *yes/no* Questions[1]

a. English:	Did	David	receive		his		new	book?	
b. Spanish:	¿Recibió			David	su		nuevo	libro?	
	receive.PstPfvInd.3sg			David	his		new	book?	
c. Chinese:	Dawei		shoudao	tade	xin		shu	le	ma?
	David		receive	his	new		book	LE[3]	Q

(6) *wh*-Questions

a. English:	Where	do	they	plan to	have	their		summer	holidays?
b. Spanish:	¿Dónde	planean			pasar	sus		vacaciones	de verano?
	where	plan.PrsInd.3pl			spend	their		holidays	of summer
c. Chinese:	Tamen	jihua	zai	nali	duguo	tamen de		shujia?	
	They	plan	at	where	have	they	Poss	summer holidays	

Grammatical errors in English questions

After this brief summary of grammatical differences in questions in the three languages involved in this dissertation, this section reviews studies on English questions related to grammatical errors produced by EFL learners and the classification of grammatical errors, which lay the research foundation for error analysis and categorization in this thesis.

Many studies have been done to investigate L2 learners' grammatical errors in English question formation (e.g., Cowan, 2008; Ellis, 1984; Eskildsen, 2015; Lee, 2016; Pozzan & Quirk, 2014; Spada & Lightbown, 1999). In an early study of young L2 learners' acquisition of *wh*-questions, R. Ellis (1984) found that early L2 learners' language development

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[3] This is an aspectual particle, often assumed to contribute perfective aspect. Its properties have been studied at length, and are still a matter of debate (e.g., Cheng & Sybesma, 1999; L. M. Huang, 1987; Wang, 1965; Chungeng Zhu, 2019 among many others). Suffice here to say that this example clearly serves to illustrate how Chinese marks certain morphosyntactic properties like aspect via particles, instead of inflecting words, as in Spanish and English.

progressed with errors in subject-verb inversion and auxiliary use. Spada & Lightbown (1999) analyzed the role that instructional interventions played on the acquisition sequences of English questions in young French learners of English, and found that except on oral production tasks, they displayed acquisition sequences in line with the five developmental stages proposed by Pienemann *et al*. (1988) (see Table 1). In the oral production tasks, they found that learners at stage 3 did not produce more accurate questions than learners at stage 2, which was contrary to Pienemann' s prediction of acquisition sequences. They further found that the progress in their L2 acquisition was influenced by a complex interactional impact between L1 influence and developmental sequences.

Table 1. Developmental Stages in English Questions

Stage	Development in English questions formulation
Stage 1	Single words or fragments
	A spot on the dog? A ball or a shoe?
Stage 2	*SVO* with rising intonation
	A boy throw the ball? Two children ride a bicycle?
Stage 3	*Fronting*
	Do the boy is beside the bus? Do you have three astronaut?
	wh-fronting
	What the boy is throwing? Where the children are standing?
	Other fronting
	Is the boy is beside the bus?
Stage 4	*wh*-with copula *BE*

	Where is the ball? Where is the spaceship?
Stage 5	*wh*-with auxiliary second
	What is the boy throwing? How do you say "lancer"?

Cited from Spada & Lightbown (1999: p.5)

According to Cowan (2008), learners from different L1 backgrounds (e.g., Portuguese, Arabic, Korean, and Japanese) displayed various problems in English question formation, such as non-inversion, tense copy on the auxiliary and main verb, omission of auxiliary, and confusion in using auxiliaries *do* and *be*. Pozzan & Quirk (2014) reported that inversion problems in *wh*-questions and embedded clause questions appeared in Spanish and Chinese university students. From a usage-based perspective, Eskildsen (2015) conducted a longitudinal study on two Mexican English learners to examine how they learned *yes/no* and *wh*-English questions and found that the main problem these two learners confronted was not being able to correctly use the copula and auxiliaries in forming English questions. In studying *wh*-questions produced by Japanese EFL learners, Morishita & Harada (2015) found that, influenced by Japanese question structures, Japanese EFL learners confronted processing difficulties in producing English *wh*-questions, and they frequently produced erroneous questions, such as *When John went home?*, *Where was John go at six?* and *When did John went home*. Lee (2016) further reported that Hong Kong English learners produced errors in *do*-support and the regular *-s* and past tense inflection on verbs in *wh*-question formation.

These studies offered insightful results in finding out learners' diversified grammatical errors in forming English questions. However, there are diverse grammatical errors in English questions produced by different L2 learners, but no systematic classifications of errors had been conducted. Error descriptions on the same type of error often varied. For example, in *Where we put it?*, the grammatical error was described as auxiliary omission in Maratsos (1979), and defined as failure in inversion in (Chen, 1986). Error descriptions and classifications like this appeared confounding and thus not easily applicable and functional. In order to study implicit knowledge acquired by EFL learners based on grammatical errors in English questions, it is necessary to build well-grounded criteria for grammatical error identification and classification based on the elaboration and refinement of existing studies on the acquisition of English questions, as will be discussed in the following subsections.

The Classification of Grammatical Errors

Error classification is important for understanding language learners' learning process (Corder, 1975). However, methods and criteria for learner error identification and classification varies across studies (Bardovi-Harlig & Bofman, 1989; Corder, 1975; Lennon, 1991; Thewissen, 2013). Corder (1975) established a standard for learner error classification from the perspective of the linguistic system and stratified errors into linguistic levels, such as orthographical, phonological, morphological, and syntactic,

as well as discourse errors. Bardovi-Harlig & Bofman (1989) categorized errors into morphological, syntactic, and lexical idiomatic to study learners' language accuracy in diversified sentence structures and vocabularies. A new dimension of *domain* and *extent* to identify errors was proposed by Lennon (1991), considering the listeners' viewpoint for error recognition and speakers' viewpoint for error repair. *Domain* means the ranking of the linguistic unit that must be taken into account for the error to be recognized. *Extent* refers to the ranking of the linguistic unit, from the morpheme at the lowest level to the sentence at the highest, that would need to be added, removed, moved around, or changed in order to fix error production. Lennon's error classification was specially designed for error analysis by distinguishing lexical errors in linguistic contexts in oral communication. These previous classifications provided significant references; yet they are not applicable to the present study. The classifications are either too general in that errors are defined at linguistic levels, such as morphological or syntactic errors, rather than locating the specific grammatical issue involved, (e.g., tense, person and number agreement, or auxiliary position) (e.g., Corder, 1975; Bardovi-Harlig & Bofrnan, 1989), or they are customized for a particular context (e.g., analyzing errors in the interlocutor-targeted communicative context) (e.g., Lennon, 1991), so that they are not appropriate for the present study.

A more recent study of error classification done by Thewissen (2013) is better suited for the research aims of the present study, because of its clear definition and description of grammatical errors. Based on the

Louvain Error Tagging Manual (a guideline developed by Dagneaux et al. (2008) to annotate learner errors) (see Table 2), Thewissen (2013) introduced The Louvain Error-Tagging System, a hierarchical error classification system to classify errors, to study L2 accuracy development. This study regards the Louvain Error-Tagging System as preferable to other error classification criteria, as it is hierarchical and includes major independent error categories that can be divided into subcategories according to the linguistic characteristics of each level.

Table 2. The Louvain Error-Tagging System

Error tags	Definition	Description
F	Formal Errors	Spelling or morphological errors that result in a non-existent English word (+homophones)
G	Grammatical Errors	Errors that break the general rules of English grammar
L	Lexical Errors	Errors involving the lexicosemantic properties of words or phrases (conceptual, collocational, or connotative)
X	Lexicogrammatical Errors	Errors that violate the lexicogrammatical properties of words; i.e., erroneous dependent prepositions, erroneous complementation patterns, or countable/uncountable noun confusion

Q	Punctuation Errors	Errors that target punctuation problems, e.g., confusion between punctuation markers, missing or redundant markers.
W	Missing/Order Errors	Unnecessary use of words, missing necessary words, or mis-ordered words
S	Style Errors	Sentence fragments and incomprehensible sentences

Cited from (Thewissen, 2013: p.81)

Thewissen's error classification method helps the researcher describe the morphosyntactic errors in English questions produced by EFL learners. To be specific, the errors in the verbal group in English questions fall within the domain defined as grammatical errors in the hierarchical classification system, which are described as 'errors that break the general rules of English grammar.' Furthermore, the hierarchical error classification allows the researcher to further divide grammatical errors into more refined categories, and to precisely locate grammatical errors in designing experimental sentence items. Constructing English questions revolves around the auxiliary system, which involves the use of copulas, modal verbs, *do*-support, word order, and morphological inflections. Therefore, grammatical errors in English questions can be subdivided according to specific error features (e.g., errors in auxiliary choice and errors in the word order of auxiliary).

To sum up, to fulfill the research objectives of identifying L1 influence on and measuring implicit knowledge of English questions

acquired by EFL learners, this thesis needs to provide a fine-grained categorization of grammatical errors that reflects the morphosyntactic features involved in forming English questions. This will provide a better understanding of the grammatical issues involved in question formation that should in turn help to suggest better pedagogical tools to approach EFL learners' needs in this domain.

L1 influence on the acquisition of morphosyntactic structures

As stated by R Ellis (2008: p249), "No theory of L2 acquisition that ignores the learner's prior language knowledge can be considered complete." Therefore, to explore EFL learners' implicit L2 knowledge, it is significant to analyze their acquisition from the perspective of L1 influence.

The study of L1 influence originated from Weinreich 's (1953) discussion of what role language learners' L1 played in L2 acquisition, in which he emphasized how one language 'interfered' with the learning or acquisition of another language. In the 1960s and 1970s, 'interference' or language transfer was frequently used, referring to the difficulties of L2 acquisition caused by learners' existing L1 knowledge. However, the connotation of language transfer evolved in the past decades, extending from negative to both negative and positive transfer and from

unidirectional L1-to-L2 influence, L1-L2 bilateral influence, to L1 and other additional languages (e.g., L2, L3, or L*n*). A more 'theory-neutral' term, 'crosslinguistic influence,' was proposed by Smith (1983), extending the definition of language transfer to include phenomena such as 'transfer,' 'interference,' 'avoidance,' 'overusing' and other L2-related perspectives of language loss. Research focusing on L1 influence has also been evolving from the earlier L1-L2 perspective to plurilingual learners' acquisition of L3 or L4 (Hammarberg, 2001). As Duran (2016) summarizes in her dissertation, "the complexity of the phenomenon of Cross-linguistic Influence (CLI) has led to the use of varied terminology in different periods and by different researchers." Cross-linguistic L1 influence has been extensively studied in Second language acquisition (SLA) (Kellerman, 1995; Odlin, 1989; Smith, 1983).

However, the present study will focus on EFL learners' acquisition of English questions, not involving other languages beyond L2. Therefore, following Odlin (2003) and R Ellis (2008), the term 'L1 transfer' and 'L1 influence' will be alternatively used to discuss whether EFL learners' L1 exerts influence on their acquisition of grammatical structures of English questions.

Previous studies (Elston-Güttler et al., 2005; Ionin & Montrul, 2010; Jarvis, 2000; Jiang et al., 2011; Spada & Lightbown, 1999; Woll & Paquet, 2021) showed diversified views on EFL learners' L1 influence on L2 morphosyntactic acquisition, which can be reduced to two main stances.

On the one hand, some studies hold that L1 influence constantly impacts L2 learners' acquisition of morphosyntactic structures (Gudmestad & Edmonds, 2021; Jarvis, 2000; Jiang et al., 2011). In investigating L1 influence on referential lexical choices, Jarvis (2000) found that the participants' L1 constantly and detectably influenced their acquisition of content words. By comparing Russian and Japanese learners of English, Jiang et al. (2011) held the view that morphological incongruency between L1 and L2 determines the difficulty for the final acquisition of morphemes by L2 learners in the sense that learners need to learn the L2 morphological marker as well as the meaning that is grammaticalized in it. For example, when Japanese learners of English learn the plural marker -*s* in a noun, they need to learn the morphological inflection -*s* and the plural meaning reflected in the plural marker in English. For Japanese learners, the difficulty comes from the automatic activation and representation of the meaning of the plural marker, as plural marking is highly restricted in their L1 Japanese (Jiang et al., 2011). An earlier study of the acquisition of Spanish tense markers done by VanPatten & Keating (2007) also found a similar L1 (English) influence effect on English speakers who learn Spanish. They found that L1 English speakers rely on time adverbs while native Spanish speakers rely on tense markers in processing tense, which revealed that, to some extent, L2 learners rely on their L1 processing strategies. In investigating the acquisition of Spanish gender marking by speakers of L1 English and French, Gudmestad & Edmonds (2021) reported that learners' L1 remarkably

influenced L2 learners' acquisition of gender marking, with French L1 learners using significantly more target-like gender marks than English L1 learners because French has a grammatical gender system, but English does not. Gudmestad & Edmonds also encouraged more studies on different L2s with other L1 backgrounds to confirm the generalizability of the findings on L1 influence. Similarly, Jiang et al. (2011) encouraged further studies exploring whether Japanese or Chinese learners of English can acquire native-like implicit knowledge of English morphemes that are not morphologically congruent in their L1.

On the other hand, a few studies (Elston-Güttler et al., 2005; Ionin & Montrul, 2010; Pozzan & Quirk, 2014) considered that L1 influence can be drastically reduced or even eliminated and that it does not substantially impact advanced learners' acquisition of target structures as learners' proficiency increases. In the study on the acquisition of plural noun phrases by Spanish and Korean learners of English, Ionin & Montrul (2010) found that Spanish learners of English tended to transfer their L1 articles to definite plurals in English. Yet, L1 transfer receded with learners' improved proficiency and L2 immersion in natural communicative contexts, an effect that was especially visible in high-proficiency learners. In investigating whether learners' L1 (German) influenced their L2 (English) lexical choice, Elston-Güttler et al. (2005) detected L1 influence in word processing but found that the degree of L1 influence was modulated by learners' proficiency, i.e., L1 influence decreased in high-proficiency learners when a semantic context was given. The study of main

and embedded questions by Pozzan & Quirk (2014) suggested that it was not the EFL learners' L1 (Spanish or Chinese) but the L2 linguistic features that predicted L2 learners' accuracy in question formation related to word order. However, Pozzan & Quirk (2014) discussed the L1 influence based on between-group comparison of learners' production of main questions and embedded questions without looking into intra-group learners' performance, one of the three key effects in Jarvis' (2000) methodological framework for identifying L1 transfer. Jarvis (2000) explicitly discussed that relying only on inter-L1-group comparison could lead one to make the conclusion that L1 influence does not exist even in situations where it may be a crucial influential factor. Considering the methodological factors, this study considers that the conclusion of L1 influence drawn by Pozzan & Quirk (2014) is not convincing enough. Although Pozzan & Quirk (2014) concluded that learners' L1 was not the primary factor affecting the inversion errors, they did not negate the effect of L1 influence, especially, in inversion (e.g., *Phil wanted to know what is Ms. Brainy's brother drinking for dinner.) and omission of morphological errors (e.g., *Phil want to know who the math teacher helping now.) in embedded questions produced by Chinese EFL learners, which leaves the question of L1 influence open for further study.

In sum, whether L1 influences advanced L2 learners' acquisition of morphosyntactic features remains controversial, and further explorations with different structures and learner populations are needed. Study 1 and study 2 of this thesis will further discuss the influence of L1 on the

acquisition of English questions for both preliminary and advanced EFL learners, respectively. For the purpose of setting up the evaluation frameworks for identifying and characterizing the L1 influence on EFL learners' acquisition of English questions, this section will next review previous studies dealing with these two aspects in detail.

Methodological framework for identifying L1 influence

Among studies of L1 influence on the acquisition of linguistic features (Corder, 1975; Gass & Selinker, 1993; Jarvis, 2000; Odlin, 1989), Jarvis (2000) established a rigorous methodological framework to identify L1 influence. Considering language learners' L1 backgrounds and Interlanguage (IL) performance differences and similarities, Jarvis (2000) constructed a methodological framework that included three hypotheses to testify whether L1 influence existed in learner language production: (i) *'intra-L1-group homogeneity in learners' IL performance,* (ii) *inter-L1-group heterogeneity in learners' IL performance,* and (iii) *intra-L1-group congruity between learners' L1 and IL performance.'* The intra-L1-group homogeneity hypothesis presumed that learners from the same L1 background performed similarly in using the L2, with similar patterns shown in their language output. The inter-L1-group heterogeneity in learners' IL performance assumed that learners from two different L1s with matched proficiency displayed differences in their IL production. Finally, the L1-IL congruity hypothesis supposed that L2 features used or

produced by learners parallel their use of the corresponding language features in their L1. Jarvis (2000) stated that to confirm L1 influence, one should test learners' performance against at least two of the above-reviewed three effects, subject to factors such as the characteristic of the tested structure and participants' proficiency. However, testing all three effects on learners' language would certainly be more convincing for verifying L1 influence (Jarvis, 2000).

Therefore, taking learner error classification as a basis, this dissertation will establish a methodological framework based on Jarvis' (2000) model for identifying L1 influence for the purpose of discussing how L1 impacts EFL learners' acquisition of English questions in different learning stages involving lower- and advanced-proficiency learners.

Theoretical framework for characterizing L1 influence

The first part of this section reviewed studies of L1 influence on acquiring different morphosyntactic structures in L2 acquisition (Elston-Güttler et al., 2005; Gudmestad & Edmonds, 2021; Ionin & Montrul, 2010b; Jiang et al., 2011; Pozzan & Quirk, 2014). Among these studies, Jiang et al. (2011) constructed a theoretical framework, which they call the *morphological congruency hypothesis*, for characterizing the L1 influence on the acquisition of L2 morphosyntactic structures by advanced L2 learners. In this subsection, the theoretical framework of the morphological congruency hypothesis will be reviewed in detail. The

description of this hypothesis goes as follows:

"When L2 learners reach an advanced or near-native level of L2 proficiency, only congruent learners (i.e., those whose L1 has a corresponding morpheme to the target L2 morpheme) are able to reach native-like proficiency in acquiring an L2 morpheme. Incongruent L2 learners will find it extremely difficult, if not impossible, to develop native-like competence with respect to the same L2 morpheme."

(Jiang et al., 2011: p.943)

According to the morphological congruency hypothesis, L1 and L2 are congruent in morphology when the meaning of a specific grammatical morpheme is grammaticalized and morphologically marked in both L1 and L2 languages. They are incongruent in morphology when there is no similar morphological marking for grammatical meaning in L1 and L2. For example, the research subjects of Jiang et al. (2011) are Russian and Japanese learners of English, so it is expected that Russian learners would encounter fewer difficulties in acquiring plural markers such as *-s/-es* than their Japanese counterparts because plural markers exist in Russian but not in Japanese. The congruency hypothesis is further supported in later research, e.g., by Gudmestad & Edmonds (2021). These authors showed that for French and English learners of Spanish, their L1 influenced their acquisition of gender marking in Spanish, with French learners performing better than their English counterparts, because of the fact that gender

marking exists in French but not in English.

Based on previous research on the morphological congruency effect on the acquisition of different grammatical features, three lines of indications given in these studies were sorted out by Jiang et al. (2011), which are: (i) advanced L2 learners faced great difficulty in acquiring native-like knowledge in L2 grammatical morphemes that are not instantiated in their L1 (Jia, 2003; Lardiere, 1998; Long, 2003; Schmidt, 1983); (ii) for L2 learners from varied L1s, learners with L1-L2 congruent morphemes generally outperformed those without L1-L2 congruent morphemes (Hawkins & Liszka, 2003); (iii) for L2 learners from the same L1 background learning different types of L2 morphemes, they perform better on L1-L2 congruent grammatical morphemes than incongruent ones (Bialystok, 1997; Franceschina, 2001; White, 2003). Some of these morphemes had a counterpart in the participants' L1, but others did not. In line with the morphological congruency hypothesis, the participants in all these studies did much better on the morphological structures that were instantiated in their L1.

In this dissertation, the morphological congruency hypothesis will enable the researcher to conduct a comparative analysis between two L1s, Chinese and Spanish, and English as L2 to analyze the role of L1 influence in question formation taking Jiang et al.'s (2011) three observations reviewed above. First, with respect to the Chinese EFL group, there are no congruent grammatical morphemes in forming questions in participants' L1, Chinese, and thus the researcher can analyze L1 influence from the

perspective of the observation in (i). Second, the contrast between both EFL groups' L1s, with Spanish bearing some congruent morphosyntactic features while Chinese is completely incongruent with English questions, provide the researcher with L1 bases to analyze L1 influence from the perspective of the indication (ii). Last, in Spanish, there are some congruent morphemes, e.g., verbs inflect for tense, aspect, and mood, and some incongruent morphemes, e.g., there is no auxiliary *do*-support or subject-auxiliary inversion, which enables the researcher to analyze the congruency effect in terms of the observation in (iii). Ultimately, the analysis will also provide an additional piece of evidence to support and endorse Jiang et al's morphological congruency hypothesis.

Therefore, in this study, based on the morphological congruency hypothesis, three inferences will be constructed to assess how learners' L1 influences EFL learners' acquisition of particular types of morphosyntactic inflections in English questions.

Implicit Knowledge

After reviewing studies on error classification and identification, this section will evaluate theoretical and empirical works in implicit knowledge studies. That is, it comprehensively reviews the concept, key constructs, and measurement tools of implicit language knowledge, which

will serve as the research basis for assessing implicit language knowledge of English questions acquired by EFL learners in studies 2 and 3.

The Concept of Implicit Knowledge

The concept of implicit knowledge, which originated in cognitive psychology, refers to the knowledge that arises in an implicit learning process or the knowledge that is acquired by transforming declarative knowledge (the knowledge that one is aware of and can describe to others) into procedural knowledge (the knowledge that is displayed in one's behavior but that one is not conscious of) (Berry, 1987). Berry's definition explained where implicit knowledge emerged and how implicit knowledge could be acquired; however, the characteristics of implicit knowledge were not specified. Shanks & Johnstone (1999) described that implicit knowledge exists in a tacit form, which can affect ongoing behavior but without being accessible to consciousness. Dienes & Perner (1999) further specified the properties of implicit knowledge based on the implicit-explicit distinction of knowledge representations as follows: procedural vs. declarative, unconscious vs. conscious, non-verbalizable vs. verbalizable, indirect tests vs. direct tests, and automatic vs. voluntary control. From the evolution of definitions and descriptions of implicit knowledge, it may be concluded that implicit knowledge can be acquired in an implicit learning process or transferred from declarative knowledge,

and is typically characterized as being unconscious, non-verbalizable, and automatically controlled.

In the field of second language acquisition (SLA) research, implicit knowledge has always been defined with reference to explicit knowledge as the characteristics of implicit knowledge are frequently elucidated by comparing properties between implicit and explicit knowledge. Among studies on implicit knowledge, the most influential and classic conceptualization of constructs of implicit language knowledge corresponds to the seven criteria specified by R. Ellis (2005), which include degree of awareness, time available, focus of attention, systematicity, certainty, metalanguage, and learnability. They account for the difference between implicit knowledge and explicit knowledge, as summarized by (Suzuki, 2015) in Table 3. These constructs have been framed as the foundation for studies on implicit knowledge.

Table 3. Constructs of L2 implicit and explicit knowledge

Criterion	Implicit knowledge	Explicit knowledge
Degree of awareness	Response according to 'feel'	Response using rules
Time available	Time pressure	No time pressure
Focus of attention	Primary focus on meaning	Primary focus on form
Systematicity	Consistent responses	Variable responses
Certainty	High degree of certainty in responses	Low degree of certainty in responses
Metalinguistic knowledge	Metalinguistic knowledge not required	Metalinguistic knowledge encouraged
Learnability	Early learning favored	Late, form-focused instruction favored

Cited from (Suzuki, 2015: p.3-4)

The comparison and discussion of the relationship between implicit and explicit knowledge permeated in definitions and descriptions of implicit knowledge by researchers. Dekeyser (2008) viewed that learners acquire implicit knowledge in the implicit learning process and explicit knowledge in explicit learning. However, he further stated that explicit knowledge could become implicit in that learners' awareness of linguistic structures would disappear over time, and they could access implicit knowledge when attempting to process and produce the language. Paradis (2009) delineated implicit language knowledge as something that is not observable but inferable from the speakers' systematic verbal performance with the non-verbalizable grammar stored in their minds. Paradis further depicted that implicit language knowledge comprises implicit linguistic competence and the grammar that enables language speakers' competence to generate sentences. R. Ellis & Roever (2018) also defined implicit language knowledge as non-verbalizable knowledge that learners are not subjectively aware of but can access in spontaneous language production through automatic processing. To sum up, the available definitions and descriptions of implicit language knowledge center on learners' unawareness of the grammatical knowledge and the language production competence driven by it.

The acquisition of implicit language knowledge always involves the discussion of the transferability issue, that is, whether explicit knowledge

can transfer into implicit knowledge. On the transferability between explicit and implicit knowledge, known as the interface hypothesis, there are three different positions. The first school of researchers, represented by (J. Hulstijn, 2002, 2005; Krashen, 1981, 1982, 2003; Paradis, 2009), considered that explicit language knowledge cannot transform into implicit knowledge. This is known as the non-interface hypothesis. Krashen (1981, 1982) held the view that L2 learners only acquire implicit knowledge in the implicit learning process. According to Krashen (1982b), learners can acquire an L2 in an immersion context with natural communication, and the explicit knowledge they learn only works on their learning process by monitoring their language production. J. Hulstijn (2002) & Paradis (2009) held the same standing point as Krashen that explicit knowledge cannot transform into implicit knowledge, but they acknowledged that explicit knowledge helped learners process and produce the L2 when implicit knowledge had not yet been developed. The second school of researchers (N. C. Ellis, 2005, 2008; Rod Ellis, 2002, 2009) considers that an indirect interaction between explicit and implicit knowledge exists, but they are not transformable. This is known as the weak interface hypothesis. N. Ellis supported the view that implicit and explicit knowledge are dissociated, but there is a dynamic interaction between the two kinds of knowledge. Explicit knowledge helped learners to recognize linguistic patterns in the initial language acquisition stage and gradually tuned into implicit knowledge in input processing and later stages (N. C. Ellis, 2005). The third school of researchers (DeKeyser, 2000;

Dekeyser, 2008; Yang & Lyster, 2010), known as the strong interface hypothesis, maintained that learners started to acquire an L2 by gaining explicit knowledge while language use and practice in communication helped learners develop spontaneous production and acquire implicit knowledge. They regarded communicative practice as essential in transforming explicit knowledge into implicit knowledge.

Although the issue of the interface hypothesis remains in dispute, it is not the focus of this thesis and will not be discussed further. However, the different working definitions of the notion of implicit knowledge discussed above are essential to show its significance and prominent status. In short, implicit knowledge is at the core of L2 acquisition, as it determines learners' language competence. This thesis focuses on measuring implicit knowledge acquired by EFL learners, which offers a portal to observe EFL learners' L2 learning process and the development of language competence. The next subsection will review the measurement tools of implicit knowledge and two key indices for evaluating implicit knowledge that will be employed in this thesis.

Measurement of Implicit Language Knowledge

The primary criterion for measuring implicit knowledge in existing studies is the degree of awareness under the condition that tasks are designed with a time limit, focus on meaning, and do not resort to metalinguistic knowledge (Dekeyser, 2009; Suzuki, 2015; Suzuki & Dekeyser, 2015).

The language knowledge measured is implicit if learners' response to a certain language structure is based on intuition or 'feel', on the condition that time pressure (to avoid participants to apply metalinguistic or explicit knowledge) and focus on meaning (to direct participants' attention away from noticing the grammatical errors in stimuli sentences) are embedded in the task.

Based on these constructs, three major categories of measurement tools have been developed to assess learners' implicit knowledge in existing studies: A battery of tests designed by Ellis (2005), including timed grammatical judgment, oral narrative, and elicited imitation test, a series of reaction time tests, such as visual-world paradigm, self-paced reading, word monitoring test (Suzuki, 2015), and a set of cognitive neurolinguistic tools, including Eye movement (Conklin & Pellicer-Sánchez, 2016), (Event related Potentials) ERPs (Dowens et al., 2011), and (Functional Magnetic Resonance Imaging) fMRI tools (Xue et al., 2004). Among these tests, two measure tools, an Elicited Imitation Test from Ellis (2005) and a reaction-time Word Monitoring Test from (Suzuki, 2015), were chosen for the present study. These tools will be critically reviewed in the next subsection.

The Word Monitoring Test

This thesis first introduces the Word Monitoring Test (WMT) experiment to measure EFL learners' implicit knowledge. WMT has been used in

exploring psycholinguistic issues such as lexical and syntactic processing, especially suitable for experiments with sentence structures. As a reaction-time experimental tool, WMT is time-sensitive, which has been used to study linguistic impairment among patients with various diseases related to language function, such as aphasia or right-brain damage, or to study linguistic sensitivity among normal individuals (Jiang, 2012).

According to Jiang (2012), the basic rationale for designing WMT lies in the hypothesis that if language learners acquired a particular linguistic structure and internalized its integrated linguistic knowledge, they would be expected to show a sensitivity to grammatical violation by displaying a latency (delay) when monitoring the target word in an ungrammatical sentence. If there is no delay in word monitoring between ungrammatical and grammatical sentences, it suggests that no such integrated linguistic knowledge was acquired. Because of their degree of implicit knowledge, native speakers showed a longer latency in responding to a target word when it emerged in an ungrammatical experimental sentence, thus displaying sensitivity to grammatical errors. The rationale also applied to second language research, taking native speakers' responses driven by their L1 implicit knowledge as references.

Typical procedures of WMT

Based on the rationale of WMT, a WMT experiment was designed to conduct L2 research with the auditory modality for presenting stimuli

based on the characteristics of the critical experimental sentences (Jeong & Jiang, 2019; Suzuki, 2015; Suzuki & DeKeyser, 2017), that is, English questions in the present dissertation.

A typical procedure of the WMT experiment done by Suzuki (2015), with instructions for each step, will be reviewed in the following for illustration. In Suzuki's WMT experiment, participants needed to listen to the audio of a complete experimental sentence item while looking at a target word shown on the screen, and they were required to press a designated key as soon as they heard the target word. The target word remained on the screen until they pressed the response key. After that, participants needed to complete a comprehension question with a Yes/No choice emerged on the screen, which was designed to focus their attention on the meaning of the experimental sentence and identifying the target word. This kind of paradigm was able to reduce the potential possibility for participants to resort to explicit knowledge or metalinguistic knowledge. In the process of the experiment, participants' Reaction Times (RT) to the target word were collected, and a calculation of the difference between grammatical and ungrammatical sentences was used as an index representing their online sensitivity to grammatical violations.

Key elements of the Word Monitoring Test

The present study adopts the WMT experiment to test implicit knowledge of English questions acquired by EFL learners. Based on the basic

rationale and the operational procedures of the WMT that has been reviewed above, the following aspects were crucial in designing an effective WMT experiment targeting a specific structure, according to Jiang (2012). First, for measuring online sensitivity to grammatical violations, the choice and location of the target word in the experimental sentences are crucial for measurement accuracy. Second, the filler items are obligatory in experiments, in the sense that filler items help to ensure the reliability of response data by preventing participants from detecting the experiment target under investigation. Third, comprehension questions are necessary for focusing participants' attention on meaning rather than the critical grammatical form under investigation.

Based on the review of the above key elements in the WMT experiment, the present study will do a refined analysis of grammatical errors in English questions, choose proper target words to ensure the same distance between the grammatical point and the target word in grammatical and ungrammatical items, and design comprehension questions that can focus participants' attention on meaning of experimental sentences.

The Oral Elicited Imitation Test

By operationalizing the construct of awareness, R. Ellis (2005) developed a battery of 5 tests to measure learners' implicit and explicit knowledge, including oral imitation test (OIT), oral narrative test (ONT), timed grammaticality judgment test (TGJT), grammaticality judgment test (GJT),

and metalinguistic knowledge test (MKT). Among the five tests, OIT, ONT, and TGJT were supposed to be able to test implicit knowledge because learners would predominantly rely on their intuition, i.e., 'feel' in real-time performance, and their attention would be on meaning without accessing metalanguage. GJT and MKT test explicit knowledge as learners are required to perform these tasks with a high level of awareness, attention to form, and no time pressure imposed. The OIT and the ONT, validated by studies including Erlam (2006), Roehr-Brackin (2020), Spada et al. (2015), and Zhang (2015), were regarded as measures of implicit knowledge, as both tasks were time-pressured, allowing participants little chance to access explicit knowledge (Bowles, 2011; Rod Ellis, 2005). OIT was designed for incorporating specific grammatical and ungrammatical structures containing target structures at the sentence level, while ONT was targeted at participants' narrative of story-based production. Therefore, for studies targeting implicit knowledge attainment in a specific type of sentence, OIT was the most suitable measure among the five tests.

In the original version of OIT, grammatical and ungrammatical sentences were orally read to participants, and then they were required to respond to what they heard by showing whether they agreed with, disagreed with, or were not sure about the content of the statement. The comprehension-checking tasks were designed into a set of belief statements based on the content of critical experimental sentences. These belief statements were used to confirm that participants' attention focused on the sentences' meaning. Next, participants were guided to repeat the

sentence in correct English, with all their repetition audios recorded as experimental data for analysis. In participants' responses, obligatory occasions for target structure were identified. The obligatory occasion refers to a test item of a target structure for testing whether learners can successfully supply the required morpheme to form a target sentence structure (Dulay & Burt, 1973). In elicited production, one failure was coded if the participant failed to present an obligatory context for the target structure or failed to imitate the given sentence. In sum, the three stages of the OIT procedures go as follows: (1) Listen to the sentence, (2) Respond to show agreement or disagreement with the concept encoded in the sentence, and (3) Reproduce the sentence in the correct form (Rod Ellis & Roever, 2018).

In the follow-up replication and validation studies, some limitations of the R. Ellis's (2005) version of OIT were found, and subsequent modifications were made to perform a more effective test of implicit language knowledge. Two modifications are crucial:

Modification 1: In R. Ellis's (2005) OIT, learners had to respond 'yes,' 'no,' or 'not sure,' not ensuring that their responses actually reflected their beliefs. However, if they have to respond 'true' or 'false' to factual statements, it is possible to see if they have understood a sentence and, therefore, to eliminate those sentences they failed to understand from the scoring. Therefore, Spada et al. (2015) substituted the belief statements used by R. Ellis (2005) with truth-value statements. The truth-value

statements outperform the belief statements in that they directly test learners' processing of the sentence stimuli for meaning.

Modification 2: Kim & Nam (2016) addressed another potential limitation of R. Ellis's (2005) OIT, namely that there is no strict time limit imposed on the learners' repetition of stimulus sentences. Kim & Nam (2016) had learners complete the OIT under time pressure (allowing just 20% more time than native speakers required) and an unpressured condition. They reported that the time-pressured version afforded a more robust measure of implicit knowledge.

On the basis of the original design from R. Ellis's (2005) OIT and the subsequent improvement from Spada et al. (2015) on comprehension check and Kim & Nam (2016) on time pressure, the present study was able to integrate the advantages of the three versions of OIT to construct a boosted version of OEIT for effective measurement of implicit language knowledge acquisition.

Grammatical sensitivity and language production

This thesis will focus on two critical indices, grammatical sensitivity and language production, to analyze EFL learners' experimental performance and discuss their acquisition. These two indices were chosen based on the

definitions of implicit knowledge in SLA. For example, implicit knowledge is most clearly defined by R. Ellis & Roever (2018) as the knowledge the learner has no subjective awareness of and can access for spontaneous language use through automatic processing. Also, according to Paradis (2009), "*Implicit language competence is acquired incidentally, stored implicitly, and used automatically.*" Therefore, both awareness and production are essential elements in studying implicit language knowledge, and they are reviewed in the next subsections.

Grammatical Sensitivity

Whether learners show grammatical sensitivity to the target structure is an important index to quantify the degree of implicit knowledge of a particular structure acquired by learners. To clarify what grammatical sensitivity is in the present study, this section will review two different interpretations of grammatical sensitivity defined in previous studies.

The first interpretation is that grammatical sensitivity is a key factor in evaluating learners' language aptitude. In Sasaki (2012), grammatical sensitivity was defined as the learners' capacity to recognize the grammatical role a certain word or linguistic entity plays in a sentence, which was one major component in testing foreign language learners' language aptitude. Similarly, in testing learners' language aptitude, Vanpatten et al. (2013) illustrated that grammatical sensitivity refers to learners' ability to identify inter-relationships among words in a sentence,

which tests whether learners recognize similar functions words play in different sentences.

The second interpretation defines grammatical sensitivity in terms of the grammaticality (grammatical or ungrammatical) of a given grammar feature in a sentence structure. In recent studies (Abrahamsson & Hyltenstam, 2008; Keating, 2009; Roberts & Siyanova-Chanturia, 2013; Suzuki, 2015; Suzuki & Dekeyser, 2015), grammatical sensitivity was used to explain whether learners are sensitive to grammatical violations. In Suzuki, (2017) & Suzuki & Dekeyser (2015), grammatical sensitivity is measured by the Grammatical Sensitivity Index (GSI). According to Suzuki & Dekeyser (2015), GSI was calculated based on the Reaction Time (RT) difference between the ungrammatical and grammatical experimental items, which indicates participants' ability to detect grammatical errors in the experiment. The rationale is that if participants acquired implicit knowledge of the target structure, they could subconsciously detect the grammatical error by displaying a delay in responding to the target word.

The present study focuses on the grammaticality of English questions for assessing EFL learners' implicit knowledge. Therefore, the grammatical sensitivity that is discussed in this thesis conforms to the second interpretation. GSI provides a valuable measure for grammatical sensitivity; however, GSI may not be the only effective index, as GSI relies on the RT, which is less direct than error or accuracy data, as addressed by Jiang (2012: p.12):

"It [RT research] is less direct than research involving error or accuracy data when such data are reliably available."

"The use of RT data, on the other hand, often relies on more assumptions or involves more steps of inference because RT is not linguistic behavior itself or may be affected by many variables."

Therefore, besides the GSI obtained by collecting RT data in the WMT experiment, a more direct GSI based on error or accuracy data to evaluate grammatical sensitivity in measuring implicit language knowledge will add to the reliability of the experimental findings. Therefore, in this dissertation, in addition to grammatical sensitivity measured by RT data, EFL learners' language production data bearing learners' accuracy data and error information is another focus of the present thesis.

Language Production

Although many studies have been done in second language research on characteristics, measures, and transferability of implicit and explicit knowledge, most studies considered learners' awareness as the only indicator to measure learners' implicit knowledge. However, except for the awareness tested by grammatical sensitivity, accessibility involving automatic processing shown in production also deserves attention from researchers. R. Ellis & Roever (2018) stated that among all the implicit knowledge characteristics, some are more central than others in designing

measuring tests. The one besides awareness is accessibility, which means that implicit knowledge is accessed for spontaneous language production in automatic processing. The importance of studying learners' production in language acquisition has also been recognized in previous studies. According to Krashen's (1982) monitor theory, accurate and fluent language production is initiated with the acquired system of knowledge. Language production promoted learners' language learning by helping learners become aware of their existing grammar knowledge gap and enhance their awareness of the links between forms, function, and meaning, which has played an important role in L2 acquisition (Kowal & Swain, 1994). Language production reveals learners' real-time processing of language structure, which provide important data for analyzing learners' difficulty in acquiring specific language structure (Grüter et al., 2012).

In previous implicit knowledge studies (e.g., R. Ellis, 2005; Kim & Nam, 2016; Spada et al., 2015), production data in OEIT has been analyzed as an indicator showing grammatical sensitivity. However, as reviewed in the previous section, in the production process of OEIT, while participants were focusing on the meaning of the experimental sentences, they subconsciously judged the grammaticity before they repeated the correct sentence in spoken form. Therefore, the OEIT tacitly tested participants' sensitivity to grammatical violation and consecutively tested the production of the experimental sentence. It offered a possibility to analyze the production data in terms of both sensitivity and production, not only providing researchers a possible measure of learners' production competence but also enabling them to study the development of grammar knowledge and production competence of participants. As an additional indicator for learners' acquisition of linguistic knowledge, L2 learners'

production offers a new channel for studying the degree of knowledge acquired by L2 learners. Therefore, this study will explore learners' production data in analyzing EFL learners' implicit knowledge.

Methodology

To achieve the research goals of this thesis, three consecutive studies are conducted using independent research tools. The project adopts a combination of survey research and experimental research design that includes written tests and two behavioral experiments to collect data. Descriptive statistics, independent and paired sample *t*-tests and ANOVA are used to analyze the data. This section will specify research methods and experimental tools for each study.

The first study (article 1) adopts an exploratory-quantitative-statistical type of research (Macky & Gass, 2005). A standardized written test focusing on English question formation is conducted with 143 participants from China and Spain to collect hands-on data of errors in English questions. To finely categorize grammatical errors in English questions, criteria for error classification are established according to the grammatical properties of verb phrases appearing in English questions, grounded in the error categorization framework of Thewissen (2013) and the error identification standard of obligatory occasions defined by Dulay & Burt (1973). Errors are typologically categorized based on morpho-syntactic grammar features and all the data are quantified in numerical scores for statistical analysis. Descriptive statistics are used for the purpose of analyzing learner error distribution. A methodological framework of

identifying cross-linguistic effects built by Jarvis (2000) is also introduced to testify to the L1 influence of EFL learners.

The second study (article 2) is a reaction time experiment with a Word Monitoring Test (WMT) to collect data for measuring advanced EFL learners' implicit knowledge. The study recruits 81 participants from native English speakers, advanced Chinese and Spanish EFL learners. Independent sample *t*-tests and one-way ANOVA are conducted to analyze EFL learners' implicit knowledge. The WMT experiment is designed on the basis of the WMT conducted by Jiang (2012) & Suzuki (2017), and it is modified for the present study based on the characteristics of experimental sentences, questions instead of statements, testing participants' on-line reaction times to given stimuli. The experimental sentence items incorporate five typical types of morpho-syntactic errors in English questions categorized in the first study, with each type of error evenly distributed.

The third study (article 3) applies an Elicited Oral Imitation Test (EOIT) to measure EFL learners' grammatical sensitivity and production competence. Ninety-one participants including native English speakers, advanced Chinese and Spanish EFL learners are recruited. The EOIT has been validated as an effective measure and replicated in previous research (Bowles, 2011; Kim and Nam, 2016; Spada et al., 2015; Zhang, 2015). In this study, the EOIT is modified by using pictures for comprehension checking and adding a time limit, for the purpose of better addressing the research objective of the study. With experimental procedures testing

participants' indirect grammatical judgment and direct corrective production simultaneously, the researcher assesses both EFL learners' degree of grammatical sensitivity and language production competence.

Results

Article 1

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Article

Morphosyntactic inconsistency in cross-linguistic transfer: Pedagogical implications for teaching English questions to Chinese EFL learners

Qiaoling He
Sichuan International Studies University, Chongqing, China

Isabel Oltra-Massuet
Universitat Rovira i Virgili, Tarragona, Spain

Abstract

As one type of the most extensively used sentences, English questions are must-learn grammatical structures for learners of English as a foreign language (EFL). However, it is commonly seen that English learners across proficiency levels produce ungrammatical English questions. To determine the source of learners' erroneous production, we conducted a written test to collect hands-on data of four types of English questions produced by 81 Chinese EFL preliminary learners. Learners' achievement scores showed that learners from both higher and lower proficiency groups had similar difficulty producing questions. The statistics also showed morphosyntactic inconsistencies in learners' production were congregating on auxiliaries' choice and tense variation. Cross-linguistic transfer from first language (L1) in English question acquisition for Chinese EFL learners was measured against the three dimensions of Jarvis' (2000) methodological model. Influence from learners' L1 was found to be related to preliminary learners' morphosyntactic inconsistencies. The findings suggest that practitioners in an EFL context should raise learners' grammatical consciousness, and design production-oriented tasks, to improve learners' morphosyntactic accuracy in English question formation.

Corresponding author:
Qiaoling He, Department of Foreign Languages Teaching, Sichuan International Studies University, No.33 Zhuangzhi Road, Lieshimu, Shapingba District, Chongqing, 400031, China.
Email: heqiaoling@sisu.edu.cn

I Introduction

As one of the most typical sentence structures, English questions have been a primary learning target for learners of English as a foreign language (EFL). Question formation is, as generally regarded, not of great difficulty for learners; however, learners, whether from the typologically far more different first language (L1) family as Chinese or Korean, or from other European languages that share some similarity such as Portuguese and Spanish, displayed problems in English question production (Cowan, 2008, pp. 78–81). Extensive research has been done on English questions, studying the developmental sequence of question formation for learners of English as a second language (Ellis, R. 1984; Eskildsen, 2015; Spada & Lightbown, 1999), focusing on the acquisition of certain question types (Guasti, Branchini, & Arosio, 2012; McDonough & Mackey, 2008; Zhu & Wu, 2011), or studying errors learners made in certain types of question (Lee, 2016; Pozzan, 2011). However, there is a dearth of in-depth research in the acquisition of English questions by secondary school learners in China's EFL context, despite the fact that the English question is one of the most frequently used structures in communication and one of the four basic sentence structures (statement, question, imperative and exclamation) to learn according to curriculum criteria (the 2017 version; Ministry of Education of the People's Republic of China, 2017) for preliminary Chinese EFL learners. To gain a clear view of why learners have problems in question formation and to what extent it might be related to cross-linguistic transfer from L1, the present study did a typological analysis of learners' basic errors in 4 typical types of English questions. As specified by Richards & Reppen (2014), learners' errors in using a specific grammatical structure can be a useful source for teaching, and class activities can be designed around a collection of typical learner errors. This study also provides practical pedagogical implications for class practitioners in EFL contexts.

In this article, we intend to further the research on question formation by (1) providing a fine-grained analysis of error distribution and error classification with hands-on data from EFL secondary school learners; (2) discussing how cross-linguistic transfer influence learners' acquisition of English questions; and (3) offering pedagogical implications.

II Research concepts and foundation

1 Error classification

To better understand the foreign language learning process, we need to investigate what constitutes learner production problems, i.e. to study learner errors. The classic error analysis (EA) model goes as follows: collection of learner language, identification of errors, description of errors, explanation of errors, and evaluation of errors (Ellis, R., 2017; Corder, 1975). Given the criticism on EA studies, variables such as learner proficiency level, learners' L1, language learning experience, medium of language sample, and the production discourse (Ellis, R., 2017, p. 47) are considered when collecting learner language for EA in this study. As Corder (1975, p. 205) puts it, an adequate linguistic explanation is needed to account for the nature of errors produced in any

particular learning context. To assign errors to the corresponding linguistic domain is the beginning of a satisfactory classification and learner language production evaluation. However, there are no unanimous criteria for the classification of errors. For example, Bardovi-Harlig & Bofman (1989) divided errors into syntactic, morphological, or lexical-idiomatic classes; Corder (1975) classified errors by assigning them to levels of language; Lennon (1991) identified errors in terms of 'domain' and 'extent'; Thewissen (2013) categorized errors in 7 hierarchical linguistic levels. As the present study focuses on English question formation based on given statement sentences, learners' competence to operate verb phrases to form questions is tested. Thus, errors in verb phrases are to be analysed, which falls into the domain of grammatical errors according to Thewissen's (2013, p. 81) classification, described as 'errors that break the general rules of English grammar'. Therefore, the classification criterion in this study is adapted from Thewissen's grammatical EA framework.

Learner errors were first filtered with the criterion of obligatory occasions. The obligatory occasion refers to a test item for checking whether learners succeed in supplying or fail to supply the required morpheme to form a specific structure (Dulay & Burt, 1973, p. 254). Learners' performance was measured on three kinds of conditions: supplying the required structure, failing by supplying none, or failing by producing an incorrect one (Brown, 1973, p. 255; Dulay & Burt, 1973). In the present study, learner production was classified into: (1a) correct questions, (1b) questions with auxiliary errors, (1c) sentences without creating an obligatory context (for example, producing the wrong type of questions), or production failure (learners left the answer blank).

When learners are required to form a Y/N question (yes/no question) with the given statement 'She went to school yesterday' learners may produce:

(1) a.   A correct question:
           Did she go to school yesterday?
     b.   A question with auxiliary error:
           * Did she went to school yesterday?
           * Does she go to school yesterday?
           * Does she went to school yesterday?
     c.   A question without creating the obligatory context:
           * When/Why she went to school yesterday?
           (no production)

Questions with auxiliary errors produced by learners were sub-categorized with annotation. Annotations of errors were created partially referring to Thewissen (2013), who followed the 2008 version of Louvain Error Tagging Manual. Thewissen's tagging of errors is hierarchical, in the sense that it divides errors into main domains and their subordinate categories. Since the errors we analysed are in the domain of grammatical errors and errors with the obligatory context of questions mostly revolve around auxiliaries, we marked them as GAUX (grammatical errors of auxiliaries), and further subcategorized them as GAUXC: grammatical mistakes in the choice of auxiliaries, GAUXO: grammatical mistakes in the word order of auxiliaries, etc. The categorization of auxiliary errors is specified in Table 1.

Table 1. Seven error tags used in the study.

Error tags	Definition	Examples of learner question formation
GAUXC	grammar auxiliary choice	He often has dinner at 6:00. * Has he often dinner at 6?
GAUXO	grammar auxiliary order or placement	He will be getting on board at 7:00. * He will be getting on board at 7:00?
GAUXT	grammar auxiliary tense	They enjoyed the birthday party. * Do they enjoyed the birthday party?
GAUXM	grammar auxiliary morphology (including verb morphology)	Why did he give up? * Can you tell me why he gived up?
GAUXA	Grammar auxiliary subject–verb agreement	What does he do for a living? * Nobody knows what he do for a living.
GAUX# /OTHER	grammar auxiliary error plus one more other error; for example, GAUXT/ OTHER: grammar auxiliary choice and combined with one other error	They went to summer school last week. * What often did they went to the summer school?
OTHER	other errors like spelling, pronouns, preposition, and conjunctions; or building wrong types of questions	They enjoyed the birthday party. * When they enjoyed the birthday party?

Exhaustive annotation of errors in 4 types of questions produced by 81 participants was done manually by the researchers. As shown in Table 1, the auxiliary grammatical errors we annotated include errors in auxiliary choice, marked as GAUXC, errors in tense: GAUXT, errors in subject-verb agreement: GAUXA, errors in order or placement of auxiliaries: GAUXO; errors in morphological errors: GAUXM, and mixed errors: GAUX#/OTHER. Errors were annotated as mixed errors, when two errors appeared in the sentence, with one being an auxiliary error. The mark # in GAUX#/OTHER refers to one of the specific auxiliary grammar errors on the list, which may be GAUXC/OTHER, GAUXO/OTHER, GAUXT/OTHER, GAUXM/OTHER, and GAUXA/OTHER. All errors other than those on verb or auxiliary were tagged as 'OTHER' (as described in Table 1). OTHER refers to errors that are not related to auxiliaries (pronouns, preposition, conjunctions, etc.)

2 L1 transfer

For learners who learn an additional language other than their mother tongue, either in a foreign language (FL) classroom setting or in a semi-natural second language (L2) communicative context, the influence of their L1 cannot be ignored. As shown in the research of methodological issues in L1 transfer by Jarvis (2000), the L1 influence may fluctuate as learners progress in their L2 proficiency. Ellis, R. (2017, p. 393) also pointed out that L1 transfer does not always appear in a linear way; some errors appearing at initial developmental stages may continue to manifest at advanced stages. In the course of L2 learning, L1 transfer can be triggered or retarded at certain points of the developmental axis,

which exerts an unavoidable influence in acquiring a new language. Therefore, for a study investigating the learning process difficulty, it is imperative to include L1 transfer as an influential variable.

Based on established research in L1 transfer (Corder, 1975; Gass, 1979; among many others), Jarvis (2000) constructed his L1 transfer research model by focusing on both learners' dynamic interlanguage performance in development and L1 background. L1 exerted influence on learning an L2 if learners displayed:

- 'intra-L1-group homogeneity' in learners' IL [interlanguage] performance;
- 'intra-L1-group congruity' between learners' L1 and IL performance; and
- 'inter-L1-group heterogeneity' in learners' IL performance.

The three potential effects from Jarvis'(2000, p. 253) methodological framework of identifying L1 influence effects were adopted to analyse L1 transfer in this study to be able to evaluate the influence of L1 transfer on English question formation.

- Hypothesis 1: The intra-L1-group homogeneity hypothesis assumes that learners who speak the same L1 behave uniformly when using the L2 (Jarvis, 2000, p. 254). Regarding question formation in this study, learners from an identical L1 background (Chinese) are supposed to show a similar degree of difficulty in formulating the four types of questions under investigation. Their errors are similar across different proficiency levels and language exposure.
- Hypothesis 2: The hypothesis of intra-L1-group congruity between learners' L1 and IL performance refers to the learners' use of a specific L2 feature paralleling their use of the corresponding L1 feature (Jarvis, 2000, p. 255). This study hypothesized that learners' errors in questions parallel the corresponding feature of the same type of question in Chinese.
- Hypothesis 3: The Inter-L1-group Heterogeneity Hypothesis proposes that comparable groups of learners from different L1 backgrounds differ from one another in their IL performance (Jarvis, 2000, p. 254). In the present study, we hypothesized equivalent-level English learners from two different L1s (Chinese and Spanish) display distinct degrees of difficulty building the four types of questions, and there are differences in errors they produced in English questions.

III Methodology

This study aims to explore what errors young Chinese learners of English may produce in forming English questions and to find out, to what extent, the influence of cross-linguistic transfer underlies their morphosyntactic inconsistency. The study follows a quasi-experimental design, with participants randomly chosen by class from two schools. The data were analysed to demonstrate specific morphosyntactic inconsistency in English question formation for Chinese secondary school learners; thereafter, the underlying influence of cross-linguistic transfer on their accuracy was discussed. In addition, to support Jarvis' (2000) third hypothesis, we collected data from Spanish learners (see the discussion and specific methodology below).

Table 2. Descriptive statistics of written test results.

	Participants	Range	Minimum	Maximum	Mean	Std. deviation
Score_FLS group	47	16	24.0	40.0*	34.447	4.1536
Score_RPS group	34	31	3.0	34.0	16.294	7.8837

Note. * The total score for the test is 40 points.

1 Research questions

1. What are typical errors in English questions produced by preliminary Chinese EFL learners?
2. How does cross-linguistic transfer from learners' L1 influence their production of English questions?

2 Participants

The empirical study was conducted with 81 participants from two secondary schools in southwest China: a foreign language specialized secondary school (FLS School) and a rural public secondary school (RPS School). The FLS school represents the highest English teaching level in secondary schools in China, widely recognized for its high quality and specialization in foreign language teaching. The RPS school stands for the widely spread rural town secondary schools, in which English teaching does not seem adequate for creating a resourceful foreign language learning context.

3 Written tests

The written tests were conducted in a 40-minute self-study session in the classroom, with their English teacher supervising the test. The test paper was designed to test learners' production into building 5 categories of English questions, namely, Y/N questions, Wh-questions, Tag questions, Embedded questions, and Choice questions (see Appendix 1).[1] Eighty-one students' test results were analysed.

4 Test material

The test paper was reviewed by two coordinators of the junior secondary school English teaching groups and two teachers with more than 15 years of secondary school English teaching. They confirmed that test items conformed to the criteria for the test of their teaching syllabus used nationwide.

IV Results

1 Written tests

Table 2 shows the test results of the two groups of learners. The different proficiency level is shown in the mean scores, 34.447 for the higher proficiency FLS group and
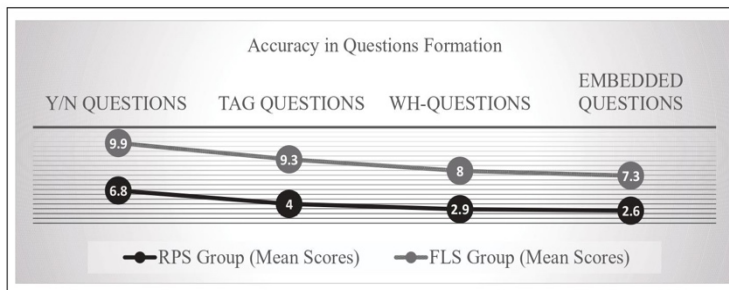
Figure 1. Ranking of accuracy in questions formation.

16.294 for the lower proficiency RPS group, respectively. The result of Standard Deviation (SD) is 4.1536 for the FLS group and 7.8837 for the RPS group, which indicates that the within-group difference in the lower-proficiency RPS group is much larger than that of the FLS group.

2 Accuracy ranking of the four types of questions

Figure 1 shows the ranking of the accuracy rate in building 4 types of English questions for students from both schools. The accuracy rate was calculated for each type of question based on the mean scores participants got in the written test (Figure 1). The test results displayed two extremes of English proficiency at the same English learning stage. The FLS school group got a mean score of 9.9, 9.3, 8, and 7.3 for accurate production in Y/N questions, Tag-questions, WH-questions, and Embedded WH-questions respectively, while the RPS school group got mean scores of 6.8, 4, 2.9, and 2.6. The results showed a huge difference in accuracy in building questions for the two groups. However, the key finding is that they displayed the same gradient of accuracy when considering the type of question as a variable: Y/N questions > Tag questions > WH-questions > Embedded questions.

3 Error distribution

There are altogether 848 erroneous questions collected from participants. Among these erroneous questions, 97 errors were from Y/N questions, 273 from WH-questions, 194 from tag questions, and 284 from embedded questions. The number of erroneous questions indicates the learning complexity of different types of questions for participants. Table 3 shows how errors were distributed in each of the 4 kinds of questions produced by the two groups of learners. Learner errors were first divided into auxiliary errors and other types of errors.

The total number of errors includes auxiliary errors and other types of errors. The number of unfilled items was listed in a separate column named production failure. The ratio of errors in auxiliaries shows that learners have difficulty in correctly using

Table 3. The error distribution among questions.

Question type	Group	GAUX	OTHER	Total errors	Production failure	Non-scored items
Y/N questions	RPS	77 (84.6%)	14 (15.4%)	91	18	109
(97)	FLS	5 (85.7%)	1 (14.3%)	6	0	6
WH-questions	RPS	49 (25.9%)	140 (74.1%)	189	53	242
(273)	FLS	5 (6%)	79 (94%)	84	10	94
Tag questions	RPS	87 (57.2%)	75 (43.8%)	162	43	205
(194)	FLS	20 (65.5%)	12 (34.5%)	32	1	33
Embedded	RPS	63 (38.7%)	100 (62.3%)	163	89	252
questions(284)	FLS	76 (62.8%)	45 (38.2%)	121	6	127
Total		382	466	848	220	1068

Note. GAUX refers to auxiliary grammatical errors;

auxiliaries. The errors in forming Y/N questions cluster around auxiliaries for both groups, with a high percentage of 84.6% and 85.7%. Errors in embedded-questions for FLS group and tag questions also revolve around auxiliaries by showing a proportion of over 50%. Errors shown in embedded questions for the RPS group deviate a bit from the other 3 types of questions, as they display only 38.7%, the only one lower than 50%. However, the low ratio of GAUX errors in embedded WH-questions displayed by the RPS group did not indicate that they have few problems in producing embedded WH-questions. On the contrary, RPS learners showed greater difficulty in producing embedded WH-questions because they produced as many as 100 errors that are categorized as OTHER besides 63 GAUX errors, and they failed in producing 89 embedded questions among the total number of 340 questions required in the test. The GAUX errors in embedded WH-questions produced by the FLS group were 76 among the total 121 errors, which showed that learners at higher proficiency level still had problems in using auxiliaries, despite generally performing better in embedded WH-question production.

The morphosyntactic errors in using auxiliaries was studied with a more elaborate sub-categorization (Table 4). Both groups of learners had about 50% of their errors in choices of auxiliary (GAUXC) and tense of auxiliary (GAUXT), which showed that learners had more difficulty in auxiliary choice and morphological variation concerning tense than the order of auxiliary and subject–verb agreement.

V Discussion

The present study analysed errors in the written production of English questions regarding Chinese EFL learners at two different proficiency levels. To be specific, the study investigated (1) the common errors committed by the higher-proficiency group and the lower-proficiency group and the specific sub-categorization; (2) the cross-linguistic transfer exerted on English question formation for preliminary Chinese EFL learners. To clarify these issues, we ranked the accuracy of learners' production in terms of 4 types of

Table 4. The distribution of sub-categories of auxiliary errors.

Question type	Group (errors numbers)	GAUXO	GAUXC	GAUXT	GAUXM	GAUXA
Y/N questions	RPS (77)	2 (2.6%)	36 (46.8%)	37 (48.1%)	2 (2.6%)	0
	FLS (5)	0	3 (60%)	2 (40%)	0	0
WH- questions	RPS (47)	13 (27.7%)	13 (27.7%)	21 (44.6%)	0	0
	FLS (5)	0	0	4 (80%)	0	1 (20%)
Tag questions	RPS (87)	2 (2.3%)	72 (82.8%)	13 (14.9%)	0	0
	FLS (20)	0	16 (80%)	3 (15%)	0	1 (5%)
Embedded questions	RPS (63)	34 (54%)	5 (7.9%)	9 (14.3%)	5 (7.9%)	10 (15.9%)
	FLS (76)	61 (80%)	4 (5%)	3 (3.9%)	0	8 (10.5%)

questions and classified learner errors into 7 sub-categories. As hypothesized, learners from different proficiency levels shared similar characteristics in question formation. First, the written performance scores clearly showed the same contour in accuracy ranking in the four types of questions. Second, the errors unanimously clustered around auxiliaries despite a sharp contrast in accuracy between groups. These results provided further support for the influence of L1 syntactic features exerted on L2 question formation in preliminary EFL learners. Thereafter, we analysed in what aspects learners' L1 affects their formation of English questions. The following sections discuss these issues in detail.

1 Distribution of auxiliary errors

The auxiliary errors in English question formation are extensively found in different EFL learners: Spanish-speaking learners of English (Eskildsen, 2015; Pozzan, 2011); Chinese learners who speak Cantonese (Lee, 2016); Thai learners of English (McDonough & Kim, 2009); Canadian L1-French learners (Spada & Lightbown, 1999), among others. In McDonough & Kim (2009), auxiliary errors such as auxiliary omission and noninversion are found in WH-questions produced by Thai university undergraduate students. The present study results found similar problems in Chinese EFL learners, with auxiliary omission classified in the category of GAUXC, and noninversion of auxiliary in GAUXO. This study shows that preliminary learners have difficulty choosing correct auxiliaries and dealing with the inflectional variation of tense in making questions. The results in this study also correspond to Lee's (2016) finding that learners produce errors in WH-questions that required *do* support and inflectional changes in verbs. However, little research has been done to further explore the exact errors in auxiliaries and why EFL learners so frequently make those auxiliary errors. The sub-categorization of learners' errors on auxiliaries in this study aims to locate the precise problems and determine the source of those difficulties for different EFL learners.

In the present study, with elaborate sub-categorization of auxiliary errors, we found that extensive auxiliary errors in auxiliary choice (GAUXC) and tense of auxiliary (GAUXT) appeared in learners' production of Y/N questions, WH-questions, and Tag

questions, plus errors in auxiliary order produced in embedded questions (see Table 4). The reasons for error congregation may be attributed to the interaction of the influence of cross-linguistic transfer, learners' grammatical consciousness, and other factors such as the developmental stage, learners' learning characteristics, or the ontological features of English proper. In what follows, we focus our discussion on the influence of cross-linguistic transfer.

2 Cross-linguistic influence and English question formation

In our study, we focus on L1 influence, since we assume such L1 influence to exist, to different degrees, in the whole foreign language learning process, much of which is weakened or eliminated, because of the form-focused instruction (FFI) class teaching or as the learners' language proficiency develops. For example, in our study, learners constructed many questions like * *What is the boy received?*, * *When does he will come?*, or * *Did/Do they enjoyed the party last night?* In these sentences, learners displayed that in their question production they were aware of the requirement to use an auxiliary before the subject to form questions. However, learners cannot use auxiliaries correctly because in their FL developmental stage, the complex morphological variation on verbs, which they never faced in their L1, still constitutes a difficulty for them. As learners' proficiency improves, their grammatical awareness on correctly using auxiliaries counteracts the negative L1 influence on auxiliary use, and auxiliary errors gradually disappear in their written production.

A number of previous research also offered evidence on the pervasive L1 influence in different aspects of English acquisition by non-native speakers (e.g. the acquisition of generic meaning with English articles for Spanish and Korean speakers, (Ionin & Montrul, 2010); English lexical reference of Finnish-speaking and Swedish-speaking Finns learners of English, (Jarvis, 2000); English question acquisition and developmental sequence for L1-French L2-English learners, (Spada & Lightbown, 1999); or the acquisition of English relative clauses for nine different L1 learners, (Gass, 1979) among others).

In the present research, we studied errors produced by learners in written form to see how cross-linguistic transfer may impact Chinese EFL learners' acquisition of English questions. Two major differences between Chinese and English questions are considered in the present study. The first one is the word order of question formation in the two languages. In Chinese questions, word order is quite stable concerning subject–verb sequence, so that Chinese is a so-called WH-in-situ language, while in English, question formation involves movement of the auxiliary to initial position. The second difference is the function of the auxiliary in question formation. English largely relies on an operation of auxiliaries to form questions, while in Chinese, there is no auxiliary, and Chinese questions are formed by adding a particle (*ma, ba*, or *ne*) or null-particle at the end of the sentence.

In the following section, we discuss the extent to which the difference in word order and function of auxiliary exert an L1 influence on learners' English question formation in the framework of intra-L1-homogeneity, L1-IL congruity and Inter-L1-Group Heterogeneity hypotheses.
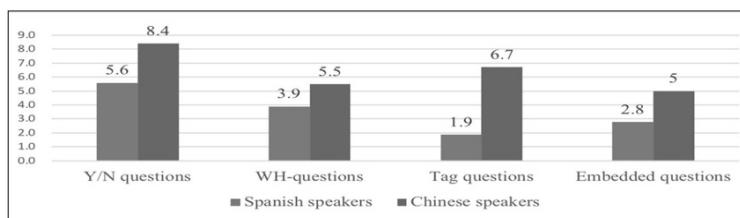
Figure 2. Accuracy ranking in questions formation for Chinese and Spanish learners of English.

3 The intra-L1-group homogeneity in question production

The accuracy ranking results of learners' production of English questions from the two groups provide a piece of evidence that L1 influence must constitute one factor for the learning difficulty of English questions, for learners displayed traces of L1 influence in their errors. As stated in hypothesis 1, learners with the same L1 background display similar performance in producing a specific structure in question. In this study, learners from two groups of learners with highly different proficiency displayed intra-L1-group homogeneity in three aspects: (1) the same ranking of accuracy regarding question type as a variable; (2) congregation of errors in auxiliary choice and tense; (3) high frequency of word order errors in embedded questions.

As shown in Figure 2, learners display a highly identical contour of accuracy rate among the types of questions under investigation, which, to some extent, lend support to the intra-L1-group homogeneity. The contrast in learners' test scores indicates that language proficiency does not constitute a variable in determining the ranking of difficulty of the 4 types of questions. Learners are learning English in an EFL context and their exposure to English is mainly in the classroom context. The same L1 background, to a large extent, must explain the identical accuracy ranking, as learners built the same prior L1 knowledge of question formation, which conforms with concepts that marked difference between L1 and L2 constitutes the acquisition difficulty in the Marked Differential Hypothesis proposed by Eckman (1985).

Learners from both groups show homogeneous distribution of errors: low incidence in word order errors and congregation of errors in auxiliary choice and tense. From the data shown in Table 4, we can see that learners from both groups do not exhibit many problems in the word order in Y/N questions, WH-questions, and tag questions, which is different from the word order problems shown by participants of L1-French L2-English learners discussed in Spada (1999). In the present study, our participants' errors in the three types of questions unanimously congregate on auxiliary choice (GAUXC) and tense of auxiliary (GAUXT). Errors in forming English questions are shown with L1-specific homogeneity in Cowan (2008, pp. 78–80). Cowan (2008, p. 78) illustrated that problems in question formation existed among learners of different L1: No do-support and non-inversion errors in Y/N questions by Portuguese and Arabic

learners who only added intonation or question markers in a way similar to their L1 question formation; learners from L1 like Romance languages and Farsi formed WH-questions by placing a WH-word before a declarative and inverting the whole content verb before the subject in the way of questions formation of their L1. In the present study, learner errors are mainly on choice and tense variation, since there are neither auxiliaries nor inflectional affixes to mark tense in Chinese question formation. Learners' L1 influence can be one important reason to explain their homogeneous distribution of errors in auxiliary choice and tense.

In embedded questions, learners exhibit a high percentage of word order errors. Contrary to the rule of auxiliary fronting in forming typical questions as Y/N questions, WH-questions, and tag questions, primary learners, both higher and lower level groups, show problems in non-inversion of auxiliary in embedded WH-questions. It seems learners from both groups unanimously displayed overapplication of the auxiliary-fronting rule in forming embedded WH-questions. Since participants are required to form embedded WH-questions with given direct questions, they need to put the word order of embedded questions back to declarative form. We must consider another possible reason for the high frequency of errors in embedded questions, as an effect of the test method used (transformation of direct questions into embedded questions). If it were for the latter, we might speculate that in spontaneous production of embedded questions in spoken form, learners would produce fewer word order errors because of the positive transfer from the corresponding L1 (Chinese) word order of subject–verb sequence.

4 L1-IL congruity in question production

Learners' L1-IL congruity is shown in the use of auxiliaries. English questions are formed by moving auxiliaries in front of the subject, and Chinese questions are formed by adding particles such as *ma* or *ba* (Zhu & Wu, 2011). The results in Table 4 show that over 90% of learner errors (for both groups) in Y/N questions and Tag questions, and about 75% in WH-questions lie in GAUXC (choice of auxiliary) and GAUXT (tense of auxiliary). L1 transfer effects were not discerned in the L1–L2 word order difference. The strongly marked structural difference in word order is likely to help learners notice the L1–L2 difference and use the correct form when building questions. However, the high percentage of errors in auxiliary choice and inflectional changes in tense in both groups suggests that learners' interlanguage production bears features of their L1 structure.

> Declarative sentence:
> (2) a. She went to school yesterday
>   Ta zuotian shangxue le.
>   'She yesterday went to school.'
>   b. * Did she went to school yesterday?
>   Ta zuotian shangxue le ma?
>   'She yesterday went to school?'

There is no auxiliary in questions in Chinese, while in English, an auxiliary is a must in questions. Besides, Chinese questions are formed by only adding a particle *ma, ba*, or *ne*

or null-particle at the end of a declarative sentence/statement, whereas English question formation involves movement of auxiliaries and necessary inflectional changes on the content verb. As stated in the previous section, the markedness of L1–L2 structure differences enhances learners' alertness of using an auxiliary in front of the subject to form the question. As shown in the example sentence (1-b), learners correctly add a *did* at the beginning of the question, but they fail to make the inflectional changes on the word *went*. In Chinese, there are no inflectional changes, which are quite common in English verbs. In (1-b), learners' errors show the traces of Chinese question formation of not making any changes on the content verb *went*. Especially for low proficiency preliminary learners, extracting the auxiliary from the content verb which bears the person, number or tense features and then fronting the auxiliary to form questions proves to be a demanding task. The high-frequency morphosyntactic inconsistency of overusing auxiliary (** Did they enjoyed yesterday?*) indicates that learners may perform well in inserting the auxiliary in initial position, but not removing the tense-marker carried on the content verb, i.e. not extracting the inflectional features in the verb and fronting them merged on a host auxiliary.

About 50% of auxiliary errors in Y/N questions (in the category GAUXC in Table 4) are on auxiliaries' choice. Erroneous questions such as ** Does she is a teacher?* and ** Do you have got your new book?* frequently appear in lower-level learners' production, which shows that low proficient primary learners cannot exactly locate and extract the verb's inflectional features from given declarative sentences. They simply learned the grammar rule of adding an auxiliary at the beginning to form a question, failing to choose the correct auxiliary required in a given sentence and relate it to the verb's inflectional features. The reason for learners' inertia in extracting the auxiliary can be traced back to their L1 language influence. It seems that the lack of morphological variation in Chinese has a cost on learners, in that it takes much longer for them to acquire the inflectional changes in English (Hawkins & Liszka, 2003; Lee, 2016). Chinese learners' difficulty of acquiring languages with complex morphology, such as Spanish (Dowens, & et al.; 2011), also lends support for the L1 language influence.

5 The inter-L1-group heterogeneity in question formation

In order to check whether there is an inter-L1-group heterogeneity in question formation, we had to incorporate data from a different L1 group of learners. Thus, we recruited a group of sixty-two Spanish learners of English of ESO (*Educación Secundaria Obligatoria*) grade-4 from three Spanish secondary schools (roughly equivalent to the Chinese secondary learners of this study) to do the same test, among which fifty-two results were valid.[2] The test results showed a significant difference between Chinese learners and Spanish learners in the acquisition of questions in both the ranking of accuracy in forming four types of questions (as shown in Figure 2) and the most prominent errors they made (Table 5).

The accuracy ranking of the four types of questions under investigation for Spanish learners of English is Y/N questions > WH-questions > Embedded questions > Tag questions. The accuracy ranking indicates Y/N questions are the easiest for them, followed by WH-questions and embedded questions, and Tag questions are the most

Table 5. The distribution of auxiliary errors for CLE and SLE groups.

Question type	Group (error numbers)	GAUXO	GAUXC	GAUXT	GAUXM	GAUXA
Y/N questions	Chinese (82)	2 (2.4%)	39 (47.6%)	39 (47.6%)	2 (2.4%)	0
	Spanish (125)	42 (33.6%)	41 (32.8%)	31 (24.8)%	10 (8%)	1 (0.8%)
WH-questions	Chinese (52)	13 (25%)	13 (25%)	25 (48.1%)	0	1 (1.9%)
	Spanish (111)	61 (55%)	31 (27.9%)	15 (13.5%)	4 (3.6%/)	0
Tag questions	Chinese (107)	2 (2.9%)	88 (82.2%)	16 (15%)	0	1 (0.9%)
	Spanish (78)	7 (9 %)	57 (73.1%)	10 (12.8%)	0	4 (5.1%)
Embedded questions	Chinese (139)	95 (68.3%)	9 (6.5%)	12 (8.6%)	5 (3.6%)	18 (12.9%)
	Spanish (62)	39 (62.9%)	5 (8.1%)	6 (9.7%)	6 (9.7%)	6 (9.7%)

difficult for them. As shown in Figure 2, the accuracy ranking for Chinese learners of English is Y/N questions > Tag questions > WH-questions > Embedded questions. Chinese learners of English and Spanish learners of English showed different accuracy rankings of questions, indicating that the ranking of accuracy is not due to the nature of questions per se, but rather, L1 influence may be one of the essential factors.

There is a remarkable difference in the distribution of the most prominent GAUX errors produced by Chinese learners and Spanish learners. As we discussed in the previous section, Chinese learners produced extensive GAUXC and GAUXT errors. Unlike their Chinese counterparts, Spanish learners of English produced sizable GAUXO errors, which means that they had more difficulty concerning word order other than the choice of auxiliary and tense variation. The highest error rates for the Spanish group are in the order of auxiliary, in Y/N questions, WH-questions, and embedded questions, which are 33.6%, 55%, and 62.9%, respectively (as shown in Table 5).

Even more interesting, the GAUXO errors produced by the Spanish group show substantial differences from those by the Chinese group. The GAUXO errors from the Spanish group are characterized by moving the whole verb in front of the subject (e.g. She went to school yesterday. – * Went she to school yesterday?), which are not produced by Chinese learners at all. The unique GAUXO errors Spanish speakers produced showed similar structures in their L1 Spanish questions, as shown in examples (3) and (4).

(3) The target question: *What did the boy receive?*
    a.   Spanish learners:
          ¿Qué recibió el niño?
          * What received the boy?
    b.   Chinese learners:
          Nage Nanhaier shoudaole shenme?
          * The boy received what?

(4) The target question: *Did they enjoy the party?*
    a.   Spanish learners:
          ¿Disfrutaron [past tense, third person plural] la fiesta?
          Enjoyed [past tense, third person plural] the party?
          * Enjoyed they the party?[3]

b. Chinese learners:
Tamen xihuan wanhui ma?
They enjoyed the party particle-ma?
* They enjoyed the party?

In forming questions 'The boy received <u>a toy car</u>. – What did the boy receive?' Chinese learners produced some GAUXO errors such as * *What the boy received?* or * *The boy received what?* but not the unique type produced by Spanish learners * *What received the boy?* The different errors made by the Spanish and Chinese learners lend support to the Inter-L1-Group heterogeneity hypothesis. The unique errors made by Spanish learners indicated there is some L1 influence for Spanish learners.

However, our study explores the L1 influence in question formation at the preliminary English learning stage. Most of the L1 transfer phenomena discussed here will gradually disappear in learners' written production as they advance in their English proficiency. However, whether some L1 influence is persistent, or at least implicitly residual, remains unknown. Therefore, further studies on advanced EFL learners' implicit knowledge and spontaneous oral production in this respect is necessary for elucidating the issue.

6 Explicit grammatical knowledge and English learning in EFL contexts

Explicit knowledge is conscious, declarative, accessible in controlled processing, allowing learners to exploit it as a 'tool' when they confront difficulty in performing language tasks (Ellis, R., 2009). In an EFL context, learners' explicit grammar weighs much in facilitating learners' acquisition. First, explicit knowledge provides learners with scaffoldings that help them to produce target structures. EFL learners rely more on explicit grammar knowledge in constructing new target structures than English learners with sufficient target language contexts. In the review of grammar teaching, Nassaji & Fotos (2004, p. 127) pointed out that it is significant to consider grammar as a necessary component of language instruction in the L2 classroom. In the present study, teachers from the two Chinese schools also confirmed that they adopted an FFI approach and emphasized that grammar knowledge instruction is an indispensable part of their English teaching. Second, explicit grammatical knowledge plays a significant role in improving learners' language accuracy. Grammar instruction contributes effectively for learners to attain the accuracy of the target language structure (Nassaji & Fotos, 2004; Nassaji & Swain, 2000). In EFL contexts, learners utilize explicit grammatical knowledge to measure whether their own language output conforms to the target language. Learners also resort to their grammatical knowledge to monitor their language production and ensure their language production accuracy. Third, explicit knowledge facilitates learners to acquire automatized or implicit knowledge of the target structure. Even though researchers did not reach an agreement on whether there is a direct interface between explicit knowledge & implicit knowledge (see, amongst others, Ellis, N.C., 2005; Ellis, R., 2005; Krashen, 1981; Suzuki & DeKeyser, 2017; Zhang, 2015), it is widely accepted that explicit knowledge facilitates learners' acquisition of implicit knowledge (Ellis, R., 2009). Therefore, the role of explicit grammar knowledge in improving language quality for learners in an EFL context should not be ignored.

a   Pedagogical implications. We have proved the validity of Jarvis' (2000) hypotheses, the intra-L1 group homogeneity, IL-L1 congruency and inter-L1 group heterogeneity in question formation. This indicates that cross-linguistic influence from learners' L1 constitutes a problem for Chinese preliminary EFL learners. The morphosyntactic inconsistency in learners' production, on the one hand, stems from the discrepancy of Chinese and English question formation, and on the other hand, it also results from lacking enough facilitative language context for learners to use and practice their language skills, which seems to favor a stronger influence from learners' L1. To reduce the impact of cross-linguistic influence sourced from L1–L2 differences, raising learners' consciousness of the structure, and providing learners with adequate context to produce what they have learned is significant in teaching practice.

b   Consciousness-raising (CR) tasks. In the EFL context, explicit grammar instruction is an important link in language classes. To raise learners' consciousness of grammar helps to promote learners' acquisition of the target structure. For both teenagers and adult learners, understanding how target language rules work underlying their production is an important part of their learning process (Scheffler & Cinciała, 2011). CR helps learners understand a specific grammatical feature and develop learners' production of a grammatical form (Ellis, R., 2002; Fotos, 2002).

From questions produced by learners, we can infer that learners have built some grammar knowledge, but their awareness may not be consolidated enough to help them produce accurate structures. According to Chan (2004), L1 factors likely affect target language acquisition as learners' incomplete target language knowledge may trigger language transfer, and learners' use of target structures reflects aids from their L1 knowledge. As explicit awareness of grammatical form contributes to learner production and helps them progress through interlanguage development (Ambridge, Rowland & Gummery, 2020; Larsen-Freeman, 2015), it is important to include CR tasks in the class design of English questions instruction. CR tasks promote learners' acquisition in that CR involves processes of implicit knowledge acquisition: noticing, comparing, and integrating. Noticing and comparing are directly attended in the CR tasks, while integration is constrained by learners' developmental stage (Ellis, R., 2002). For EFL learners at the preliminary level, noticing helps them to become aware of the target linguistic feature presented in the input, which may otherwise be ignored (Ellis, R., 2002). In comparing linguistic features they noticed with their present mental grammar formed in their L1 knowledge, learners become aware of the difference between L1 and L2. As long as learners build up explicit grammar knowledge and reach their developmental stage, they reach the integrating process, in which they incorporate the new knowledge into their present mental grammar and thus acquire the target structure.

c   Production-Oriented Approach. As learners lack a natural context to practice and produce, an appropriate approach that suits EFL learners to promote their production helps mitigate the problem. The Production-Oriented Approach (POA) proposed by Wen (2016) is tailored for Chinese EFL learners. The POA, which fully considered the Chinese EFL context, has been practiced in tertiary classroom instruction in China and proved to improve the quality of learner's language production. As Wen (2016)

suggested, POA might also work for learners from primary and secondary teaching contexts if effectively implemented.

The POA comprises three stages of instruction, which are motivating, enabling, and assessing:

- Motivating activities are designed based on the output-driven hypothesis. In this stage, learners are motivated to finish a productive activity, and they understand what is needed to fulfill the task (Wen, 2016). The motivating activities will help learners maintain initiative to conduct enabling activities, which ensure the success of their production.
- Wen (2016) suggested the core of the enabling phase is teachers' carefully selecting material pertinent to the assigned task, which can then be used as enablers in order to help learners gain scaffolding to approach their own zone of proximal development. Learners are also encouraged to selectively learn what they need to fulfill their productive activity. Considering the smaller volume of L2 language knowledge and learning capacity of preliminary learners in secondary school, we suggest a modified version of POA that brings CR tasks into the essential stage of enabling.
- In the assessing activity, learners' language products are presented and evaluated, which can be in written or oral form. The assessing phase exists in the enabling stage when learners are consciously working on language inputs or in presenting specific language products.

d   An integrated design of POA and CR tasks. The POA is initially designed for adult learners at the university stage. In this study, we suggest a modified version of POA by adding CR tasks in the second phase to take into account learning characteristics of preliminary EFL learners. Based on the key hypotheses and the theoretical foundation of CR tasks and POA, we present an integrated version of POA and CR tasks, as shown in Table 6.

The integrated version of POA follows Wen's (2016) three phases of motivating, enabling, and assessing. In EFL contexts, the scarcity of natural communicative context requires more on the teachers' choice of effective teaching approach and design of meaningful tasks. For preliminary EFL learners, introducing visual incentives (for example, picture cues, or video cues) into productive activities in the motivating phase can help elicit learners' question production. Meanwhile, a clear instruction of tasks in the first phase is key for subsequent successful productions. The enabling phase for preliminary EFL learners is different from the original POA in virtue of learners' inadequacy of fulfilling demanding tasks for tertiary learners. The CR-tasks for enabling learners to accomplish productive activities requires teachers to help learners to 'focus on a known source of difficulty [and to enable learners to discover the rule' (Ellis, R., 2002). Raising learners' consciousness of target structures offers them scaffoldings to accomplish the assigned productive activities. In the assessing phase, teacher's feedback and learners' peer feedback on language products serves as 'auto-input' to enhance learners' acquisition of target structures.

Table 6. Phases and tasks of an integrated version of Production-Oriented Approach (POA) and Consciousness-raising (CR) tasks.

Phases	Specific tasks
1. Motivating	• assigning a productive task; • guiding learners to find out what they need to accomplish their productive tasks.
2. Enabling	CR-tasks: • noticing the target structure in input material; • forming consciousness of the target structure by comparing with their present grammar knowledge; • building up explicit grammar knowledge.
3. Assessing	• learners' presenting of language products; • learners' evaluation and feedback on language products; • teachers' evaluation and feedback on language products.

VI Conclusions

In this study, we used the written test to measure learners' ability to form four typical types of questions correctly. Their performance was analysed on the accuracy ranking of the four types of questions and a fine-grained sub-categorization of learners' errors. Analysis of learners' morphosyntactic inconsistency was conducted to elaborate on the exact source of errors learners produced, and L1 transfer was discussed to tackle their learning difficulty at a preliminary learning stage. Overall, this study showed that: (1) preliminary Chinese EFL learners have great difficulty in choice and morphological variation of auxiliaries in English question formation; (2) learners from the same L1 displayed similar problems in forming English questions, independent from their proficiency level; (3) cross-linguistic influence plays an important role in learning difficulty of English question formation for EFL learners at the preliminary stage. We have provided further support for Jarvis' (2000) three hypotheses for identifying L1 influence effects, on the basis of linguistic data from Chinese learners, with additional support from Spanish learners verifying the inter-L1-group heterogeneity.

Therefore, teachers in the EFL context should take full consideration of the L1 influence in designing teaching tasks. On the basis of the specific problems raised by the structure of English questions for Chinese learners, this study further provides general pedagogical implications in how to deal with difficulties in learning a foreign language structure for EFL learners, how to provide effective input, and how to promote learners' production of high-quality language.

The findings reported in this study raise questions for further study. First, whether the errors appeared in the preliminary EFL stage will completely vanish, or any specific errors persist as learners gain high English proficiency. Second, further studies are needed to find out whether EFL learners can gain native-like accuracy in English question formation. Studies should be conducted in varied EFL contexts to tackle whether learners from distinct L1 differ in their difficulty in English question formation, which may provide further evidence of how L1 influences the acquisition of the L2 language

structure. The findings also suggest that the degree of consciousness of grammatical knowledge can be an important variable that affects learners' accuracy in forming English questions.

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ORCID iD

Qiaoling He https://orcid.org/0000-0002-9831-2066

Notes

1. Choice questions were not analysed, for we found that it did not test any new grammar knowledge other than verbal phrases or W-words choice, which have already been tested in the analysis of Y/N questions and WH-questions.
2. We ran exactly the same test with the same set of exercises with the Spanish learners. Despite a potential test effect, which had been specifically prepared for the Chinese context, the results are robust and point towards a clear support for Jarvis' Inter-L1-Group Heterogeneity hypothesis in question formation, as we argue in the main text.
3. In spontaneous speech, the pronoun is generally omitted. Its presence here may be a test effect.

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Appendix 1

Written test of question formation

疑问句测试 (40 minutes: 40分钟)

School 学校: _____   Grade&Class 年级班级: _____

Name 姓名: _____   Gender 性别: _____ Age 年龄: _____

1. Sentence Transformation 句型转换

Please change the sentence into a Yes or No question.

请将下列句子变为一般疑问句 。

1.   She is a teacher.
     _____ ?
2.   He did his homework.
     _____ ?
3.   He often has dinner at 6:00.
     _____ ?
4.   They can speak French.
     _____ ?

5. You have got your new books.
    _____ ?
6. I like watching TV.
    _____ ?
7. She went to school yesterday.
    _____ ?
8. He will be getting on board at 7:00 P.M.
    _____ ?
9. They enjoyed the birthday party.
    _____ ?
10. I would like to have an ice cream.
    _____ ?

2. Pattern Shift 句型变换

Please ask a question for the underlined part to form a WH-question.
请根据划线部分提问, 构成特殊疑问句 。

1. I want to buy <u>a new schoolbag</u>.
    _____?
2. He will come <u>at 12:00A.M.</u>
    _____?
3. They went to the summer school <u>last week</u>?
    _____?
4. <u>My uncle</u> will visit us tomorrow.
    _____?
5. The boy received <u>a toy car</u>.
    _____?
6. The man <u>in the office</u> is my teacher.
    _____?
7. The girl <u>in red skirt</u> is my friend.
    _____?
8. There is <u>a pencil</u> in the bag.
    _____?
9. There are <u>some cakes</u> in the box.
    _____?
10. <u>Their</u> classroom is closed.
    _____?

3. Sentence Completion 补全句子

Please fill in the blank on the line and make the sentence into a tagged question.
请将以下句子划线部分补充完整 , 构成反义疑问句 。

1. She is good at dancing, _____ _____?
2. It's not the proper time to leave, _____ _____?

3. He comes back home early today, _____ _____?
4. They will come to visit you next week, _____ _____?
5. The workers can't come on time, _____ _____?
6. She went away, _____ _____?
7. Let's go to the supermarket, _____ _____?
8. Come to the library earlier, _____ _____?
9. Don't bother him, _____ _____?
10. You think what he said is right, _____ _____?

4. Sentence Rewriting 句子改写

Please rewrite the sentence into an indirect or embedded question.
请用给出的疑问句将以下句子补充完整，构成间接疑问句或复杂疑问句 。

1. What am I going to do?
   I don't know_____
2. Why did he give up?
   Can you tell me _____
3. Will you come tomorrow?
   We would like to know_____
4. Is there a supermarket nearby?
   Do you by any chance know_____
5. What does he do for a living?
   Nobody knows_____
6. What can we do for you?
   We'd like to know_____
7. Who is the man standing at the door?
   She has no idea _____
8. Are you going to finish the whole project?
   Can you tell us_____
9. Is it proper for us to leave now?
   I don't know _____
10. Have you got the final permission?
    Would you let us know _____

5. Sentence Formation 连词成句

Please connect the words into a grammatical choice question.
请用给出的单词组成完整的句子 ，构成选择疑问句 。

1. like, would, you, chocolate, ice cream, or
   _____?
2. want, which, you, or, do, a book, a toy
   _____?
3. you, can, or, sing, dance
   _____?

4. which, do, can, you, or, sing, dance
    _____?

5. he, is, a teacher, a student, or?
    _____?

6. what, he, a teacher, or, is, a student?
    _____?

7. do, like, to, go, you, or, stay
    _____?

8. you, which, like, do, to go, to, stay, or
    _____?

9. you, can, can't, help, or, you, me
    _____?

10. can, help, me, you, not, or
    _____?

6. Please rank exercises 1 to 5 according to the difficulty for you (from the easiest, 1, to the most difficult, 5). 请将本套试题的*5*道大题根据你的做题难度排序 。（排序方式: 由简到难，以数字1，2，3，4，5标出，数字越大，难度越大）

_____ 1. Sentence Transformation 句型转换
_____ 2. Pattern Shift 句型变换
_____ 3. Sentence Completion 补全句子
_____ 4. Sentence Rewriting 句子改写
_____ 5. Sentence Formation 连词成句

This is the end of the test!
此处为本卷结尾处 。

Article 2

Article

Implicit Knowledge Acquisition and Potential Challenges for Advanced Chinese and Spanish EFL Learners: A Word Monitoring Test on English Questions

Qiaoling He [1,2,*] and Isabel Oltra-Massuet [2,*]

1   College of General Education, Sichuan International Studies University, Chongqing 400031, China
2   Department of English and German Studies, Universitat Rovira I Virgili, 43002 Tarragona, Spain
*   Correspondence: qiaoling.he@estudiants.urv.cat (Q.H.); isabel.oltra@urv.cat (I.O.-M.)

Abstract: This study aims to explore whether advanced EFL learners can acquire implicit knowledge of basic sentence structures, such as English questions. We ran a reaction-time experiment, a word monitoring test experiment to test learners' implicit knowledge by checking advanced EFL learners' grammatical sensitivity to English questions with five types of grammatical errors. The study recruited three groups of participants: native English speakers ($n = 12$), advanced Chinese EFL learners ($n = 32$), and advanced Spanish EFL learners ($n = 37$). Our results revealed that advanced EFL learners had not yet attained native-equivalent implicit grammar knowledge in English questions, despite their English proficiency level. The results also indicated that the learners' different L1 languages do not impact advanced learners' overall implicit knowledge acquisition but constitute influential factors for particular morphosyntactic inflections in English question formation.

Keywords: implicit knowledge; English questions; morphosyntactic inflections; grammatical sensitivity; EFL learners

1. Introduction

One important topic in second language acquisition (SLA) concerns L2 learners' acquisition of implicit knowledge and, specifically, to what extent L2 learners can acquire implicit language knowledge. A high level of implicit knowledge correlates with learners' high linguistic competence [1–3]. Therefore, one would assume that advanced language learners should have acquired a high degree of implicit knowledge. Studies regarding implicit language knowledge have mainly concentrated on distinguishing implicit from explicit knowledge [3–8] and developing and validating research tools for measuring the two kinds of knowledge [1,5,9–16]. To push forward and generalize previous findings on this topic, further studies on L2 learners with different L1–L2 combinations and on other linguistic structures are needed [11,17]. This study measured the implicit knowledge levels of a native English-speaking group and two groups of advanced EFL learners from different L1 backgrounds (Mandarin Chinese, hereafter referred to as Chinese, and Peninsular Spanish, hereafter referred to as Spanish), using the word monitoring test (WMT) experimental paradigm. We also conducted a comparison of the implicit knowledge levels between native speakers and the two advanced EFL learner groups. The present study seeks to contribute to the debate on whether advanced EFL learners can acquire implicit knowledge of English questions that are equivalent to the native speakers' level and whether English learners from different L1s encounter specific difficulties in the acquisition of particular kinds of morphosyntactic features in English questions.

To address the aforementioned research concerns, we raised the following two research questions for the present study.

RQ1: Did advanced EFL learners acquire implicit knowledge that was equivalent to the level of native speakers?

RQ2: What might potentially impact Spanish and Chinese EFL learners' implicit knowledge acquisition, in terms of English question formation?

2. Literature Review

2.1. Acquisition of English Questions for Chinese and Spanish EFL Learners

The acquisition of morphosyntactic inflections in question formation is difficult for L2 English learners since the syntactic manipulation of interrogatives is far more complex than the syntax of statements [18]. Diversified errors do appear when building English questions for both preliminary Chinese and Spanish EFL learners [19]. One reason for this difficulty may come from the syntactic differences between L1 and L2 question formation. Chinese is a so-called "*wh* in situ" language [20]. That is, in Chinese, the word order is stable, and there is no *wh*-movement, nor any subject-verb inversion or auxiliary insertion in questions. Chinese yes/no-questions are formed by adding particles, such as *ma* or *ba*, at the end of a declarative sentence (as shown in (1c)), with no morphological inflection on verbs [21]. Meanwhile, Spanish, despite belonging to the same Indo-European language family as English, significantly differs from English. In Spanish, verbs inflect for tense, aspect, and mood, and show morphosyntactic agreement features (person and number) in all forms, so that pronoun subjects are generally left unexpressed. Simplifying things somewhat, while Spanish *wh*-questions do show *wh*-movement, as in English, but without auxiliary *do*-support or subject–auxiliary inversion, basic Spanish yes/no questions are built by just changing intonation in sentences, as exemplified in (1b) and (2b). Although Spanish does have auxiliaries, such as *haber*, "have", or *ser*, "be", for perfective and passive tenses, respectively, their syntactic behavior differs from those in English [22].

To illustrate the syntactic differences between English and Spanish auxiliaries, see the contrast in (i)–(ii), where examples can be said to be word-by-word translations.

(i)   English: John has gone to Tarragona.—Has John gone to Tarragona? vs. *John has gone to Tarragona?

(ii)   Spanish: Juan ha ido a Tarragona.—*Ha Juan ido a Tarragona? vs. Juan ha ido a Tarragona?

The following example questions in English, Chinese, and Spanish illustrate basic morphosyntactic differences in question structures in these three languages. We use the following abbreviations for glosses: 2: second person; 3: third person; sg: singular; pl: Plural; PrsInd: Present Indicative; q: Question marker.

(1) *Yes-no* Questions

a. English:	Do	you	get		permission	to	enter	the		office?
b. Spanish:	¿Tienes				permiso	para	entrar	a	la	oficina?
	get.2SG.PRSIND				permission	to	enter	to	the	office?
c. Chinese:	Ni		dedao		xuke	qu	jin	bangongshi		ma?
	You		get		permission	to	enter	office		Q

(2) *Wh*-Questions

a. English:	Where	do		they	want to	build	their	new		factory?
b. Spanish:	¿Dónde	quieren				construir	su	nueva		fábrica?
	where	want.3PL.PRSIND				build	their	new		factory?
c. Chinese:	Tamen	xiang	zai	nali		xiujian	tamen de	xin		gongchang?
	They	want.to	at	where		build	their	new		factory?

Morphological inflection is problematic for FL/L2 learners from various L1 [23] languages, as it is relatively easy to study inflection but it is difficult to acquire [24]. Studies on the acquisition of English questions for learners from different L1s (e.g., Chinese, Korean, Portuguese, and Spanish) revealed different morphosyntactic errors in forming English questions from different perspectives. Cuza (2016) [25] reported that Spanish–English bilingual learners showed a low level of inversion in forming *wh*-questions and embedded questions [25]. In a corpus study of learner errors, McCauley et al. (2019) [26] reported a high frequency of non-inversion errors in children's spontaneous production of *wh*-

questions [25,26]. Pozzan and Valian (2017) [27] found that Spanish and Chinese learners displayed comparable subject–verb inversion errors when forming English questions [27]. Ma (2018) [28] found a high occurrence of inversion errors in the production and judgment of English embedded *wh*-questions by Cantonese learners of English. More importantly, those learners who seem to have gained a high communicative ability still produce basic English grammatical errors, such as dropping plural markings or creating third-person present-tense morphemes. Acquisition difficulty in morphology is also reflected in morphosyntactic inflections, in the context of forming English questions. For example, Hong Kong ESL learners had difficulty in acquiring *wh*-questions, and exhibited grammatical errors when using *be* and *do* (e.g., *What is Miss Wong say?*), or failing to invert verb structures [29]. Moreover, Zhu and Wu found that intermediate and advanced Chinese learners' interpretation of the discourse function of three different types of *yes/no* questions in their L1 language affected their choice of linguistic forms [21].

Although a series of studies have investigated the difficulties found in acquiring morphosyntactic features in English questions from different perspectives, morphosyntactic errors in English question formation have not been systematically reviewed and categorized. To find out whether cross-linguistic transfer from L1 hindered the formation of English questions in preliminary L2 learners, He and Oltra-Massuet [19] classified five types of errors, including GAUXC errors (erroneous use/wrong choice of the auxiliary verb, e.g., *Is your son like doing extreme sports as much as you?*), GAUXT errors (mistakes involving tense and its related morphology, e.g., *Before their final decision, what do they say in the meeting?*), GAUXA errors (errors in the agreement between the subject and the verb, e.g., *Does they agree to sign the contract in seven days?*), GAUXO errors (errors in word order between the auxiliary and content verb, e.g., *Shall be we working for that company for a whole year?*), and GAUXM errors (mistakes involving the morphology of the verb, e.g., *Have your students conduct the experiment all by themselves?*). Among all five categories of errors, grammatical errors made by Chinese preliminary learners were mainly distributed between GAUXC and GAUXT errors, while those from preliminary Spanish learners were evenly located among GAUXA, GAUXC, and GAUXT errors [19]. However, whether these morphosyntactic errors disappear or persist in advanced Chinese and Spanish learners remained unclear.

Therefore, a study targeting advanced EFL learners' grammatical sensitivity to the fine-grained types of morphosyntactic errors displayed by preliminary learners was conducted to uncover the learners' degrees of implicit knowledge acquisition. Moreover, focusing on a specific sentence structure with a group of advanced EFL learners from two different L1 backgrounds should reinforce the results regarding the potential influence of L1 on the learners' acquisition of implicit knowledge.

2.2. Implicit Knowledge and Its Acquisition Issues

In the field of second-language acquisition (SLA), the concept of implicit knowledge has been defined in comparison with explicit knowledge, as its characteristics are elucidated, to a large extent, by the contrasting properties between the dyads of implicit and explicit knowledge. Ellis (2005) [30] differentiated implicit knowledge from explicit knowledge by identifying its seven key characteristics. That is, implicit knowledge is intuitive, procedural, and variable but systematic, automatic, non-verbalizable, and unlearnable [30]. Paradis (2009) [31] defined implicit knowledge in L2 as knowledge that individuals are not aware of, in terms of its grammar rule, but that can be inferred from their systematic behavior, allowing them to speak in a consistent way [31]. Ellis and Roever (2018) [11] further clearly defined implicit language knowledge as non-verbalizable knowledge that learners are not subjectively aware of but that they can access in spontaneous language production, via automatic processing [11].

Implicit knowledge is acquired in a natural and simple process that involves no conscious operations [4]. Although the definition of implicit knowledge has been evolving over time, there is a wide consensus in SLA that learners' linguistic competence primarily consists of implicit knowledge, and that L2 production relies on implicit knowledge [7].

Importantly, it is broadly agreed upon that the ultimate goal of acquiring an L2 is to develop implicit knowledge [8]. However, to what extent L2 learners can acquire implicit L2 knowledge remains a matter of dispute, as there is a series of key variables involved that are not yet fully understood, such as L2 learners' age-related issues [9] or learners' L1 [10] or L2 residential experiences [11,12]. Therefore, it is important to study whether advanced EFL learners can acquire native-like implicit L2 knowledge and what might constitute the appropriate challenges by which L2 learners can acquire such knowledge. Theoretical linguists, from either the innatists' or connectionists' stances, showed a common grounding regarding the importance of implicit L2 knowledge in L2 learning, pursuing the same goal of elucidating whether implicit knowledge can be acquired and in what way L2 learners build up their implicit knowledge [3]; implicit knowledge, to a large extent, determines the L2 learners' final attainment of language competence [3,16,18].

However, previous studies have shown differing views on whether L2 learners can acquire implicit L2 knowledge and on how implicit knowledge is acquired. In reflecting on frequency effects in language processing, N. Ellis (2002) [32] evaluated the roles of attention and form-focused instruction and summarized that form-focused instruction (FFI) can aid the acquisition of implicit knowledge. R. Ellis (2002) [33] reviewed 11 studies on the role played by FFI in implicit knowledge development, and supported the view of N. Ellis (2002) [32], suggesting that FFI can promote the acquisition of implicit knowledge. In studying whether L2 learners from diversified L1s acquired implicit lexical knowledge after the treatment of lexical form recall, recognition, and priming. Sonbul and Schmitt (2013) [34] found that these learners did not show improvement in the acquisition of implicit knowledge. However, by replicating the experiments of Sonbul and Schmitt (2013) [34], Toomer and Elgort (2019) [35] extended the findings of Sonbul and Schmitt (2013) [34] and found a certain degree of development of implicit knowledge in their participants.

By comparing cross-linguistic experiments, Hopp (2010) [36] showed that it is possible for adult learners with L1 English, Dutch, and Russian to achieve native-like attainment in terms of acquiring L2 inflections in German [36]. In exploring whether L2 learners acquired implicit knowledge of causative sentences with the verbs "have" and "get", Zereshki and Rezaie (2018) [37] found that consciousness-raising tasks worked effectively on facilitating EFL learners in acquiring implicit knowledge of causative grammatical structure [37]. In examining whether Chinese learners of English can acquire knowledge of the past tense and past participles, Goad and White (2006) [38] showed that knowledge of both past tenses and participles in English is equally acquirable for Chinese speakers [38]. In studying the acquisition of L2 grammatical morphemes, Jiang (2011) [39] found that it is extremely difficult for Japanese learners to acquire English plural markers, although their acquisition is supposedly possible.

Existing studies [2,3,16,40–42] stated that learners' language proficiency is revealed in their implicit knowledge. Advanced EFL learners, or high-proficiency learners, are learners with high language competence in terms of comprehension and production. It is, thus, reasonable to hypothesize that they possess a high degree of implicit knowledge. Therefore, measuring advanced EFL learners' implicit knowledge, which is further checked against native speakers' implicit knowledge, should allow the researchers to explore to what extent learners in an EFL context can acquire another language.

2.3. L1-Influenced Issues and The Morphological Congruency Hypothesis

As for whether EFL learners' L1 influences their L2 morphosyntactic acquisition, previous studies [39,43–47] show diverse views. While they agreed that a learner's L1 influenced their L2 acquisition, even if to different degrees, previous studies have offered various opinions on the role of such L1 influence. Some studies have held the view that L1 influence constantly interferes with L2 learners' language acquisition [39,45], while others considered that L1 influence can be drastically reduced or even eliminated so that it does not substantially impact advanced learners' acquisition of target structures as the learners' proficiency increases [43,44].

In the study of the acquisition of plural noun phrases by Spanish and Korean learners of English, Ionin and Montrul [44] found that Spanish learners of English tended to transfer their L1 interpretation of articles with definite plurals to the target language, although the L1 transfer receded with the learners' improved proficiency and L2 immersion, an effect that was especially visible in high-proficiency learners. Goad and White [38] found that the inflectional morphology of English tenses and past participles are both acquirable by Mandarin learners of English despite the absence of such inflections in their L1. Elston-Güttler et al. [43] also found that the L1's influence in word processing had been expected and detected, but its influence decreased in high-proficiency learners when a semantic context was given. Pozzan and Quirk [48] suggested that the L2 English linguistic features predicted L2 learners' accuracy in question formations related to word order, while both Chinese and Spanish learners' L1 played a minor role.

Other research has suggested that the L1's influence constantly affects L2 learners' acquisition of target structures. These studies revealed that learners' L1 had an influence on L2 morphosyntactic acquisition, and L1–L2 morphosyntactic congruity was one of the most prominent factors. Jarvis [45] found that the participants' L1 constantly and detectably influenced their acquisition of content words. In studying the Spanish imperfect tense acquired by English learners of Spanish, Domínguez et al. (2017) [49] found that the L1's influence on English features impacted the L2 learners' acquisition of the morphology of the Spanish imperfective aspect. By comparing Russian and Japanese L1 learners of English, Jiang et al. [39] concluded that whether there is morphological congruency between L1 and L2 determines the L2 learners' final attainment of morpheme acquisition. They stated that it is easier for learners to acquire a grammatical morpheme that is represented in their own L1. Furthermore, Jiang et al. [39] encouraged further studies exploring whether Japanese or Chinese learners of English can acquire native-like implicit knowledge of English morphemes that are not morphologically congruent in their L1. Gudmestad and Edmonds [50] found that the L1's influence affected L2 learners' acquisition of gender marking in Spanish and also encouraged more studies on different L2s with other L1 backgrounds to confirm the generalizability of the findings on L1 influence. Whether L1 influences advanced L2 learners' acquisition of inflectional morphology is thus controversial and needs further exploration since studies on the acquisition of morphosyntactic inflection remain insufficiently explored. The present study seeks to contribute to this debate by focusing on advanced EFL learners from two different L1 backgrounds, to explore whether their L1 morphological features play a role in language acquisition for advanced learners and to investigate what morphosyntactic features in English questions remain difficult for advanced EFL learners, together with the influencing factors potentially impeding their acquisition.

The present study intends to explore this issue from the perspective of the morphological congruency hypothesis of Jiang et al. [39]. This was developed to delve into the issue of the "acquirability" of grammatical morphemes, especially from the perspective of the learners' L1 influence on the L2 acquisition of particular morphological features, which helps to explain the difficulty and final attainment of L2 morphological features. This hypothesis is also in line with the feature-assembly hypothesis proposed by Lardiere (2009) [51]. Lardiere analyzed the comparison of the L1–L2 language system from the perspective of generative grammar and concluded that learners need to reset the existing L1 parameters or reassign the values to L2; if they fail to do so, they cannot attain L2 proficiency [51]. According to Jiang et al. [39], L1 and L2 are congruent in morphology when the meaning of a specific grammatical morpheme is grammaticalized and morphologically marked in both L1 and L2, whereas they are incongruent in morphology when there is no similar morphological marking for grammatical meaning in both L1 and L2.

Jiang et al.'s *morphological congruency hypothesis* is as follows:

"When L2 learners reach an advanced or near-native level of L2 proficiency, only congruent learners (i.e., those whose L1 has a corresponding morpheme to the target L2 morpheme) are able to reach native-like proficiency in acquiring an L2 morpheme.

Incongruent L2 learners will find it extremely difficult, if not impossible, to develop native-like competence with respect to the same L2 morpheme." (Jiang et al., 2011: p. 943) [39]

As illustrated by Jiang et al. (pp. 943–944) [39], their hypothesis was supported by previous research in three lines, which are:

(i) Advanced L2 learners encountered great difficulty in acquiring native-like knowledge in grammatical morphemes when the morpheme in their L1 was not congruent with the target morpheme in an L2.

(ii) For L2 learners with different L1s, learners with congruent L1 morphemes performed better than those without congruent L1 morphemes.

(iii) For L2 learners from the same L1 background who were learning different morphemes, the learners performed better concerning grammatical morphemes that were congruent than on those that were incongruent with their L1.

When exploring the potential challenges in the acquisition of English questions for the EFL learners under investigation, we formed three predictions, based on the morphological congruency hypothesis.

Prediction 1: Advanced EFL learners are confronted by great difficulty in the acquisition of native-like implicit knowledge of morphosyntactic features in English question formation that are not instantiated in their L1.

Prediction 2: Spanish EFL learners outperform Chinese EFL learners in acquiring morphosyntactic features in English question formation because there are morphological inflections on verbs in Spanish, but not in Chinese.

Prediction 3: For Spanish EFL learners, there are congruent morphosyntactic features and incongruent morphosyntactic features in question formation. Spanish EFL learners are expected to perform better on English morphosyntactic features that are congruent with morphological inflections in Spanish.

2.4. Hypotheses

The goal of the present study is to find out to what extent advanced EFL learners can attain implicit language knowledge and investigate whether EFL learners from two different L1s displayed a difference in their acquisition of implicit knowledge. This study further explores what might constitute difficulties for advanced EFL learners in acquiring implicit knowledge of morphosyntactic features in English question formation. Based on previous studies on the acquisition of implicit knowledge and the theoretical framework of morphological congruency, we formulated the following two hypotheses:

Hypothesis 1 (H1). *Advanced EFL learners cannot acquire an implicit knowledge level equivalent to native speakers' level.*

Hypothesis 2 (H2). *Particular types of morphosyntactic inflections in English question formation constitute an influencing factor for EFL learners' implicit knowledge acquisition of English questions.*

3. Materials and Methods

3.1. Participants

The study recruited 81 participants online, comprising 12 monolingual native English speakers and 69 advanced EFL learners, ranging from 20 to 40 years old. All advanced English learners were reported to possess a C1 English proficiency level (common European framework of reference for language (CEFR)), which was further confirmed via a short online C1-level test (Cambridge English test) immediately prior to completing the experimental tasks. The EFL learners consisted of two groups of participants: advanced Chinese EFL learners ($n = 32$) and advanced Spanish EFL learners ($n = 37$). We collected data from 75 participants, and obtained valid data from 69 participants, with an effective rate of 92%. Table 1 shows the participants' basic demographic information.

Table 1. Demographic information for all participants.

Variables	NS Group (%)	CS Group (%)	SS Group (%)		
Age			$\chi^2 = 8.385, p = 0.078$		
18–20	1 (8.3)	1 (3.1)	5 (13.5)		
21–30	8 (66.7)	30 (93.8)	25 (67.6)		
31–40	3 (25.0)	1 (3.1)	7 (18.9)		
Gender			$\chi^2 = 4.096, p = 0.129$		
Male	4 (33.3)	10 (31.2)	20 (54.1)		
Female	8 (66.7)	22 (68.8)	17 (45.9)		
Education			$\chi^2 = 6.273, p = 0.180$		
Secondary school	1 (8.3)	3 (9.3)	4 (10.8)		
Undergraduate	8 (66.7)	12 (37.5)	10 (27.0)		
Graduate	3 (25)	17 (53.2)	23 (62.2)		
Starting year			$\chi^2 = 20.598, p < 0.001$		
Kindergarten	NA	0 (0.0)	7 (18.9)		
Primary school	NA	25 (78.1)	24 (64.9)		
Junior secondary school	NA	7 (21.9)	4 (10.8)		
University	NA	0 (0.0)	2 (5.4)		
Residence in an English-speaking country			$\chi^2 = 3.824, p = 0.027$		
Yes	NA	0 (0.0)	6 (16.2)		
No	NA	32 (100.0)	31 (83.8)		
Years of taking English class			$t = 6.507, p < 0.001$		
	NA	12.66 ± 2.48	11.57 ± 3.97		

NS, Native speaker group; CS, Chinese-speaking group; SS, Spanish-speaking group.

3.2. Procedures

The experimental procedures in the present study were reviewed and approved by the Research–Innovation Ethics Committee from the Universitat Rovira i Virgili, Spain. The experiment was conducted online on the behavioral experiment platform, https://app.gorilla.sc/ (accessed on 25 July2021). All participants were recruited via the experiment participants' recruitment platform, https://www.prolific.co/ (accessed between 20 June 2021 and 22 December 2021), which routes participants directly to the experiment platform. Every participant was required to give informed consent and read the experiment instruction before entering the experiment page. Participants started the experiment after filling out the background information questionnaire and passing the English proficiency test by presenting at least three correct answers out of five questions. The whole experiment lasted for about 30 min.

3.3. Experimental Instrument
3.3.1. Word Monitoring Task (WMT)

There is a battery of tests that were designed by R. Ellis [3,30] to measure implicit knowledge, which includes the imitated oral elicitation test, the oral narrative test, and the timed grammar judgment, which have been employed widely in previous studies [1,16,30,52]. However, recent studies on the measurement of implicit knowledge [14,15,17] have suggested that tasks such as timed grammar judgment require participants to pay attention to linguistic forms and, thus, raise their awareness of related linguistic knowledge [53]. Suzuki and Dekeyser [15] found that the reaction time (RT) experiment, such as the word monitoring test (WMT), is a more effective tool to measure implicit knowledge as participants' reactions are intuitive responses that are given within a limited time frame, while their focus is on the sentence's meaning. The WMT experiment was designed based on the work of Jiang et al. [39] and Suzuki [14] and was modified for the present study based on the characteristics of experimental sentences, with questions instead of statements. The rationale underlying the WMT test is that if L2 learners have acquired a particular linguistic

structure at an equivalent level to their native counterpart, they are supposed to be as sensitive as native speakers in displaying a similar degree of response delay regarding a violation of grammaticality in the linguistic structure under investigation.

The experimental procedure is displayed in Figure 1. In the experiment, participants were guided to listen to the audio recording of a sentence for a target word shown on the screen, then they needed to press a designated key as soon as they heard the target word (Figure 2). The morphosyntactic feature violation was designed to immediately precede the target word(s) in each critical experimental item. The target word was displayed on the screen before the response key was pressed, and participants were instructed to press the key immediately after they heard the target word. The reaction time that is recorded corresponds to the duration of the onset of the audio until the key-pressing action upon the appearance of the target word. A conceptual statement for checking the participants' comprehension of the sentence was shown on the screen, and participants were instructed to press the corresponding key representing their judgment regarding the meaning. Thus, participants were directed to focus their attention on sentence meaning while identifying the target word. There was a practice session for participants to familiarize themselves with the experimental operation before they started the experiment.
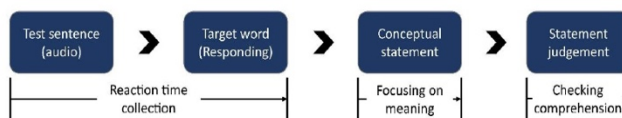

Figure 1. Experimental design.

Press 'space' for reaction   Press 'Y' or 'U' for judgement
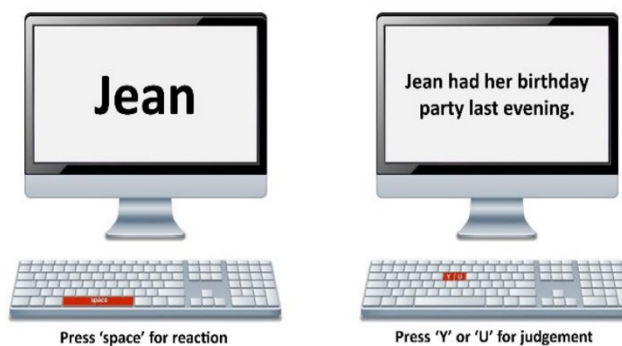
Figure 2. Illustration for the experimental operation.

An example of an experimental item is shown in the following:
Sentence audio: *Did she enjoyed Jean's birthday party last evening?*
Target word: Jean
Conceptual sentence for judging the meaning: Jean had her birthday party last evening (the Y key refers to the correct answer; the U key refers to the incorrect answer (see Figure 2).

While the participant was listening to the experimental sentence *Did she enjoyed Jean's birthday party last evening?* the target word *Jean* was shown on the screen. The participant should press the response key as soon as he/she heard the word "Jean". The participant may or may not display a delay in responding to the grammatical violation of the verb enjoyed in *Did she enjoyed Jean's ... ?*, which immediately precedes the target word(s).

3.3.2. Experimental Items

There were 5 practice items, 60 critical experimental sentences, and 30 filler items in the experimental design. Participants had to complete all 90 items in the experiment. Among the 60 critical experimental sentences, 30 ungrammatical sentences were experimental items, and 30 grammatical sentences were used as control items to calculate the RT. The grammatical sentences were used as "a baseline for determining if the phenomenon of lags in response, driven by implicit knowledge, is present" [54]. Thirty filler items were used to reduce the chances of the participant noticing the research focus of the stimuli items, that is, grammatical errors in question formation. The 30 fillers were all statements intended to conceal the fact that the experimental sentences were questions. Five types of grammatical errors were incorporated into the ungrammatical sentences. They referred to the findings regarding EFL learners' grammatical errors in English questions reported by He and Oltra-Massuet [19]. The five types of grammatical errors are the choice of auxiliary (GAUXC), order of auxiliary (GAUXO), tense of auxiliary (GAUXT), auxiliary/verb morphology (GAUXM), and subject–verb agreement (GAUXA). All error types were incorporated as grammar violation features in the experimental items. Each type of error appeared twice in each list; thus, there are 6 items for each grammatical error type in total, with an equivalent of 6 grammatical sentences. All 60 experimental sentences were divided into three lists of experimental items, with one list consisting of 10 pairs of grammatical and ungrammatical items representing all five grammatical error types. The sequence of all experimental items, including grammatical, ungrammatical, and filler items, was randomly ordered so that participants could not predict the oncoming item. Examples of the ungrammatical and grammatical item pairs for each type of error are illustrated below.

Experimental items (five types, both grammatical and ungrammatical):

a. GAUXC:*Are you get the permission to enter the office?
   Do you get the permission to enter the office?
b. GAUXT: * Before their final decision, what do they say in the meeting?
   Before their final decision, what did they say in the meeting?
c. GAUXA:*Do your uncle live in the new neighborhood nearby?
   Does your uncle live in the new neighborhood nearby?
d. GAUXO:*Will be he giving a presentation at the conference?
   Will he be giving a presentation at the conference?
e. GAUXM:*Have you get a new job offer after the interviews?
   Have you got a new job offer after the interviews?

3.3.3. Variable Manipulation

This study is designed to find out whether EFL learners can acquire implicit knowledge of typical English questions, as measured by participants' reaction times in response to the target word in both grammatical and ungrammatical sentences. The reaction time reflects the participants' sensitivity to grammar violations in morphosyntactic errors in English questions. For example, in the paired test sentences, *When did they went to the fun park yesterday?/When did they go to the fun park yesterday?*, by comparing the participants' Reaction Time (RT) on the target words *the fun park*, we can determine whether participants are sensitive to grammatical violations. The preposition "to" was not included as part of the target words, because of its status as an unstressed functional word, which is easily missed in audio recordings. As pointed out by Jiang (2013: p. 196), "One can be quite flexible in choosing targets. It can be any word that happens to be at a particular location in a sentence." The concept of the grammatical sensitivity index (GSI) developed by Suzuki [55] was introduced in this study, comparing participants' reaction times in response to ungrammatical and grammatical sentences. A longer delay in RT for the ungrammatical item revealed the participants' grammatical sensitivity.

Each learner's language background is an important variable that may influence their acquisition of implicit knowledge. Therefore, language background was manipulated as an independent variable in the study, which included Spanish and Chinese EFL learn-

ers as experimental groups and native speakers as the referring group. In addition, in order to detect what constitutes an influential factor in EFL learners' implicit knowledge acquisition, we also introduced five types of morphosyntactic errors in question formation as an independent variable to measure their degree of acquisition, compared to native speakers' data.

3.4. Statistical Analysis

After the experiments were completed, we pre-processed the data, and then input them into the Microsoft Excel database. The IBM Statistical Package for Social Sciences (SPSS) version 22.0 (SPSS Inc., Chicago, IL, USA) was used for statistical description and statistical inference. The participants' demographic characteristics were described using descriptive statistics, including the frequency and constituent ratio. The difference in categorical variables in the demographics between groups was tested using the chi-square test, while the difference in the number of years of taking English classes between Chinese speakers (CS) and Spanish speakers (SS) was tested using an independent two-sample *t*-test, with the number of years of English classes as an independent variable and the group as the dependent variable. The Kolmogorov–Smirnov test suggested that the GSI was not normally distributed; however, we selected parametric tests for data analysis for the following two reasons: (1) the Kolmogorov–Smirnov test results flux and are not always reliable as the sample size varies, especially with a large sample size [56]; (2) a normal distribution of GSI was assumed in the present study, based on the histogram, the normal Q-Q plot, and the values for skewness and kurtosis [57]. Therefore, we summarized the GSI using the mean and standard error (SE). Before performing the statistical analysis, the data was preprocessed. We first discarded those values that were more than or less than 2.5 standard deviations from each participant's mean as outliers. Then, a one-way analysis of variance (ANOVA) was applied to examine the overall difference in GIS among the different groups. When a statistically significant result was detected for the overall difference using an ANOVA, a post hoc test was performed using Fisher's least significant difference (LSD) to investigate which group differed from the others in terms of GSI. For all statistical analyses in the current study, a *p*-value of 0.05 was considered to be the statistical significance threshold.

4. Results

4.1. Differences between the Native Speakers' Group and EFL Groups

The participants' grammatical sensitivity index (GSI) values were computed based on the RT difference derived from the mean RT of ungrammatical items, minus the mean RT of the grammatical items. Based on the pre-designed criterion for eliminating outliers, we excluded 105 items from the NS group, 132 items from the CS group, and 158 from the SS group. The mean GSI of the native-speaker group was 125.8 ± 25.8; for the Chinese EFL learner group, it was 40.4 ± 11.4, and for the Spanish EFL learner group, it was 58.9 ± 11.7.

The results of the ANOVA indicated a significant difference among the three groups in terms of mean GSI ($F = 5.630$, $p = 0.004$). The post hoc tests using the LSD test further suggested that the NS group had a mean GSI of 125.8, which was significantly higher compared to that in the CS group (GSI = 40.4, $t = 3.04$, $p = 0.001$) and SS group (GSI = 58.9, $t = 2.55$, $p = 0.008$) indicating that both the Spanish and Chinese advanced EFL learners did not acquire a general implicit knowledge level that was equivalent to the native speakers' level.

However, the difference between the CS and SS groups in terms of the mean GSI was not statistically significant ($t = -1.13$, $p = 0.272$). The results are depicted in Table 2, illustrating that Spanish and Chinese learners of English do not show a significant difference in their overall level of implicit language knowledge acquisition.

Table 2. Results of between-group post hoc analysis with an LSD test.

Comparison	MD	SE	t	p	95% CI	
					Lower Limit	Upper Limit
NS vs. CS	85.469	25.481	3.406	0.001	35.494	135.438
NS vs. SS	66.900	25.077	2.545	0.008	17.720	116.081
CS vs. SS	−18.565	16.910	−1.126	0.272	−51.726	14.595

NS, native speaker; CS, Chinese speaker; SS, Spanish speaker; MD, mean difference; SE, standard error; CI, confidence interval.

4.2. GSI for Different Types of Morphosyntactic Errors

For the five types of error, the results of the ANOVA for each type of error among the three groups are as follows: GAUXA ($F = 1.19$, $p = 0.304$), GAUXC ($F = 4.24$, $p = 0.015$), GAUXM ($F = 1.506$, $p = 0.224$), GAUXT ($F = 2.691$, $p = 0.069$), and GAUXO ($F = 1.367$, $p = 0.256$), suggesting a significant difference among the three groups in terms of GAUXC, that is, the choice of auxiliary. However, the mean GSI scores of the NS group are numerically higher than those of the SS group, followed by the CS group in all types of errors, except for the GAUXT items (see Figure 3). The post hoc test result with the LSD test is shown in Table 3, indicating a significant difference in terms of GAUXC between the Chinese group and the native group ($p = 0.004$) and between the Spanish group and the native group ($p = 0.021$). Meanwhile, the Chinese group showed significantly lower sensitivity compared to the native group ($p = 0.028$) in terms of GAUXT when detecting the morphological inflection related to verb tense in forming questions, while the Spanish group did not show significant differences compared to the native group ($p = 0.163$).
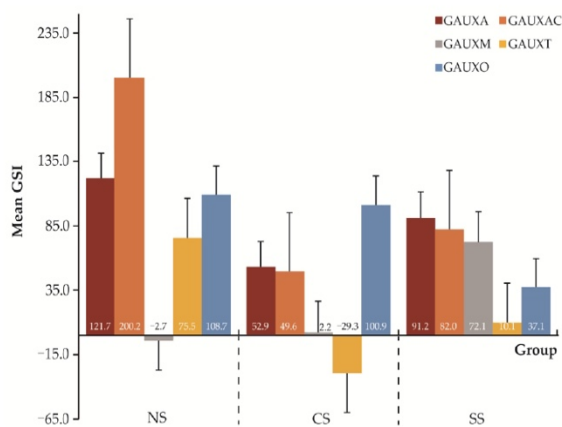

Figure 3. Mean GSI for each morphosyntactic error type.

Table 3. Results of the post hoc comparisons according to error types, with the LSD test.

Error Type	Comparison	MD	SE	p	95% CI Lower Limit	95% CI Upper Limit
GAUXA	NS vs. CS	68.81086	49.00933	0.161	−27.5401	165.1619
	NS vs. SS	30.48046	48.20425	0.528	−64.2878	125.2487
	CS vs. SS	−38.33040	34.16390	0.263	−105.4957	28.8349
GAUXC	NS vs. CS	150.61708	51.76794	0.004 *	48.9547	252.2795
	NS vs. SS	118.18102	50.89790	0.021 *	18.2272	218.1348
	CS vs. SS	−32.43606	35.13534	0.356	−101.4352	36.5631
GAUXM	NS vs. CS	−4.94959	67.90427	0.942	−138.8707	128.9715
	NS vs. SS	−74.77882	66.85778	0.265	−206.6360	57.0784
	CS vs. SS	−69.82922	43.57119	0.111	−155.7605	16.1021
GAUXT	NS vs. CS	104.88754	47.60696	0.028 *	11.2957	198.4794
	NS vs. SS	65.43957	46.84237	0.163	−26.6491	157.5283
	CS vs. SS	−39.44797	28.18437	0.162	−94.8564	15.9605
GAUXO	NS vs. CS	7.72514	62.69404	0.902	−115.5158	130.9661
	NS vs. SS	71.59009	61.91893	0.248	−50.1272	193.3074
	CS vs. SS	63.86496	42.72014	0.136	−20.1123	147.8422

NS, native speaker; CS, Chinese speaker; SS, Spanish speaker; MD, mean difference; SE, standard error; CI, confidence interval; * statistical significance.

5. Discussion

The present study analyzed the GSI, as represented in the RT for ungrammatical and grammatical English questions in a WMT experiment regarding Spanish and Chinese EFL groups. To be specific, the study investigated: (1) the GSI difference between the native-speaking group (NS) and two EFL groups (CS, SS), exploring the degree of implicit knowledge of English questions acquired by advanced EFL learners; (2) the statistical results between advanced EFL learners and the NS group with respect to the morphosyntactic inflections involved in English question formation, revealing whether morphosyntactic inflections may impede EFL learners' implicit acquisition regarding English questions.

5.1. Implicit Knowledge Acquisition for Advanced EFL Learners

As we hypothesized, we found a significant difference in GSI between the NS group and the two EFL groups, revealing that advanced EFL learners did not attain a general level of implicit knowledge in English questions that is equivalent to that of native speakers. As summarized in Section 2, previous research studied EFL learners' acquisition of English questions at different levels, including Spanish learners of English, the topic of subject–verb inversion [25], a corpus analysis of child learners of English from various L1 in acquiring *wh*-questions [26], Indian learners of English [58], Cantonese learners of English [28], and Spanish and Chinese learners' production of questions [27,48]. The studies found that learners had problems with different morphosyntactic inflections, such as subject–verb inversion or subject–verb agreement. However, no systematic investigation had as yet been conducted to explore whether advanced EFL learners can reach a native-like proficiency level with respect to their acquisition of implicit knowledge. By studying a series of potential grammatical errors, including word order, auxiliary choice, tense morphology, subject–verb agreement, and auxiliary and verb morphology, the current study found that proficiency-matched advanced EFL learners from two completely different EFL contexts consistently and uniformly showed that they were not able to acquire native-like implicit knowledge in terms of English questions. Overall, this finding contributes an additional piece of evidence to the preceding studies, supporting their results on the ultimate attainment of native-like implicit knowledge, showing that it is enormously difficult for L2/FL learners to acquire a native-like knowledge of morphosyntactic features, despite this being theoretically possible.

The present study also revealed that the two advanced EFL groups of Chinese and Spanish learners showed a similar overall level of implicit knowledge in terms of English questions. Similar conclusions were drawn on the issue in previous studies. Hopp's [36]

study on the acquisition of L2 inflection showed that it is possible for adult L2 learners to acquire native-like morphosyntactic inflection, such as L2 subject–verb agreement or case inflection; however, L1 transfer is an important constraint for L2 learners in acquiring native-equivalent accuracy of these morphosyntactic inflections. The ultimate attainment of L2 inflectional morphology is extraordinarily difficult for learners whose L1 does not have a congruent morphology, even though acquisition may be possible [39]. Even after L2 learners may have obtained high-level proficiency, they are still confounded by grammatical inflection, with morphological problems such as omission or commission in L2 production [24].

5.2. Major Challenges in EFL Learners' Implicit Knowledge Acquisition of English Questions

Since we found that the two advanced EFL learner groups did not acquire a native-like level of implicit knowledge of English questions, we further explored the experimental data on five different types of errors, in order to ascertain what might constitute the specific difficulties impeding EFL learners from progressing to a native-like level of implicit knowledge. The statistical results in Table 3 revealed that neither group of participants exhibited a significant difference in most of the five types of potential errors, except in the case of GAUXC for Spanish learners, and GAUXC and GAUXT for Chinese learners.

We can relate these specific morphosyntactic problems to Jiang et al.'s [39] morphological congruency hypothesis and can investigate the three predictions that we made regarding the acquisition of morphosyntactic features in English questions by each group of learners. Advanced Spanish EFL learners encountered great challenges in detecting the GAUXC type of error, which indicated that they did not acquire implicit knowledge of the choice of auxiliary in English questions. This finding is in agreement with prediction 1 since auxiliary selection is not found in their L1, Spanish. In Spanish, no *do*-support auxiliary is required to form questions, even if the language does have auxiliaries in other contexts. Advanced EFL learners may be able to use auxiliaries on specific occasions, when they are consciously paying attention to the language forms, but the participants did not detect the grammatical violations when their focus had been directed toward key-pressing and sentence meaning in the experiment, which indicates that no implicit knowledge was available for them to recognize the error subconsciously.

As for the other four types of morphosyntactic errors, GAUXA, GAUXO, GAUXT, and GAUXM, which involve morphological inflections on number, person, and tense, Spanish EFL learners showed a high degree of implicit knowledge, as this first language displays a complex morphosyntactic system for person, number, tense, mood, and aspect features in verbs [59]. This supports the third prediction that Spanish EFL learners performed better on morphosyntactic features that were congruent with morphological inflections in Spanish.

With respect to Chinese, this language has neither auxiliaries nor morphological verb inflections of person, number, or tense (as seen in examples (1c) and (2c), above); thus, no morphological congruency exists at all between Chinese and English questions. Therefore, most Chinese EFL learners rely heavily on the grammatical knowledge they have learned at different stages, progressing to high proficiency by means of practice and communication, which facilitate their language acquisition. Although advanced Chinese EFL learners showed similar levels of implicit knowledge to their Spanish counterparts, they were confronted with more challenges in recognizing GAUXC and GAUXT errors, which means that they did not acquire implicit knowledge in either the choice of auxiliary or in verbal tense morphology in English questions. This finding is in line with the prediction that Spanish EFL learners would outperform Chinese EFL learners in acquiring morphosyntactic features in English question formation because of Spanish's congruent morphological inflections in verbal phrases.

Our findings showed similarities and differences between advanced Chinese and Spanish EFL groups in the acquisition of the implicit knowledge of morphosyntactic features in English questions. The experimental results revealed that the degree of implicit knowledge acquisition of English questions is similar for EFL learners from two differ-

ent L1 backgrounds when they are at an equivalent proficiency level. However, the two groups encountered different challenges in the acquisition of implicit knowledge regarding different types of morphosyntactic features, due to the differences in L1–L2 morphosyntactic congruity. As shown in previous studies [2,14,30,60,61], the L2 linguistic context for L2 acquisition, such as the natural communicative context or L2 country residential experience [14], affected the acquisition of implicit knowledge by L2 learners. The chi-square test results shown in Table 1 indicate that these two groups of EFL learners are at an equivalent level of proficiency and they are both from EFL contexts; however, their different learning backgrounds, such as the year of the onset of L2 learning, residential experience in target language-speaking countries, and the number of years of taking formal English classes, may also partly explain Spanish and Chinese EFL learners' different challenges. Investigating language-learning contexts within the framework of social-cultural theory falls outside the scope of this study but certainly deserves further research.

5.3. Limitations

The present study was conducted within an online environment. There are many advantages of using the online experimental mode. For example, recruited participants can be drawn from different areas of the same L1 background, which may be more representative than targeting participants from a specific language class. However, the drawbacks of the present study cannot be ignored. Although we explicitly stated that participants should have a quiet and undisturbed experimental environment, quality equipment in terms of audio and recorder toolsets, a stable internet connection, and be in a peaceful state, we could not control for other potential factors that may have disturbed them, such as noise, interactions with co-inhabitants, and other distractions affecting their concentration. A pure experimental environment, such as that in a laboratory, would be optimal for the stricter control of disrupting factors. Moreover, we need to acknowledge that L2 learners are more tolerant of errors; however, the present study did not introduce acceptability judgment tasks to the model to investigate our participants' degree of tolerance of the different types of morphosyntactic errors, which is worthy of exploration in future studies.

The hypotheses and experiments were well-grounded in previous studies; however, the sample size of this study is relatively small. In order to magnify the significance and explanatory power of the study, future studies may collect a larger sample from different proficiency levels and L1 backgrounds for more robust hypothesis support.

6. Conclusions

In the current study, we adopted the word monitoring task, to measure the degree of implicit knowledge acquisition of English questions for advanced EFL learners from two different L1 backgrounds and explore the potential effect of L1 morphological influence on their language acquisition process. The grammatical sensitivity index comparing participants' RTs to (un)grammatical sentences was analyzed, and an in-depth exploration was performed with a fine-grained classification of the five different types of grammatical problems, based on the different aspects of the morphosyntactic inflection of English questions. The L1 morphosyntactic features of these questions were discussed to reveal the inhibiting factors for implicit knowledge acquisition for different advanced EFL learners. To sum up, this study revealed that: (1) it is difficult for advanced EFL learners to acquire implicit language knowledge that is equivalent to that of native speakers, despite their having acquired a high level of language knowledge and achieved high English proficiency; (2) EFL learners' different L1 backgrounds do not affect their overall implicit knowledge acquisition; (3) EFL learners encounter distinct difficulties in acquiring implicit knowledge of morphosyntactic inflection in the context of questions, due to L1–L2 incongruency.

Future studies involving EFL learners at different proficiency levels, including beginner, medium, and advanced levels, who are drawn from different L1 backgrounds, may ideally uncover the trajectory of how the influence of the L1 evolves in the L2 acquisition process. In addition, studies investigating the language learning context within the frame-

work of social-cultural theory may be of great significance to improving our understanding of EFL learners' acquisition of implicit knowledge in their unique language contexts.

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Article 3

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An experimental study on grammatical sensitivity and production competence in Chinese and Spanish EFL learners and its implications on EFL teaching Methods

Qiaoling He[1,2*] and Isabel Oltra-Massuet[1]

[1] University of Rovira i Virgili, Spain
[2] Sichuan International Studies University, China

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Abstract:
Implicit knowledge acquired by L2 learners determines their language competence, although it remains an issue that to what extent advanced EFL learners can acquire implicit language knowledge. This study aims at finding out whether advanced EFL learners from two different L1s could acquire a level of implicit knowledge of English questions by using the modified Elicited Oral Imitation Task. A total number of 91 participants were recruited, including a native speaker group, a Chinese EFL learner group, and a Spanish EFL group. The study evaluated participants' implicit language knowledge by assessing two indicators: the grammatical sensitivity index and the production index. Results revealed that both EFL groups displayed a significant difference with the native speaker group in their degree of implicit knowledge of English questions in general. A further comparison of the two indicators showed that while both EFL groups displayed a relatively high grammatical sensitivity to morphosyntactic errors in English questions, their corrective production rate of ungrammatical sentences was notably lower. These results indicate that advanced EFL learners had difficulty in acquiring implicit knowledge of English questions at native speaker' level. These findings also imply a gap between EFL learners' language knowledge level and corresponding language production competence. Targeting this gap within the Interaction-based production-oriented approach pedagogical implications based on were suggested for enhancing EFL learners' language production competence in EFL contexts.

* Correspondence: Dr. Qiaoling He, University of Rovira i Virgili, Tarragona, 43001, Catalonia, Spain

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An experimental study on grammatical sensitivity and production competence in Chinese and Spanish EFL learners and its implications on EFL teaching Methods

Qiaoling He[1,2], Isabel Oltra-Massuet[2]

1. Sichuan International Studies University, Chongqing 400031, China.
2. Universitat Rovira I Virgili, Tarragona 43002, Spain.

Correspondence to:

Qiaoling He, Sichuan International Studies University, No.33, Zhuangzhi Road, Lieshimu, Shapingba District, Chongqing 400031, China. E-mail: heqiaoling@sisu.edu.cn & qiaoling.he@estudiants.urv.cat. Tel: 34 688079876;

Isabel Oltra-Massuet, Faculty of Arts - Campus Catalunya, Avinguda Catalunya, 35, Building D2, Office 2.19, 43002 Tarragona, Spain. E-mail: isabel.oltra@urv.cat

Qiaoling He, ORCID: 0000-0002-9831-2066

Isabel Oltra-Massuet, ORCID: 0000-0003-2802-3856

1 **Abstract:**

2 Implicit knowledge acquired by L2 learners determines their language competence;

3 however, it remains an issue to what extent advanced EFL learners can acquire implicit

4 language knowledge. This study aims at finding out whether advanced EFL learners

5 from two different L1s could acquire a level of implicit knowledge of English questions

6 by using the modified Elicited Oral Imitation Task. A quantitative, experimental study

7 with the Elicited Oral Imitation Task experimental tool was designed. A total number

8 of 91 participants were recruited via the online experimental platform from October to

9 November, 2021, distributed into a native speaker group, a Chinese EFL learner group,

10 and a Spanish EFL group. The study evaluated participants' implicit language

11 knowledge by assessing two indicators: the grammatical sensitivity index and the

12 production index. Independent-sample *t*-test and one-way analysis of variance

13 (ANOVA) were applied to examine the differences in the two indices among different

14 groups. Results revealed that both EFL groups displayed a significant difference with

15 the native speaker group in their degree of implicit knowledge of English questions in

16 general. A further comparison of the two indicators showed that while both EFL groups

17 displayed a relatively high grammatical sensitivity to morpho-syntactic errors in

18 English questions, their corrective production rate of ungrammatical sentences was

19 notably lower. These results indicate that advanced EFL learners had difficulty in

20 acquiring implicit knowledge of English questions at native speaker' level. These

21 findings also imply a gap between EFL learners' language knowledge level and

22 corresponding language production competence. Targeting this gap within the

23 Interaction-based production-oriented approach pedagogical implications based on

24 were suggested for enhancing EFL learners' language production competence in EFL

25 contexts.

26

27 **Keywords:** EFL learners; Implicit knowledge; grammatical sensitivity; language

28 production competence; Interaction-based POA tasks

29

Introduction

The extent to which second language (L2) learners can acquire implicit knowledge (IK) largely determines their language competence, including comprehension and production (Paradis, 2009), but whether L2 learners can acquire IK has remained a matter of debate (VanPatten et al., 2020). It is not unusual for researchers and practitioners to see that advanced English as a Foreign Language (EFL) learners who can articulate grammar rules and perform excellently in various written examinations still produce ungrammatical morpho-syntactic structures in sentences that appear to be simple in spontaneous oral communication. This kind of 'what I know' and 'what I can' incongruity aroused our interest to experimentally probe whether EFL learners' language knowledge and language production competence develop simultaneously as that of native speakers. A number of previous studies have investigated L2 learners' implicit language knowledge by testing their grammatical sensitivity (Abrahamsson & Hyltenstam, 2008; Roberts & Siyanova-Chanturia, 2013; Suzuki & DeKeyser, 2017b; Tokowicz & MacWhinney, 2005; Zhang, 2015), whereas little research has studied learners' language production, despite its importance in evaluating learners' L2 acquisition (Grüter et al., 2012; Kowal & Swain, 1994; VanPatten & Williams, 2015). Aiming at finding out whether and to what extent advanced EFL learners can acquire L2 IK, the present study first addresses the issue of IK acquisition by comparing advanced Chinese and Spanish EFL learners' imitated production of English questions with native speakers, with an experiment subsuming a consecutive process of grammatical sensitivity and language production. The second objective of this study is to delve into the language acquisition trajectory for EFL learners. We tackle the development of language knowledge and language production competence through the analysis of the experimental data unveiling learners' grammatical sensitivity and production competence. Finally, building on the experimental findings, the study puts forward a series of pedagogical implications for course designers and class practitioners in EFL contexts, targeting at enhancing learners' language production competence.

The following two research questions are formulated to address the first and second goals, the IK acquisition and the development of grammar knowledge and production competence.

RQ1: Do advanced EFL learners from different L1s acquire native-equivalent IK in English questions?

RQ2: Does advanced EFL learners' language production competence develop simultaneously with their grammatical knowledge of English questions?

Background

Implicit Knowledge and its measurements

The concept of implicit knowledge is elusive and has proved difficult to confront

69 against the notion of general knowledge learning. To address this issue, Berry (1987)
70 distinguished two types of IK, the IK that was once explicit and declarative and the IK
71 that arose from implicit learning, which had never been explicit. In the domain of
72 language acquisition, the former kind of IK defined by Berry explains the L2 learning
73 process in EFL learners, while the latter accounts for the First Language (L1)
74 acquisition process in native speakers. In L2 acquisition, Ellis & Roever (2018) defined
75 implicit language knowledge as the knowledge that learners have not consciously
76 noticed but can access in spontaneous language production through automatic
77 processing, even if it cannot be verbalized. Ellis (2005) summarized the key
78 characteristics of IK through seven properties: intuitive awareness, procedural
79 knowledge, systematicity, automatic processing, accessibility in fluency performance,
80 non-verbalizable language rules, and learnability.
81 Among all the seven characteristics categorized by Ellis (2005), learners' awareness of
82 grammar has been the focus in studies of implicit language knowledge measurement
83 (Kim & Nam, 2016; Roehr-Brackin, 2020; Spada et al., 2015; Suzuki & DeKeyser,
84 2017b; Zhang, 2015). To measure learners' IK, some studies have tested learners'
85 grammatical awareness in the process of language comprehension using tools such as
86 timed grammatical judgment, word monitoring test, or self-paced reading, *i.a.*
87 (Gutiérrez, 2013; Suzuki, 2015; Suzuki & DeKeyser, 2017). Other research has
88 evaluated learners' grammar awareness in the process of language production
89 employing tools such as elicited imitation or oral narrative (Ellis, 2005; Erlam, 2006;
90 Spada et al., 2015; Suzuki & DeKeyser, 2017a; Zhang, 2015). These previous findings
91 laid a sound empirical foundation for further experimental studies on implicit
92 knowledge. However, existing studies, by either collecting data in language
93 comprehension or language production, only took learners' awareness as the indicator
94 for evaluating learners' implicit knowledge, without paying much attention to learners'
95 production, although production is regarded as essential for explaining the language
96 acquisition process (Grüter et al., 2012; Guasti et al., 2012; Kowal & Swain, 1994;
97 MacDonald, 2013; McDonough & Chaikitmongkol, 2010). Considering the role
98 language production plays in language acquisition, the present study aims at focusing
99 on both learners' awareness of grammar (grammar sensitivity) and competence of
100 production (corrective language production) to explore implicit language knowledge
101 taking the acquisition of English questions by EFL learners as empirical target basis.
102 The study will evaluate the level of advanced EFL learners' implicit knowledge through
103 these two perspectives and explore whether advanced EFL learners' competence of
104 production develops simultaneously with their grammar knowledge in English
105 questions.

106 *Grammatical sensitivity*

107 Grammatical sensitivity, according to Sasaki (2012), was defined as learners' ability to

108 identify the grammatical role of certain words or sentence components in given
109 sentence structures. Students with grammatical sensitivity were able to detect
110 relationships between words and their grammatical function in the sentence (Vanpatten
111 et al., 2013). In Sasaki (2012) & Vanpatten et al. (2013), grammatical sensitivity was
112 defined as learners' ability to recognize the grammatical roles of sentence components,
113 but in more recent studies (Abrahamsson & Hyltenstam, 2008; Keating, 2009; Roberts
114 & Siyanova-Chanturia, 2013; Tokowicz & MacWhinney, 2005), grammatical
115 sensitivity refers to the sensitivity degree that learners show to grammatical violations
116 in ungrammatical structures. The event-related brain potentials (ERPs) data from
117 Tokowicz and MacWhinney (2005) suggested that L2 learners across different
118 proficiency levels were implicitly sensitive to grammatical violations. Keating (2009)
119 found that grammatical sensitivity displayed by adult L2 Spanish learners can be a
120 robust predictor of their aptitude to acquire the structure of gender agreement.
121 Abrahamsson & Hyltenstam (2008) suggested that late learners' high grammatical
122 sensitivity indicated their high language proficiency. Roberts & Siyanova-Chanturia
123 (2013) supported that assessing learners' sensitivity to ungrammatical sentence
124 structures in processing comprehension can uncover how that acquired language
125 knowledge is used in real-time language processing.
126 These studies revealed that sensitivity to grammatical violation is an important
127 indicator in assessing L2 learners' IK acquisition (Suzuki, 2017; Vafaee et al., 2017).
128 The present study adopted the concept of grammatical sensitivity in terms of learners'
129 reactions to grammatical violations to evaluate EFL learners' level of implicit
130 knowledge in acquiring morpho-syntactic structures of English questions. Therefore,
131 grammatical sensitivity in this study is exclusively defined as the learners' capacity to
132 recognize the grammar components in English questions tacitly and to unconsciously
133 display a delay in reaction to the ungrammatical features in English questions under
134 experiment. The grammatical sensitivity index, referring to the percentage of
135 ungrammatical sentences detected by participants, is used to quantify learners'
136 sensitivity levels.

137 ***Language production***
138 Language production, together with language comprehension, constitutes an
139 interwoven process in the development of language competence when language
140 learners receive input and create output. Recent research done by cognitive
141 psycholinguists such as Pickering & Garrod (2007) regarded that language
142 comprehension and production came from the same system, and the production system
143 was used when prediction and imitation were activated to emulate how imitation and
144 comprehension worked. According to Krashen's (1982) monitor theory, accurate and
145 fluent language production is initiated with the acquired system of knowledge.
146 Language production promoted learners' language learning by helping learners become

147   aware of their existing grammar knowledge gap and enhance their awareness of the

148   links between forms, function, and meaning, which played an important role in L2

149   acquisition (Kowal & Swain, 1994). Language production reveals learners' real-time

150   processing of language structure, which provides important data for analysing learners'

151   persistent difficulty in acquiring specific language structures (Grüter et al., 2012). As

152   an additional indicator for learners' acquisition of linguistic knowledge, L2 learners'

153   production offers an approach to studying the degree of knowledge acquired by L2

154   learners. However, so far, not much research focusing on production has been done

155   because of the difficulty in designing an appropriate task to measure learners' language

156   competence (VanPatten & Williams, 2015). In particular, it is not feasible to capture

157   language data in natural language to study a specific target structure. The present study

158   conducts a production experiment to overcome the issue raised by Gass & Mackey

159   (2015) that participants may avoid producing the target structures, eliciting participants

160   to generate the structures of interest with stimuli sentences. We specifically defined

161   learners' production as the number of sentences participants produced with given

162   stimuli. In the elicitation process, participants noticed the ungrammatical features and

163   made corresponding grammatical sentences. We use the production index to designate

164   the percentage of participants' corrective production of ungrammatical experimental

165   sentences.

166   ***The Oral Elicited Imitation Test (OEIT)***

167   The study chose the elicited oral production test to collect data for measuring EFL

168   learners' IK from language production among the three major categories of

169   experimental methods: (1) a battery of tests including timed grammatical judgment,

170   OEIT, and oral narrative designed by Ellis (2005); (2) a series of reaction time (RT)

171   tests (Suzuki, 2015) covering visual word paradigm, word monitoring test, and self-

172   paced reading; and (3) a set of cognitive neurolinguistic tools comprising eye-tracking

173   (Conklin & Pellicer-Sánchez, 2016; Keating, 2009; Maie & Godfroid, 2021), event-

174   related potentials (ERPs) (Dowens et al., 2011; Martínez de la Hidalga et al., 2021;

175   Tokowicz & MacWhinney, 2005), and functional magnetic resonance imaging (fMRI)

176   (Xue et al., 2004; Yokoyama et al., 2006). The OEIT has been considered a promising

177   option since in RT tests and cognitive neurolinguistic experiments, participants were

178   tested mainly in comprehension, not involving learner production, which leaves the

179   question of whether there is a gap between learners' sensitivity and production unsolved.

180   The OEIT originated from elicited imitation (EI) that can be dated back as early as the

181   1970s. Early researchers, such as Crain and Thornton (1983), had designed elicited

182   production to perform empirical studies of learners' language competence. However,

183   there has been constant questioning over its effectiveness. Vinther (2002) reviewed

184   studies on the application of EI in child language, neuropsychology, and second

185   language research from 1970 to 1994 and suggested that EI was able to test learners'

186　process of language in comprehension and production under the condition that it was
187　applied with careful consideration of variables such as imitation process, the stimulus
188　length and structure, and linguistic contextual support. On the state that stimuli sentence
189　items of target grammatical features are well-designed, EI could test both learners'
190　sensitivity to knowledge in tacit forms as well as learners' competence in production
191　directly. In the present study, we modified the experimental stimuli sentences by fully
192　considering variables such as sentence length, structure, and contextual support to
193　ensure effective measurement of learners' grammar sensitivity as well as their
194　production.

195　The OEIT caters best to the research goals of the present study in the sense that it
196　incorporates experimental procedures testing participants' tacit grammatical judgment
197　and direct corrective production. With OEIT experimental data, the authors are able to
198　dissociate participants' performance into grammatical sensitivity and language
199　production indexes. Moreover, the OEIT has been regarded as an effective tool for
200　measuring learners' IK, with its measuring power for language learners' knowledge
201　having been replicated and validated in previous research (Bowles, 2011; Kim and Nam,
202　2016; Spada et al., 2015; Zhang, 2015). In contrast to earlier studies employing OEIT,
203　the current study intends to go beyond validating and replicating the findings. We adopt
204　the OEIT test tool in this study to collect data from participants' production, intending
205　to investigate the participants' performance from the perspectives of both grammatical
206　sensitivity and production competence.

207　As reviewed in this section, grammatical sensitivity and language production are two
208　crucial indices for studying implicit knowledge, and OEIT can actually test both.
209　Existing studies on implicit knowledge have mainly focused on analysing grammatical
210　sensitivity, without paying much attention to the production index. In fact, previous
211　OEIT studies have not focused on the production index, either. However, OEIT tasks
212　tacitly tested participants' sensitivity to grammatical violation and consecutively tested
213　the production of experimental sentences, thus offering the possibility to study both
214　sensitivity and production. In contrast to previous research, the present study analyses
215　implicit knowledge acquired by EFL learners from the perspectives of both
216　grammatical sensitivity and production competence and further investigates the
217　development of grammar knowledge and production competence of participants.

218　**Methodology**

219　*Research design*

220　A quantitative study with the OEIT experimental tool is designed to reveal EFL learners'
221　degree of implicit knowledge and explore the relationship between the acquisition of
222　language knowledge and language competence.

223　*Participants*

224　The sample size is based on related studies in SLA (Ellis, 2005; Suzuki & Dekeyser,

225 2015; Suzuki & DeKeyser, 2017b). All participants were recruited with simple random
226 sampling via the experiment participants' recruitment platform https://www.prolific.co/,
227 which directs participants straight to the experiment platform (www.Gorilla.sc). The
228 study recruited a total number of 91 participants, but only received valid data from 84
229 participants, comprising monolingual English native speakers (n = 12), Chinese (n =
230 35), and Spanish (n = 37) learners of English, after removing those who did not correct
231 any grammatical sentences or provided less than 75% correct answers to
232 comprehension judgments. All native speaker participants are monolingual English
233 speakers, with an education level of undergraduate or above. All EFL participants are
234 advanced learners with an English proficiency level at or equivalent to the C1 level
235 following the CEFR (*The Common European Framework of Reference for Languages*).
236 We further qualified all participants by adding a short C1-level test, filtering out those
237 who could not give three correct answers to five questions. The short C1-level test
238 comes directly from the official Cambridge English test paper, so the test content is
239 reliable for testing participants language proficiency. Before the experiment, we
240 conducted a pilot test with the short C1-level with 8 EFL learners for validation. By
241 comparing their test results with their reported C1-level scores, we got a Spearman
242 correlation coefficient of 0.761 (p=0.028), showing that the short C1-level test has high
243 validity. Participants from both EFL groups are equivalent in their age, education, and
244 starting time of English learning, guaranteeing an effective comparison of the
245 experimental data. Participants were aged from 18 to 40, most of whom were in the age
246 range 21-40 years old. Over 90% of participants were undergraduates or graduates, and
247 most of them started to learn English in primary or secondary school (Appendix A
248 shows detailed demographic information of participants).

249 ***Experimental Tool***
250 Aimed at testing participants' grammatical sensitivity and corresponding production
251 ability, we created a modified experimental tool based on the OEIT (Ellis, 2005). The
252 test in the present study adopted essential criteria for operationalizing constructs from
253 Ellis (2005): intuitive, time-pressure, meaning-focused, and consistent responses
254 without relying on explicit grammatical rules.
255 The OEIT was updated and revised in the following aspects. First, we added pictures
256 to test participants' understanding of the content of experiment sentences. Linguistic
257 structures tested in OEIT in previous studies were mainly statements, allowing
258 participants to make immediate True/False judgments right after listening to sentence
259 prompts without extra incentives. But in this study, all experimental sentences are
260 questions, with equal amount of grammatical and ungrammatical statements included
261 as fillers to disguise our experimental aim on questions. It is thus impossible for
262 participants to make meaning-focused True/False judgments directly. We presented
263 pictures on the screen simultaneously with the recording to test participants'

8

264 comprehension of experimental sentences. Second, two improvements discussed in
265 previous validation research (J. E. Kim & Nam, 2016; Spada et al., 2015) were also
266 incorporated into the present test. Since truth-value judgment (used in Spada et al., 2015)
267 is based on the content of the given sentences and is more objective than the belief
268 statement, the current test chose to use truth-value judgments to ensure that learners
269 have processed the sentence stimuli for meaning. True/False judgment was designed in
270 choice (A/B) to test participants' understanding of the content; furthermore, a time limit
271 was added to the test, which allowed participants 20% more time than native speakers
272 (used in J. Kim & Nam, 2017).

273 After we designed the initial experimental sentence items, two native speakers were
274 invited to check the naturalness, understandability, and grammaticity of each
275 grammatical item to confirm the face validity of the items. Based on their feedback, we
276 revised all points they provided with correction feedback. Furthermore, to testify the
277 experimental validity and responsibility of the modified OEIT, we conducted a pilot
278 study with 8 native speakers. The results of the pilot study showed a 100% response
279 rate, with an averaged accuracy of 96.9% in grammatical sensitivity, and 96.6% in
280 production competence, suggesting that this modified OEIT effectively measured the
281 level of implicit knowledge.

282 ***Experimental Procedures***

283 The experiment was approved by the Research-Innovation Ethics Committee from
284 Universitat Rovira i Virgili, Tarragona, Spain. The whole experiment was conducted in
285 the online platform www.Gorilla.sc. After participants read the experimental instruction
286 and ticked the consent form, they filled out a questionnaire about their language
287 learning background. Participants were automatically directed to the experiment page
288 after passing a short proficiency test. The instructions were displayed on the screen with
289 words, pictures, and audios. They informed participants that they might hear a
290 grammatical or an ungrammatical sentence. While the audio (the stimulus) was played,
291 participants had to press a key as a response when they heard the target word that was
292 displayed on the screen. The target word was presented simultaneously to the entire
293 duration time of the audio stimulus. Participants needed to respond quickly by pressing
294 the key before the experimental webpage automatically switched to the next screen.
295 Participants' RT for measuring sensitivity was automatically recorded by the online
296 experimental platform when the key was pressed. To further confirm the authenticity of
297 the RT, pictures (including one picture that revealed the situation/content and one
298 unrelated picture) were used to check whether participants understood the meaning of
299 the stimuli sentences. They needed to choose the picture that matched the content of
300 each sentence. Next, participants were guided to repeat the sentences orally using
301 correct English, and their productions were audio recorded. After the instruction, they
302 completed five practical trials and could choose to re-practice if necessary. All their

303   comprehension answers and their utterances were recorded as experimental data. The

304   experimental procedure is shown in Figure 1.

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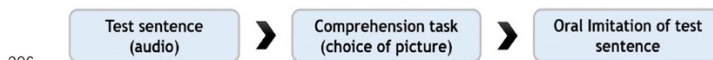
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307   Figure 1. Experimental procedures of Elicited Oral Imitation Task

308

309   *Scoring*

310   Before scoring, filler sentences and invalid experimental sentences with incorrect

311   comprehension judgments were eliminated, and we only kept the critical experimental

312   sentences with correct comprehension judgments. The scoring criterion was based on

313   obligatory occasions (Dulay and Burt, 1973). In this case, only matched question

314   structures produced by participants were included in the analysis because participants

315   needed to form the same type of question structure as what they heard in the audio.

316   Each participant's grammatical sensitivity and production accuracy score was marked

317   separately. One score was given for a correct response and zero for an incorrect one,

318   with a total score ranging from 0 to 40. A higher score indicated a higher sensitivity or

319   production accuracy. The scoring was independently done by one researcher and a

320   research assistant, and the score of each item was double checked. Any disagreement

321   in scores was solved after discussion. The scoring criteria in terms of sensitivity and

322   production score for ungrammatical and grammatical experimental items are specified

323   in Appendix B.

324

325   **Statistical analysis**

326   Descriptive statistics, including frequency and constituent ratio, were used to describe

327   participants' demographic characteristics and the overall performance of each group in

328   grammatical sensitivity and language production. The Kolmogorov-Smirnov test

329   suggested that the grammatical sensitivity and language production were not normally

330   distributed; however, we selected parametric tests for data analysis due to the following

331   two reasons: (1) the Kolmogorov-Smirnov test results flux and are not always reliable

332   as the sample size varies, especially with a big sample size (Steinskog et al., 2007); and

333   (2) normal distribution of these two indicators was assumed in the present study based

334   on the Histogram, the Normal Q-Q Plot, and values of skewness and kurtosis (Ho & Yu,

335   2015). Therefore, we summarized grammatical sensitivity and language production

336   using mean and standard error (SE). Meanwhile, independent-sample t-test and one-

337   way analysis of variance (ANOVA) were applied to examine the difference in

338   grammatical sensitivity and language production among different groups. When a

339   statistically significant result was detected for the overall test using ANOVA, a post-

340   hoc test was performed using Fisher's Least Significant Difference (LSD) to investigate
341   which group differed from the others in terms of grammatical sensitivity and language
342   production. All statistical analyses were performed by using IBM Statistical Package
343   for Social Sciences (SPSS) version 22.0 (SPSS Inc., Chicago, United States). A two-
344   tailed p <0.05 indicated statistical significance.
345
346   **Results**
347   *Descriptive data*
348   The participants produced 3360 valid utterances. Among these sentences, 480 were
349   from native speakers, 1480 were from Spanish EFL learners, and 1400 were from
350   Chinese EFL learners. Native speakers showed grammatical sensitivity in 470
351   sentences (97.9%) and produced 468 sentences correctly (97.5%), indicating they are
352   extremely sensitive to grammatical errors and highly proficient in correcting
353   grammatical errors automatically. In comparison to the Spanish group, which produced
354   1295 (87.5%) and 1224 (82.7%) correct sentences out of 1480 total, the Chinese EFL
355   group demonstrated grammatical sensitivity at 1186 (about 84.7%) and produced 1102
356   (78.7%) correct sentences.
357   The results showed that EFL learners developed a high sensitivity to ungrammatical
358   structures, but their production lagged. To explore the relationship between sensitivity
359   and production competence, we looked into the data of the native speaker group and
360   the two EFL learner groups. We observed that native speakers corrected about 99.5%
361   (468 out of 470) of ungrammatical sentences to which they showed grammatical
362   sensitivity, i.e., they produced almost all ungrammatical sentences in correct forms. The
363   results indicated a high degree of IK in their native language. For Chinese and Spanish
364   learners, they successfully corrected 92.9% (1102 out of 1186) and 94.5% (1224 out of
365   1295) of the sentences where they detected grammatical errors (Table 1). The results
366   revealed that advanced EFL learners could correct most ungrammatical errors they
367   recognized, but their correction rates were much lower.
368   Table 1. Response in Grammatical sensitivity & Production and Percentage (in
369   Parentheses)

	Sensitivity	Production	Production-Sensitivity
NS group	470 (97.9%)	468 (97.5%)	468 of 470 (99.5%)
CH group	1186 (84.7%)	1102 (78.7%)	1102 out of 1186 (92.9%)
SP group	1295 (87.5%)	1224 (82.7%)	1224 out of 1295 (94.5%)

370   NS, native speaker; CH, Chinese speaker; SP, Spanish speaker.
371   *Results of between-group difference in sensitivity and production*
372   Results of ANOVA indicated a significant difference in the overall score of sensitivity
373   (F=9.59, p=0.000) and production (F=13.69, p=0.000) among the three groups.

11

374 Furthermore, the LSD post-*hoc* multiple comparison tests showed that the mean
375 sensitivity and production scores for the native group were respectively 39.2 and 39 out
376 of 40 in total, significantly higher than the Chinese group with a large effect size for
377 sensitivity (MD=5.28, SE=1.21, $p<0.001$, Cohen's d=0.822) and a medium effect size
378 for production (MD=7.51, SE=1.44, $p<0.001$, Cohen's d=0.691), and the Spanish group
379 with a large effect size for sensitivity (MD=4.12, SE=1.20, $p=0.001$, Cohen's d=0.637)
380 and with a large effect size for production (MD=5.92, SE=1.43, $p<0.001$, Cohen's
381 d=0.535). However, the difference in sensitivity and production between the two EFL
382 groups was not significant, with a small effect size (MD=-1.11, SE=0.85, $p=0.195$,
383 Cohen's d=0.219) for sensitivity and a small effect size (MD=-1.60, SE=1.015, $p=0.120$,
384 Cohen's d=0.183) for production (see Table 2). Even though the two advanced EFL
385 groups were highly sensitive to ungrammatical structures and were able to produce
386 grammatical sentences with an accuracy rate of about 80%, they were at significantly
387 lower level of sensitivity and production compared to native speakers.

388 Table 2. Results of between-group multiple comparisons with LSD test

Test type	Comparison	MD	SE	*p*-value	95% CI Lower limit	Upper limit
Sensitivity	NS vs CH	5.2809*	1.20854	.000*	2.8763	7.6856
	NS vs SP	4.1666*	1.20018	.001*	1.7787	6.5546
	CH vs SP	-1.1142	.85186	.195	-2.8092	.5807
Production	NS vs CH	7.5142*	1.43931	.000*	4.6505	10.3781
	NS vs SP	5.9189*	1.42935	.000*	3.0750	8.7629
	CH vs SP	-1.5953	1.01452	.120	-3.6139	.4232

389 NS, native speaker; CH, Chinese speaker; SP, Spanish speaker; MD, mean difference;
390 SE, standard error; CI, confidence interval.

391 **_Results of within-group of sensitivity and production_**
392 We analysed participants' sensitivity and production scores in order to further examine
393 whether there was a notable gap between participants' grammatical knowledge and
394 production competence. The results showed no significant difference with a medium
395 effect size (t=1.483, p=0.166, Cohen's d=0.605) in the NS group, but a significant
396 difference in the Chinese with a large effect size (t=7.364, $p<0.001$, Cohen's d=1.760)
397 and Spanish group with a large effect size (t =8.703, $p<0.001$, Cohen's d=2.023) (see
398 Figure 2). The results demonstrated that native speakers possessed a high degree of
399 implicit language knowledge that enabled them to produce correct sentences
400 automatically. However, the results from Chinese and Spanish EFL learners revealed
401 that, even at an advanced level, there was a notable difference between their language
402 knowledge and language production competence.
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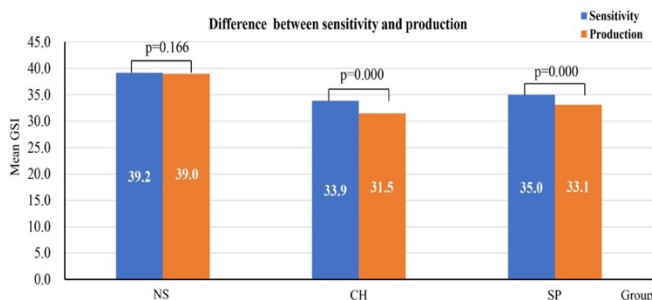
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405   Figure 2. Paired *t*-test of difference between sensitivity and production. NS, native
406   speaker; CH, Chinese speaker; SP, Spanish speaker.

407

408   **Discussion**

409   The present study first shows that Spanish and Chinese advanced EFL learners have
410   hardly acquired native speakers' IK of English questions. The results also reveal that
411   advanced EFL learners' language production competence falls behind their language
412   knowledge acquisition. This section will discuss EFL learners' acquisition of English
413   questions by analysing learners' IK level and the development of language production
414   competence from the perspectives of grammatical sensitivity and language production.

415   *Implicit knowledge of native speakers and advanced EFL learners*

416   The results of both between-group and within-group comparisons answered the first
417   research question. First, the native and EFL between-group comparisons showed that
418   both Spanish and Chinese EFL learners' sensitivity and production scores are
419   significantly lower than Native speakers (as shown in Table 2), which suggests that EFL
420   learners do not possess the same IK as native speakers. Therefore, we may conclude
421   that it is difficult for EFL learners to acquire IK, even at an advanced proficiency level.
422   As elaborated in the previous section, language learners who acquire IK are supposed
423   to be highly sensitive to morpho-syntactic errors and capable of producing grammatical
424   language with a high accuracy rate.

425   Another difference between EFL learners and native speakers comes from the
426   comparison of their capacity for correcting morpho-syntactic errors to which they
427   showed sensitivity. From the Production-Sensitivity data in Table 1, we can see that
428   native speakers correct almost every error they detect, while the Chinese group and the
429   Spanish group show a relatively lower correction rate. We assume that IK refers to an
430   equivalency between sensitivity and production. Native speakers can make
431   grammatical sentences automatically because their IK enables them to produce them as
432   soon as they subconsciously recognize ungrammatical features. Therefore, for learners

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433   who have acquired IK, there should not be a significant gap between their grammatical
434   sensitivity and production competence. However, the sensitivity-production gap
435   reflected in both Chinese and Spanish groups is significant (shown in Figure 2), which
436   suggests that the grammatical knowledge they acquired is not implicit. They did not
437   show equivalent automatic correction to morpho-syntactic errors they recognized.
438   These findings allow us to conclude that advanced EFL learners may have acquired
439   some L2 IK but not IK *per se* of the native speakers.

440   Moreover, the native speaker group shows high consistency between their grammatical
441   sensitivity and production, because their implicit L1 knowledge enables them to
442   produce correct sentences as soon as they tacitly recognize the grammatical violation.
443   It is sensible for us to propose that the consistency in the native group and inconsistency
444   in the EFL groups stem from the difference in their degree of implicit language
445   knowledge. As discussed above, native speakers could spontaneously produce norm-
446   conforming language without relying on conscious grammar knowledge (Ellis &
447   Roever, 2018). Native speakers' L1 acquisition depends mainly on the IK they acquired
448   via implicit learning, while EFL learners' L2 acquisition generally comes from explicit
449   and implicit knowledge through both explicit and implicit learning (Hulstijn, 2005).
450   Native speakers and EFL learners acquire the language in distinct contexts and
451   processes, which causes differences in the knowledge they acquire. We can surmise that
452   advanced EFL learners' differences in sensitivity and production stem from their lack
453   of IK on par with their native counterparts.

454   ***Grammatical sensitivity vs. production competence***
455   Grammatical sensitivity reflects learners' degree of acquired language knowledge,
456   which subsequently influences their production competence (Vanpatten et al., 2013).
457   Therefore, in this study, we studied advanced EFL learners' grammatical knowledge
458   level and language production competence to answer the second research question. We
459   found that both Chinese and Spanish EFL learners show more robust competence in
460   language sensitivity than in production, so we suggest that this inequivalence indicates
461   that (1) advanced EFL learners' grammatical knowledge develops prior to their
462   production, and thus their acquisition process in EFL contexts tends to be more explicit,
463   and that (2) advanced EFL learners still confront difficulty in accuracy when they are
464   outputting language in a time-pressed automatic production.

465   Previous research studying learners of various L2 also showed that language learners
466   faced difficulty in attaining production competence regarding some grammatical
467   features, despite an advanced language proficiency level. Grüter et al. (2012) found that
468   high-proficiency L2 Spanish learners showed difficulty in gender marking for nouns
469   with real-time processing in an elicited production task. Siyanova & Schmitt (2008)
470   reported that advanced Russian learners of English could not automatically produce
471   English collocations with the same fluency as native speakers.

472   Our result that Chinese and Spanish EFL learners' grammatical sensitivity significantly
473   exceeded their production competence was also supported by a few previous studies on
474   language perception and production. Linebaugh & Roche, (2015) found that L2 learners'
475   accurate production is generally preceded by their L2 perception, even though
476   production may enhance learners' perception. Ahmadian (2012) supported L2 English
477   learners of lower, intermediate, and even advanced proficiency showed problems
478   producing accurate English articles, although they learned the grammar knowledge of
479   articles well. The findings of the present study further confirm that EFL learners
480   confront problems building some structures even though they are familiar with related
481   grammar knowledge. Our study contributes additional evidence showing that advanced
482   EFL learners' language competence of production does not develop simultaneously
483   with their grammatical knowledge. Targeting the problem of the unbalanced
484   development of EFL learners' language knowledge and language production
485   competence, the following section will offer pedagogical implications for practitioners
486   to improve learners' production competence in the EFL contexts.

487   **Pedagogical Implication**

488   *Implicit Knowledge fostering EFL context*

489   A primary concern for improving learners' production competence is to promote EFL
490   learners' degree of IK, which, to be specific, lies in how to encourage the simultaneous
491   development of learners' language knowledge and production competence. It is closely
492   related to how to convert the 'monitoring' function of grammar knowledge into the
493   'driving' power from subconscious grammar sensitivity. The conversion process highly
494   conforms to the first type of IK in the seminal definition by Berry (1987), namely, the
495   IK that was once explicit and declarative but gradually evolved into subconscious IK.
496   Berry (1987) described a classical three-stage model of the IK formation process
497   comprising a cognitive stage, an associative stage, and an autonomous stage (as shown
498   in Figure 3). According to Berry's (1987) model, implicit knowledge develops in three
499   stages: the cognitive stage, where instruction or observation aids in knowledge
500   acquisition; the associative stage, where practice helps to transform knowledge
501   acquired in the previous stage into production; and the autonomous stage, where
502   practice allows learners to process knowledge to the degree that they unconsciously
503   produce what they have learned, at which point it becomes procedural or implicit. To
504   gauge our EFL participants' performance, we found that learners showed grammatical
505   sensitivity but could not produce certain grammatical structures correctly. This suggests
506   that in their learning process, learners were still in the cognitive stage and had only
507   learned some grammatical rules of the structure, and they had not yet reached the
508   associative and autonomous stages. To 'implicitize' the knowledge from its declarative
509   and explicit predecessor, it is crucial to assist language learners in moving from the
510   cognitive stage to the associative stage, where they can use the language structures in

511   correct forms. And it is important to foster learners' IK acquisition when moving from
512   the associative stage to the autonomous stage in which they can produce language
513   'without thinking'. From Figure 3, we can see that in the two transitions of the in-
514   between stage, a key word 'practice' is mentioned. To put it in the domain of L2
515   acquisition, 'practice' does not mean, in no way, to do mechanical drills and repetitions
516   to promote learners' acquisition of IK. Instead, we consider that it will be effective if
517   'practice' is conducted in production-oriented learning activities based on meaningful
518   interactions in communicative episodes.

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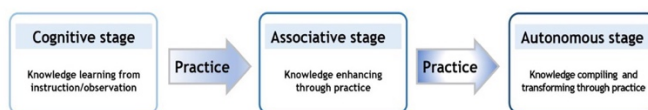
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521   Figure 3. Berry (1987)'s three-stage model of IK acquisition

522

523   ***Production-oriented & interaction-based EFL pedagogical principles***
524   In EFL environments, classroom-based language teaching and learning contexts are
525   prevailing. Therefore, pedagogical concepts must assist teaching designers or
526   practitioners to "foster acquisition-rich interaction" (Ellis, 2017). To reduce the
527   discrepancy between grammar knowledge and language production identified in our
528   study among EFL learners, we propose constructing language class activities that are
529   production-oriented (Wen, 2018) and interaction-based (Adams & Oliver, 2019; Ellis,
530   2017; Oliver et al., 2017). The following subsections provide more details on the
531   concepts we put forward.

532   ***Production-oriented Approach   tasks***
533   In EFL contexts, one of the most prominent challenges teachers and learners must face
534   is the lack of natural communicative contexts for learners to practice the L2. We suggest
535   that creating communicative contexts in the teaching process focusing on output be
536   conducive for learners to produce an L2. Meanwhile, how to encourage learners'
537   willingness to produce the target language structures is also a pedagogical concern that
538   practitioners need to consider. Wen's (2018) ***Production-oriented Approach*** (POA)
539   tasks offer teaching guidelines to solve the problem of insufficient communication and
540   production in EFL contexts. In POA, the first stage, namely the motivating stage, aims
541   at getting learners prepared to participate in activities and notice their gaps in
542   knowledge and competence (He & Oltra-Massuet, 2021). Language learners are
543   encouraged to recognize their own deficiencies in language knowledge. During this
544   process, they may resort to their explicit language knowledge, which serves as the basis
545   for their subsequent production. In the second stage of POA, enabling stage, learners

546 are provided contexts for them to conduct specific mini-production tasks in close-to-
547 life communicative scenarios. The target structures are used in communicative
548 activities when they are working on completing their production tasks. Therefore, their
549 explicit knowledge is covertly or explicitly practiced, which helps to enhance their
550 comprehension of knowledge and automaticity of production. The final assessing stage
551 includes teacher feedback, peer feedback, and learners' self-evaluation on learners'
552 production, which consolidates learners' knowledge and confirms their achievement in
553 language production.

554 *Interaction-based Production-oriented Approach tasks*

555 Interaction should be taken into full consideration in POA tasks, as interaction fosters
556 EFL learners' implicit learning of target language structures. Interaction promotes
557 learners' L2 acquisition in that interactive activities, such as implicit and explicit multi-
558 source feedback, provide learners with opportunities to recognize problems in their
559 interlanguage and propel them to produce modified output (VanPatten & Williams,
560 2015). In reviewing POA, Ellis (2017) also suggested that the inclusion of interactive
561 activities into POA facilitates learners' acquisition of target language structures.
562 Therefore, interactive activities should be incorporated into designing the whole
563 production-oriented tasks.

564 According to Gass & Mackey (2015), three main components of the interaction
565 approach that account for the learning process are exposure to the target language,
566 production of the language, and feedback on the production, which links learners'
567 language acquisition with the cognitive mechanisms of noticing, working memory,
568 attention, and automation. These essential concepts are represented in interactive
569 activities such as elaboration, recasting, repetition, or feedback. Merging these
570 interactive activities into the three-stage procedures of each POA mini-task boosts its
571 interactive function and facilitates learners' language acquisition.

572 As shown in Figure 4, the psychological mechanism that includes noticing, working
573 memory, and attention links interaction and language learning, which is at the core of
574 the Interaction-based POA tasks. These core concepts are then realized in mini tasks
575 designed for the three POA stages for promoting learners' language production in
576 communication. Finally, interactive activities such as exposure to language, production
577 of the language, and feedback on the production are carried out throughout the three
578 POA stages. The whole Interaction-based POA tasks can be cycled throughout the
579 whole learning process until learners automatically produce the target language,
580 stimulating them to acquire target structures with communicative motives in the
581 simulated scenarios. The cycling process explains Berry's (1987) key element of
582 'practice' in an interactive way rather than using mechanical drills in forming the IK.
583 The entire interaction process loaded on POA tasks pushes language learners to advance
584 from the cognitive stage to the associative stage and finally reach the autonomous stage,

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585   facilitating their acquisition of IK.
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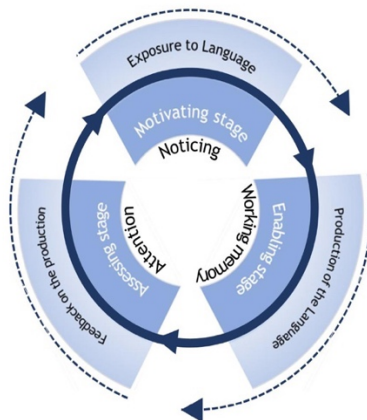
588   Figure 4. Interaction-based POA tasks
589

590   **Conclusions**
591   In the present study, we adopted the OEIT test to measure learners' grammatical
592   sensitivity and language production competence on English questions with refined
593   grammatical errors. Chinese and Spanish EFL participants' performance was analysed
594   compared to native speakers, to probe the degree of implicit language knowledge
595   acquired by EFL learners from two different L1s. The OEIT data was dissociated to
596   study their grammatical sensitivity and production competence, revealing their
597   development trajectory of language production competence. In sum, this study showed
598   that: (1) both Chinese and Spanish EFL learners face great difficulty in acquiring IK of
599   English questions, despite having attained an advanced proficiency level; (2) Chinese
600   and Spanish EFL learners' grammar knowledge and production competence do not
601   develop simultaneously, and their production competence falls behind their level of
602   grammar knowledge. Our results also support previous studies (Ahmadian, 2012;
603   Grüter et al., 2012; Linebaugh & Roche, 2015; Siyanova & Schmitt, 2008) showing
604   that even advanced language learners still confront difficulty in acquiring high
605   production competence in certain grammatical features. The findings answered the
606   question raised in He & Oltra-Massuet(2021) that certain types of errors, such as choice
607   of auxiliaries (their GAUXC), produced by preliminary learners in English question
608   formation, persist in the production from advanced EFL learners.
609   Based on the findings of this study, pedagogical implications have been formulated
610   following Berry's (1987) three-stage model of developing IK that derives from explicit

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611 and declarative knowledge, developed within Wen's (2018) POA. We suggest that
612 Interaction-based POA tasks assist EFL learners in attaining balanced development of
613 their language knowledge and production competence, promoting their IK acquisition.
614 However, the present study is not without limitations. First, although our sample size is
615 based on similar sizes in related studies, larger and more extensive participants would
616 be preferable for more reliable results in future studies. Second, the present study
617 focused only on implicit knowledge measurement, including experiments for directly
618 testing participants' grammatical knowledge would add additional support for exploring
619 the development of language knowledge and production competence.

620 More research is needed along both theoretical and practical inquiries to support the
621 findings of the present study. First, a series of experiments, including written tests,
622 explicit language knowledge measurements, and IK measurements, need to be
623 performed to explore the evolving mechanism of EFL learners' language competence
624 development. Second, action research based on the pedagogical implications discussed
625 above needs to be conducted to trace the practical value of the findings achieved in this
626 study so as to generate more theoretical and practical contributions to the language
627 teaching and research field.
628

642 **Consent to participate**
643 All participants in this study agreed to participate and provided informed consent.
644

645 **Consent for publication**
646 All authors of this manuscript agreed to publish.
647

648 **Conflict of interest**
649 The authors declare no competing interests.

650

Data Availability Statement

651

652 The data that support the findings of the study are delivered by the corresponding

653 author, upon reasonable request.

654

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816 **Appendixes**

817 Appendix A. Demographic information of participants

818 Appendix B. The scoring criteria in terms of sensitivity and production score

25

Conclusions

This dissertation has addressed a variety of issues involved in the acquisition of implicit knowledge by advanced Chinese and Spanish EFL learners based on the study of morphosyntactic errors appearing in forming English questions. Three studies have been conducted to answer the following five research questions:

RQ 1. What are typical errors in English questions produced by preliminary Chinese and Spanish EFL learners?

RQ 2. How does cross-linguistic transfer from learners' L1s influence their production of English questions?

RQ 3. Do advanced EFL learners acquire implicit knowledge equivalent to native speakers' level?

RQ 4. What may potentially impact Spanish and Chinese EFL learners' implicit knowledge acquisition of English question formation?

RQ 5. Does advanced EFL learners' language production competence develop simultaneously with their grammatical knowledge of English questions?

Regarding research question one (RQ1), the first study identifies five typical categories of errors produced by preliminary Chinese and Spanish

EFL learners within the morphosyntax of verbs and auxiliaries, which are GAUXC, GAUXO, GAUXT, GAUXM, and GAUXA. The investigation showed that errors on the choice of the auxiliary, GAUXC, and on the tense of the auxiliary, GAUXT, are most prevalent among these learners, with conspicuous differences depending on the learners' L1.

To answer the second question (RQ2), three hypotheses based on Jarvis' (2000) methodological framework were formulated to test whether and how L1 influences Chinese and Spanish EFL learners' production of English questions.

H 1. Learners from an identical L1 background show a similar degree of difficulty in formulating the English questions under investigation.

H 2. Learners' errors in questions parallel the corresponding feature of the same type of question in Chinese and Spanish.

H 3. Equivalent-level English learners from two different L1s (Chinese and Spanish) display distinct degrees of difficulty building English questions, and there are differences in the errors they produce.

The first study proves the above three hypotheses and concludes that Chinese EFL learners display a similar level of difficulty in English question formation; grammatical errors in English questions produced by Chinese and Spanish EFL learners show features that are similar to questions of their respective L1; and Chinese and Spanish EFL learners' difficulty degree and error types in building English questions vary, despite

their equivalent language proficiency.

As for the third research question (RQ3), the experimental results in the second and third studies support that advanced EFL learners do not acquire implicit knowledge equivalent to that of native speakers, despite being at high proficiency, which proves the hypothesis (H4) that advanced EFL learners cannot acquire implicit knowledge equivalent to native speakers' level.

With respect to the fourth research question (RQ4), the second study reveals that the most challenging morphosyntactic features are GAUXC and GAUXT; to be specific, GAUXC for Spanish EFL learners, and GAUXC and GAUXT for Chinese EFL learners. The three predictions of morphosyntactic congruency were verified in the second study, showing that (1) advanced EFL learners confront great difficulty in acquiring morphosyntactic features that do not instantiate in their L1, (2) the existence of morphological inflectional features in Spanish enables Spanish EFL learners to perform better than Chinese EFL learners in acquiring morphosyntactic features in English questions, and (3) Spanish EFL learners perform better on morpho-syntactic features that are congruent with Spanish than those that are incongruent. Supported by findings on these three predictions, it is concluded that L1-L2 incongruency may constitute the most influential factor for such challenges. It further proves hypothesis five (H5) that EFL learners' different L1 backgrounds, with respect to the L1-L2 morphosyntactic congruency, influence their implicit knowledge acquisition.

Finally, although it is hypothesized (H6) that advanced EFL learners' grammatical sensitivity and production competence develop simultaneously, the experimental results of the third study support that advanced EFL learners do not acquire language production competence simultaneously with their acquisition of grammatical knowledge, which answers the fifth research question (RQ5). The lack of implicit knowledge-fostering language context should be one crucial factor for this acquisition gap. However, the issue remains open for multiple considerations and deserves further study.

After reviewing main answers to research questions posed in this study, next, I summarize major theoretical and practical contributions of this dissertation.

Contributions

On the theoretical side, after fully reviewing and referring to criteria for error classification in previous studies, the first study set up a refined error classification framework by categorizing morphosyntactic errors into auxiliary choice, word order, tense, verb morphology, and subject-verb agreement. This framework provides a finer-grained methodological framework for future research topics related to grammatical errors. The first study also contributes to the study of language transfer by having extended S. Jarvis' methodological framework to sentence level for

identifying L1 influence. Research results in the second study present an additional piece of evidence to support the morphological congruency hypothesis proposed by N. Jiang, which provides a new theoretical perspective to evaluate and testify to L1 influence. The third study contributes to the research topic of implicit knowledge measurement by dissociating unconscious grammatical judgment and language production while analyzing participants' production data, which offers a new strategy to deal with experimental data in measuring implicit knowledge.

On the practical or pedagogical side, considering the distinct features of EFL learners' L1 and the insufficient implicit-knowledge-fostering teaching and learning context, this dissertation makes specific contributions to the language teaching practice by discussing pedagogical implications that foreground the importance of explicit grammar instruction and implicit grammar acquisition. According to the findings of the first study, explicit grammatical knowledge acquired by EFL learners facilitates their learning process in the sense that their grammatical knowledge monitors their language production and improves their accuracy in production. Therefore, targeting preliminary EFL learners, the first study discusses pedagogical implications that integrate consciousness-raising tasks and production-oriented activities, aiming at raising learners' grammar consciousness while promoting their language production. This pedagogical implication also echoes previous studies on the production-oriented English teaching approach for the EFL context and extends the application of the teaching approach to secondary-school EFL

learners. The second and third studies' findings reveal that advanced EFL learners do not acquire native-equivalent implicit knowledge, and in the second study, L1-L2 incongruency is proven to be one of the main influential factors, which suggests the importance of implicit-knowledge-fostering language activities for counter-balancing the EFL learners' L1 influence. Moreover, in the third study, the finding of the unbalanced development of grammatical knowledge and language production competence further supports the necessity of designing language teaching and learning tasks to facilitate EFL learners' acquisition of implicit knowledge. Informed by the above findings on the gap in EFL learners' implicit knowledge, the third study proposes pedagogical implications that incorporate production tasks and interactive activities for boosting EFL learners' implicit knowledge acquisition, emphasizing the promotion of both grammar knowledge acquisition and EFL learners' language production competence.

Limitations

As with any piece of research, some limitations in the studies presented in this dissertation must be noted.

First, the researcher was forced to conduct the two experiments in study 2 and study 3 on an on-line platform, due to the COVID-19 outbreak and the special pandemic restriction period. Although significant findings

have been reached from the two studies, it is undeniable that the experiments may have been influenced by external interference factors, such as environmental noise, disturbance of co-inhabitants, and concentration distraction in some participants. Therefore, a pure laboratory-based experiment environment in future research, which was part of the initial design of the study, is needed to further sanction and strengthen our findings, where such external influences can be controlled.

Second, the sample size of this study is relatively small. To boost and reinforce the explanatory power of the study, a larger sample size across a wider population is necessary for a more robust hypothesis support.

Third, in recruiting EFL learners, participants' reported proficiency was used for the first-round screening, and a short proficiency test was conducted to further confirm their English proficiency level. However, although the recruitment criteria are reliable on most cases, it is difficult to ensure that every participant reaches the required level, which may lead to bias in the results.

Future Studies

The present dissertation studied whether grammatical errors appearing in early EFL stages would vanish or whether any errors would persist in high-proficient EFL learners. However, only preliminary and advanced EFL learners were included in the studies. Thus, experimental research

including learners of beginning, medium, and advanced proficiency levels are necessary. Or, alternatively, longitudinal studies following specific learners' proficiency development from beginning, medium, to advanced levels are needed, which would better uncover the language acquisition trajectory of EFL learners.

Besides, the present study found that EFL learners' L1, Spanish and Chinese, impacted learners' acquisition of implicit knowledge, but learners from more varied L1 backgrounds should be studied to further demonstrate L1 influence under the framework of social-cultural theory, for the purpose of providing more insightful findings on how different EFL contexts impact learners' acquisition of implicit knowledge.

Moreover, this dissertation mainly focused on the measurement of implicit knowledge; however, in future experimental studies, a wider range of experiments that include written tests, explicit knowledge, and additional implicit knowledge measurements need to be performed to explore the development of EFL learners' language competence.

Last but not least, the first and third study proposed pedagogical implications for secondary-school and higher-proficient EFL learners, respectively. The feasibility and applicability of these pedagogical strategies needs to be evaluated in practice in the different linguistic contexts. Therefore, action research of the pedagogical design based on these strategies should be conducted to testify to their practical value, and thus to generate more theoretical and practical contributions to the language teaching and research field.

Dissemination of investigation

Conference Oral Presentation

2022

1. International Congress on English Language Education and Applied Linguistics (ICELEAL 2022), An oral presentation of *"Implicit Knowledge Acquisition of English Questions in Advanced Chinese and Spanish EFL Learners: Results from Grammar Sensitivity in a Word Monitoring Test"* at the *Symposium 2 on Postgraduates' Research on Applied Linguistics and English Language Education* at 14:00-15:40, on 8th, Dec. 2022, in Room S2E (virtual), The Education University of Hong Kong, Hong Kong, China. (Presentation certificate is attached in the Appendix 7)

2. European Society for the Study of English (ESSE) Conference 2022, an oral presentation of *"Grammatical Sensitivity and Language Production Competence: Exploring Advanced EFL Learners' Acquisition of English Questions"* at 14:00-16:00, on 31st, Aug. 2022, Room 611, University of Johannes Gutenberg, Mainz, Germany. (Presentation certificate is attached in the Appendix 8)

2021

3. The 2021 Linguistics and English Language Postgraduate Conference (LELPGC21), an oral presentation of *"Morphosyntactic Discrepancy between Secondary-level Chinese and Spanish EFL Learners: Tracing Cross-linguistic Influence in English Questions"* (Virtual) at 15:00-16:00, on 10th, June, 2021, the University of Edinburgh, Edinburgh, UK. (Presentation certificate is attached in the Appendix 9)

4. The international online conference "3rd New Trends in Foreign Language Teaching", an oral presentation of *"A study of Accuracy of English Question Formation for Chinese EFL learners"* (virtual) at 10:00-11:00, on 20th, May, 2021, Universidad de Granada, Spain. (Presentation certificate is attached in the Appendix 10)

2020

5. Doctoral conference, URV, *"The Acquisition of English Questions for Learners in*

English as a Foreign Language (EFL) Contexts" at 11:00, 26th, May, 2020, Universitat Rovira i Virgili (Presentation certificate is attached in the Appendix 11)

Appendix

Appendix 1

Certificate for research stay

四川外国语大学

SICHUAN INTERNATIONAL STUDIES UNIVERSITY

October, 21, 2021

To Whom It May Concern:

As the Dean of College of Western Languages and Cultures at Sichuan International Studies
University, I hereby certify that Qiaoling He has carried out research activities at the Institute
from June 20 to July 25, and August 20 to October 20, 2021.

Qiaoling He has been working on her doctoral dissertation, in particular conducting her
dissertation experiment with undergraduate students and graduate students, interviewing on
foreign language learning and teaching with teaching staffs of our institute, and designing
foreign language teaching method and plan.

Sincerely,

Zhongzheng Liu

Prof. Zhongzheng Liu, Dean
College of Western Languages and Cultures

Administrative Office: Tel: +86-23-65385238   Fax: +86-23-65385207   E-mail: sisuoffice@sisu.edu.cn
International Office: Tel: +86-23-65385218   Fax: +86-23-65385875   E-mail: faosisu@sisu.edu.cn
Add: 33, Zhuangzhilu Rd., Shapingba District, Chongqing, 400031, P.R. of China

Appendix 2

Certificate of ethic approval for the studies

UNIVERSITAT ROVIRA i VIRGILI

CEIPSA
Comitè Ètic d'Investigació en Persones, Societat i Medi Ambient

En español a continuación / In English below:

CATALÀ

DICTAMEN

AITOR GÓMEZ GONZÁLEZ, President del Comitè Ètic d'Investigació en Persones, Societat i Medi Ambient de la Universitat Rovira i Virgili (CEIPSA) dona fe dels acords aprovats.

Aquest Comitè, en la reunió de data 26/3/2021, acta número 4/2021, ha avaluat i decidit emetre Informe favorable perquè es realitzi l'estudi titulat:

"The acquisition of English Questions for English as a Foreign Language (EFL) Learners"

Codi CEIPSA: CEIPSA-2021-TD-0002
Directora de la tesis: Maria Isabel Oltra Massuet
Doctoranda: Qiaoling He

CONSIDERA QUE:

- La proposta de projecte presentada està d'acord amb les bones pràctiques científiques, els valors de correcció científica, capacitació, justícia, solidaritat, protecció dels subjectes vulnerables, tracte digne, autonomia personal, privacitat, confidencialitat, reparació del dany i respecta els Drets humans.
- La proposta de projecte compleix amb la legislació europea, espanyola i catalana vigent aplicable, així com la normativa pròpia de la URV en matèria d'R+D+I.
- La proposta de projecte compleix amb les exigències metodològiques, ètiques i jurídiques en l'àmbit de les competències de l'CEIPSA, en relació amb els següents aspectes:
  a) Valor social i justificació del projecte.
  b) Personal investigador.
  c) Metodologia.
  d) Aspectes ètics específics: risc-benefici, mesures de prevenció i reparació del dany, selecció i reclutament, protecció de subjectes vulnerables, informació, consentiment, privacitat i confidencialitat.
  e) Compliment de la documentació: consentiment informat, document de seguretat de l'arxiu, autoritzacions i requisits normatius vigents.

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Comitè Ètic d'Investigació en Persones, Societat i Medi Ambient

En el cas que s'avaluï algun projecte en què participi com a investigador / col·laborador algun membre d'aquest comitè, s'absentarà de la reunió durant la discussió de l'estudi.

La composició a la data de l'avaluació de l'CEIPSA de la Universitat Rovira i Virgili és la següent:

President
Dr. Aitor González Gómez
Professor Agregat del Departament de Pedagogia de la URV

Secretària
Sra. Cristina Salvadó Baza
Secretària CEIPSA

Vocals

Dr. António Miguel Osório Da Costa
Professor Agregat del Departament d'Economia de la URV

Dra. Gisela Cebrián Bernat
Professora Lectora del Departament de Pedagogia de la URV

Dra. Josefa Canals Sans
Catedràtica d'Universitat de Departament de Psicologia de la URV

Dra. María Dolores Jiménez López
Professora Agregada del Departament de Filologies Romàniques de la URV

Dra. Maria Teresa Novo Molinero
Professora Agregada del Departament de Bioquímica i Biotecnologia de la URV

Antonio Cortés Martínez
Delegat de Protecció de Dades de la URV

Sra. Mireia Herranz Aparicio
Delegada de Protecció de Dades de la URV

Sra. Gemma Garcia Camps
Coordinadora de l'Oficina de Prevenció de Riscos Laborals Mancomunada de la URV i la FURV

Sra. Sandra Rodríguez Rodríguez
Jurista del Gabinet Jurídic de la URV

Signatura

AITOR GÓMEZ GONZÁLEZ - DNI 38140434v
Firmado digitalmente por AITOR GÓMEZ GONZÁLEZ - DNI 38140434v
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Dr. Aitor Gómez González
President CEIPSA URV

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CEIPSA
Comitè Ètic d'Investigació en Persones, Societat i Medi Ambient

ESPAÑOL

DICTAMEN COMITÉ ÉTICO DE INVESTIGACIÓN EN PERSONAS, SOCIEDAD Y MEDIO AMBIENTE

DON AITOR GÓMEZ GONZÁLEZ, Presidente del COMITÉ ÉTICO DE INVESTIGACIÓN EN PERSONAS, SOCIEDAD Y MEDIO AMBIENTE DE LA UNIVERSITAT ROVIRA I VIRGILI (CEIPSA) da fe de los acuerdos aprobados.

Este Comité, en su reunión de fecha 26/3/2021, acta número 4/2021, ha evaluado y decidido emitir <u>Informe Favorable</u> para que se realice el estudio titulado:

"The acquisition of English Questions for English as a Foreign Language (EFL) Learners"

Código CEIPSA: CEIPSA-2021-TD-0002
Directora de la tesis: Maria Isabel Oltra Massuet
Doctoranda: Qiaoling He

CONSIDERA QUE:

- La propuesta de proyecto presentada está de acuerdo con las buenas prácticas científicas, los valores de corrección científica, capacitación, justicia, solidaridad, protección de los sujetos vulnerables, trato digno, autonomía personal, privacidad, confidencialidad, reparación del daño y respeta los Derechos humanos.
- La propuesta de proyecto cumple con la legislación europea, española y catalana vigente aplicable, así como la normativa propia de la URV en materia de I+D+I.
- La propuesta de proyecto cumple con las exigencias metodológicas, éticas y jurídicas en el ámbito de las competencias del CEIPSA, en relación con los siguientes aspectos:
a) Valor social y justificación del proyecto.
b) Personal investigador.
c) Metodología.
d) Aspectos éticos específicos: riesgo-beneficio, medidas de prevención y reparación del daño, selección y reclutamiento, protección de sujetos vulnerables, información, consentimiento, privacidad y confidencialidad.
e) Cumplimiento de la documentación: consentimiento informado, documento de seguridad del archivo, autorizaciones y requisitos normativos vigentes.

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En el caso que se evalúe algún proyecto en el que participe como investigador/colaborador algún miembro de este comité, se ausentará de la reunión durante la discusión del estudio.

La composición a la fecha de la evaluación del CEIPSA de la Universitat Rovira i Virgili es la siguiente:

<u>Presidente</u>
Dr. Aitor González Gómez
Profesor Agregado del Departamento de Pedagogía de la URV

<u>Secretaria</u>
Sra. Cristina Salvadó Baza
Secretaria CEIPSA

<u>Vocales</u>

Dr. Antònio Miguel Osório Da Costa
Profesor Agregado del Departamento de Economía de la URV
Dra. Gisela Cebrián Bernat
Profesora Lectora del Departamento de Pedagogía de la URV
Dra. Josefa Canals Sans
Catedrática de Universidad del Departamento de Psicología de la URV
Dra. María Dolores Jiménez López
Profesora Agregada del Departamento de Filologías Románicas de la URV

Dra. Maria Teresa Novo Molinero
Profesora Agregada del Departamento de Bioquímica y Biotecnología de la URV
Sr. Antonio Cortés Martínez
Delegado de Protección de Datos de la URV
Sra. Mireia Herranz Aparicio
Delegada de Protección de Datos de la URV
Sra. Gemma Garcia Camps
Coordinadora de la Oficina de Prevención de Riesgos Laborales Mancomunada de la URV y la FURV
Sra. Sandra Rodríguez Rodríguez
Jurista del Gabinete Jurídico de la URV

Firma

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Dr. Aitor Gómez González
Presidente CEIPSA URV

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CEIPSA
Comitè Ètic d'Investigació en Persones, Societat i Medi Ambient

ENGLISH

STATEMENT BY THE ETHICS COMMITTEE CONCERNING RESEARCH INTO PEOPLE, SOCIETY AND THE ENVIRONMENT

AITOR GÓMEZ GONZÁLEZ, President of the ETHICAL COMMITTEE CONCERNING RESEARCH INTO PEOPLE, SOCIETY AND THE ENVIRONMENT OF THE UNIVERSITAT ROVIRA I VIRGILI (CEIPSA) attests to the agreements passed.

During its meeting on 26/3/2021 (archive number 4/2021), the Committee evaluated and decided to issue a <u>Favourable Report</u> for the study entitled:

"The acquisition of English Questions for English as a Foreign Language (EFL) Learners"

CEIPSA code: CEIPSA-2021-TD-0002
Director or the doctoral thesis: Maria Isabel Oltra Massuet
Doctoral student : Qiaoling He

THE COMMITTEE CONSIDERS THAT:

- The project proposal presented is in accordance with good scientific practices and the values of scientific correctness, training, justice, solidarity, protection of vulnerable subjects, dignified treatment, personal autonomy, privacy, confidentiality, reparation of damage and respect for human rights.
- The project proposal complies with current applicable European, Spanish and Catalan legislation, as well as the URV's own regulations on R+D+I.
- The project proposal complies with the methodological, ethical and legal requirements within the scope of CEIPSA's competences and in relation to its:
  a) Social value as a project.
  b) Research staff.
  c) Methodology.
  d) Specific ethical aspects, namely the risks and benefits, the measures regarding damage prevention and repair, the processes regarding selection and recruitment, the protection of vulnerable subjects, and the aspects relating to information, consent, privacy and confidentiality.
  e) Compliance with the documentation, namely the informed consent document, the document confirming file security, the authorizations and the current regulatory requirements.

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UNIVERSITAT ROVIRA i VIRGILI

CEIPSA
Comitè Ètic d'Investigació en Persones, Societat i Medi Ambient

If a member of this committee participates as a researcher / collaborator in a given project, they will not attend any meeting at which the project is discussed.

On the date of the URV's CEIPSA evaluation, the committee's members were:

President
Dr Aitor González Gómez
Associate Professor of the Department of Pedagogy of the URV

Secretary
Mrs. Cristina Salvadó Baza
CEIPSA Secretary

Members

Dr António Miguel Osório Da Costa
Associate Professor of the Department of Economics of the URV

Dr Gisela Cebrián Bernat
Lecturer at the URV's Department of Pedagogy

Dr Josefa Canals Sans
University Professor at the URV's Department of Psychology

Dr María Dolores Jiménez López
Associate Professor of the URV's Department of Romance Studies

Dr Maria Teresa Novo Molinero
Associate Professor of the URV's Department of Biochemistry and Biotechnology

Mr Antonio Cortés Martínez
URV Data Protection Officer

Ms Mireia Herranz Aparicio
URV Data Protection Officer

Ms Gemma Garcia Camps
Coordinator of the Joint Occupational Risk Prevention Office of the URV and the FURV

Ms Sandra Rodríguez Rodríguez
Lawyer from the URV's Legal Office

Signed by

AITOR GÓMEZ
GONZÁLEZ -
DNI 38140434v

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Dr Aitor Gómez González
President CEIPSA URV

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UNIVERSITAT ROVIRA i VIRGILI

Oficina de coordinació i assessorament
en seguretat i protecció de dades
Delegats de Protecció de Dades

Informe de valoració en matèria de privacitat de l'Estudi "The Acquisition of English Questions for English as a Foreign Language(EFL) Learners"

1. Introducció

En data 3 de febrer de 2021, la Qiaoling He es posa en contacte amb els Delegats de Protecció de Dades (DPD) de la Universitat Rovira i Virgili (URV) per tal de sotmetre a la seva valoració l'estudi denominat "The Acquisition of English Questions for English as a Foreign Language(EFL) Learners".

Per fer aquesta valoració la sol·licitant aporta la següent documentació:

1. Protocol previst per realitzar l'estudi sota denominació d'arxiu: *Qiaoling He-XXX_CERI - Comissió ètica recerca-innovació - Document_2_Memòria_20210201.pdf.*

2. Els qüestionaris previstos sota denominació d'arxiu: *Qiaoling He-Questionnaire EFL.pdf* i *Qiaoling He-Questionnaire NS.pdf.*

3. Full d'informació al participant sota denominació d'arxiu: *Qiaoling He-experiment instruction and information sheet.docx.*

Prèviament a la valoració del projecte, els DPD i l'equip de suport han assessorat a la investigadora per aplicar els principis i normes de protecció de dades personals des del disseny i per defecte.

Aquest informe recull un resum de les observacions fetes al projecte i conclou sobre la seva conveniència des de la perspectiva de la protecció dels drets i les llibertats de les persones participants en l'estudi pel que fa al tractament de les seves dades personals.

2. Observacions sobre l'estudi

Un cop analitzada la documentació s'ha pogut concloure el següent, que ha quedat degudament recollit als diferents documents relacionats amb el plantejament de l'estudi i que s'han enumerat a l'apartat introductori d'aquest informe:

1. L'estudi es basa en investigar l'aprenentatge de preguntes en anglès per a estudiants d'anglès com a llengua estrangera, i per això les persones participants realitzaran les proves i els qüestionaris adjunts a aquest informe.

2. La identificació de la persona participant només constarà al full de consentiment informat i tota la resta de dades personals es vincularan a un codi únic de manera que

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Delegats de Protecció de Dades

només el personal autoritzat pugui conèixer la identitat de a qui pertanyen les dades. Per tant, les dades personals seran tractades de manera pseudoanonimitzada.

3. Està previst entregar a les persones participants un full d'informació en el qual s'informarà sobre l'estudi, la finalitat del tractament de dades personals, les possibles cessions i la normativa i mesures de seguretat aplicables.

4. Està previst un full de consentiment informat en el qual s'obtindrà el consentiment de la persona participant al tractament de les dades personals.

5. El qüestionari que es preveu realitzar a les persones participants ha estat revisat de conformitat amb el principi de minimització de dades. Respecte la vinculació del qüestionari en línia amb la persona participant, està previst que la persona participant especifiqui en el qüestionari el codi únic que se li va atorgar al full de consentiment informat per tal que el personal investigador i col·laborador puguin relacionar les respostes amb la persona que les dona. Aquest codi estarà recollit en una base de dades a la qual només hi tindran accés el personal investigador i els seus col·laboradors.

6. Tot el personal investigador participant és informat sobre l'objecte i els procediments de l'estudi, incloses les mesures de seguretat aplicades, i signen un compromís conforme coneixen i accepten sotmetre's a aquests procediments. També s'inclou el compromís de confidencialitat de les dades personals que tractaran i el de realitzar una adequada custòdia evitant-ne qualsevol accés no autoritzat.

7. D'acord amb les instruccions que indiqui el Responsable de Seguretat de la URV, s'han d'utilitzar per a la realització de l'estudi, els sistemes d'informació i dispositius propis de la URV al qual s'apliquen les mesures de seguretat de l'Esquema Nacional de Seguretat. Només el personal participant durant l'estudi hi tindrà accés autoritzat.

8. En tot moment la persona participant podrà exercir el seu dret d'oposició al tractament de les seves dades i es procediria al manteniment de totes les dades que corresponguin al participant per mantenir la validesa dels resultats de l'estudi, però sense que el participant pugui tornar a ser identificat.

9. La publicació dels resultats de l'estudi no contindrà cap tipus de dada personal.

URV_DPD_10-21_Informe estudi EFL_v1.1

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en seguretat i protecció de dades
Delegats de Protecció de Dades

3. Conclusió

Considerem l'estudi com adequat des de la perspectiva de la protecció de dades personals.

Mireia
Herranz
Aparicio - DNI
39887671J
(SIG)

Fecha:
2021.03.1
8 12:36:01
+01'00'

Mireia Herranz Aparicio

Delegada de Protecció de Dades

URV_DPD_10-21_Informe estudi EFL_v1.1

Appendix 3

Participants' informed consent template

Consent to Participate in Research (For English native speakers)

Project Name

EFL learners' performance on English questions in an elicited oral production test and a word monitoring test

Investigator Qiaoling He   **Telephone** 0034-688079876

E-mail: qiaoling.he@estudiants.urv.cat

Sponsor

None (The University Institutional Review Board has approved this research project. For information on your rights as a research subject, contact isabel.oltra@urv.cat)

Introduction

You are invited to consider participating in this study. We will be comparing the performance of a word monitoring reaction time test and an elicited oral English production test between native English speakers and advanced EFL learners. This form will describe the purpose of the study and your rights as a participant. The decision to participate or not is yours. If you decide to participate, please sign, and date the last line of this form.

Explanation of the study

We will be looking at the time it takes for you to respond to certain listening activities and the language you produce in an elicited oral production task. About 15 participants will participate in this study. First, as part of the survey, you will complete a general background questionnaire. After that, you will do a key-pressing task and an elicited

oral production task responding to the given audios. The whole procedure will take about 25 to 30 minutes.

Confidentiality

All of the information collected will be anonymized and will only be used for research purposes, which means that your identity will be completely unknown. Whenever performance data from this study are published, your identity will remain undisclosed. The reaction time and elicited oral production data will be stored on a computer, and only the researcher will have access to it.

Your participation

Participating in this study is strictly voluntary. Your decision to participate will in no way affect your grade (if you were a student). If at any point you change your mind and no longer want to participate, you can tell us. You will be paid for participating in this study upon completing all the experimental tasks. If you have any questions about the research, you can contact me by telephone at 0034-688079876, or by e-mail qiaoling.he@estudiants.urv.cat.

Investigator's statement

I have fully explained this study to the participants. I have tested all the activities and solved all the problems that I can foresee.

Signature of investigator ___Qiaoling He_____

Date ___01-Feb-2021_____

Participant's consent

I have read the information provided in this Informed Consent Form. I voluntarily agree to participate in this study.

Your   signature   _____

Date_____

Consent to Participate in Research (For EFL learners)

Project Name

EFL learners' performance on English questions in an elicited oral production test and a word monitoring test

Investigator Qiaoling He   **Telephone** 0034-688079876

E-mail: qiaoling.he@estudiants.urv.cat

Sponsor

None (The University Institutional Review Board has approved this research project. For information on your rights as a research subject, contact isabel.oltra@urv.cat)

Introduction

You are invited to consider participating in this study. We will be comparing EFL learners' performance on two different tasks: an elicited speaking task and a reaction time test in listening activities. This form will describe the study's purpose and your rights as a participant in the study. The decision to participate or not is yours. If you decide to participate, please sign and date the last line of this form.

Explanation of the study

We will be looking at the language you produce when you do the elicited oral English production activities and your word monitoring reaction time responding to the given audios. About 40 participants will participate in this study. First, as part of the survey, you will complete a background questionnaire. After that, you will do a key-pressing task and an elicited

oral production task responding to the given audios. The whole procedure will take about 25 to 30 minutes.

Confidentiality

All of the information collected will be anonymized and will only be used for research purposes, which means that your identity will be completely unknown; in other words, the researcher will know your age range, gender, L1, and English language level. The above mentioned general demographical information will be analyzed as a group property rather than an individual one. Whenever performance data from this study are published, your name will remain undisclosed. The reaction time and elicited oral production data will be stored on a computer, and only the researcher will have access to it.

Your participation

Participating in this study is strictly voluntary. Your decision to participate will in no way affect your grade (if you were a student). If at any point you change your mind and no longer want to participate, you can tell us. You will be paid for participating in this study upon completing all the experimental tasks. If you have any questions about the research, you can contact me by telephone at 0034-688079876, by e-mail qiaoling.he@estudiants.urv.cat.

Investigator's statement

I have fully explained this study to the participants. I have tested all the activities and solved all the problems that I can foresee.

Signature of investigator ___Qiaoling He_____

Date ___01-Feb-2021_____

Participant's consent

I have read the information provided in this Informed Consent Form. I

voluntarily agree to participate in this study.

 Your   signature   _____

Date_____

Appendix 4

Experiment Instruction Sheet

Experiment Instruction Sheet

Thank you for agreeing to participate in the experiment on English language processing. During the experiment, we require your undistracted attention. Therefore, we ask that you read these instructions carefully. You may not open other apps on your computer, chat with other people, use your cellphone, or do other distracting activities.

The entire experiment will take place via computer terminals with internet access. The experiment is time-sensitive, as we are looking at the time it takes for you to give correct responses. It is absolutely essential that you are focused during the experiment process.

There are two separate experiments to complete the whole project, including a word monitoring test (Experiment 1) and an elicited oral production test (Experiment 2). The two experiments will be conducted in two independent stages. As this study is conducted anonymously, each participant will be identified with a given code number. Please use the same code number in both experiments. Each experiment will take about 25 minutes to finish.

Experiment 1

Experiment 1 is run with a remote mode of the DMDX software to record response time, which runs on a Windows system. Make sure you log out all other apps on your computer before you start. The whole experiment

will automatically run after you log in by double-clicking the icon. There are three parts to the entire test: an introduction, a practice part, and the experiment part.

Experiment procedures

You will see the following words in the introduction part:

"This is a word monitoring test experiment. In each trial of the test, you will hear a sentence and see a word on the screen. While you are listening, please focus on the meaning of the sentence.

1. When you hear the word shown on the screen, please press the Y key on the keyboard as quickly as you can.

*2. When the sentence is finished, please continue the statement judgment task. **Please put your fingers of your right hand on the Y and U keys**. If the statement shown on the screen matches what you heard, please press the Y key; if not, press the U key. Please press the Spacebar to Continue."*

Before you start the experiment, put your forefinger on the Key Y, your middle finger on the Key U, and your thumb on the Spacebar (as it shows in the following picture).
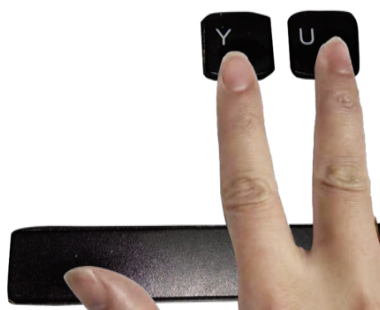
The second part is the practice part. There are six practice items in total. The response time of the practice part is not analyzed, and the items are used for you to get familiar with how to respond by pressing the keys.

The third part is the experiment part, which requires your full attention when doing the test. There are altogether 120 sentence items, divided into three blocks. You need to finish 40 sentence items in each block. You may take a 3-minute break after you finish each block, or you may press the Spacebar to continue the test without breaks.

Experiment 2

Experiment 2 is run on with a PPT and an audio recorder. Make sure you have no other distracting activities around. There are three parts to the experiment test: The introduction part, The practice part, and the experiment part.

Experiment procedures

In the first part, you will see the following words in the introduction:

"You are going to hear some English sentences. Meanwhile, you will

see two pictures marked with 'A' or 'B' on the screen. After each sentence,

you need to choose one picture which matches what is said in the sentence.

Press the Key 'A' for picture A or the key 'B' for picture B. After you choose

the picture, you will hear a "beep". After the beep, repeat the sentence

using correct English. Do not repeat the sentence until you hear the beep."

There are four practice items in the second part. You will get familiar with

how to choose the correct picture and do the recording after the beep.

The third part is the experiment part, which requires your full attention

during the test. You need to understand the audio to finish the picture

choice and to give a correct repetition of the sentence you heard. There are

80 sentence items in the whole test, and you may take a short break after

you finished 40 items.

Thank you for your cooperation!

Appendix 5

Supplementary material (Appendix A) of Article 3

Appendix A

Demographic information of participants

	NS group (%)	CS group (%)	SS group (%)
Age			
18-20	1 (8.3)	1 (3.1)	5 (13.5)
21-30	3 (25)	30 (93.8)	25 (67.6)
31-40	8 (66.7)	1 (3.1)	7 (18.9)
Gender			
Male	4 (33.3)	10(31.2)	20 (54.1)
Female	8 (66.7)	22 (68.8)	17 (45.9)
Education			
Secondary school	1 (8.3)	0 (0.0)	4 (10.8)
Undergraduate	8 (66.7)	15 (46.9)	10 (27.0)
Graduate	3 (25)	17 (53.2)	23 (62.2)
Starting year			
Kindergarten	NA	0 (0.0)	7 (18.9)
Primary school	NA	25 (78.1)	24 (64.9)
Junior secondary school	NA	7 (21.9)	4 (10.8)
University	NA	0 (0.0)	2 (5.4)
Residence in an English-speaking country			
Yes	NA	0 (0.0)	6 (16.2)
No	NA	32 (100.0)	31 (83.8)

Appendix 6

Supplementary material (Appendix B) of Article 3

Appendix B

The scoring criteria in terms of sensitivity and production score

1. If participants produced the original ungrammatical sentences they heard, or the wrong sentence type, such as a WH-question for a Y/N question, or failed to produce the sentence, the score was zero. For example, if participants were required to imitatively produce the question 'Did your uncle visit you yesterday?', they produced the question 'Why did your uncle visit you yesterday?', or they did not produce any word at all, the score of sensitivity and production was zero for this item.

2. A sensitivity score was given if participants intended to modify the ungrammatical sentence but did not produce a proper sentence (e.g., using the wrong tense, person or word order). For example, when participants heard the sentence '*Does John and Mary go to the library yesterday?', they were supposed to say 'Did John and Mary go to the library yesterday?'. If they produced the sentence '*Do John and Mary go to the library yesterday?', a sensitivity score was identified, but the production score was zero because they did realize the grammatical problem in subject-verb agreement, but they did not produce it in the correct form

required by the past tense indicated by the adverbial 'yesterday'.

3. The following cases were all counted into successful production. One score was given in both sensitivity and production count if (a) participants modified the ungrammatical sentence and produced it in the grammatical form; (b) participants produced a correct question using a different expression for the same meaning; or (c) participants corrected a morpho-syntactic feature in an ungrammatical sentence with mistakes not influencing the structure under analysis, e.g., using a wrong article or preposition, or changing a proper name; the sentence was also counted as correct production.

Appendix 7

Certificate for Presentation at ICELEAL 2022

Certificate of Attendance

This certificate is awarded to

He Qiaoling

for presenting at the International Congress on English Language Education and Applied Linguistics 2022 (ICELEAL 2022) hosted by the Department of English Language Education, the Department of Linguistics and Modern Language Studies, and Centre for Research on Linguistics and Language Studies, under the leadership of the Faculty of Humanities, 06-09 December 2022.

Co-chairs, ICELEAL 2022

Dr WANG, Lixun

Prof GU, Mingyue

Dr CHIN, Chi On

Dr MA, Qing

Appendix 8

Certificate for Presentation at ESSE 2022

JOHANNES GUTENBERG-UNIVERSITÄT MAINZ - 55099 Mainz
Qiaoling He
Department of English and German Studies
Carrer Pin i Soler, 11, Escalera B, 2-2,
Qiaoling He PhD candidate
Carrer Pin i Soler, 11, Escalera B, 2-2,
43002 Tarragona
SPAIN

European Society for the
Study of English (ESSE)
Conference 2022 Mainz

Prof. Dr. Rainer Emig

Johannes Gutenberg-Universität
Mainz

Department of English and
Linguistics

Jakob Welder Weg 18
(Philosophicum 1)

55128 Mainz

Germany

ESSE2022@uni-mainz.de

https://esse2022.uni-mainz.de/

Mainz, 3 September 2022

CONFIRMATION OF PARTICIPATION

This is to confirm,
that Dr. Qiaoling He
Qiaoling He

participated in "European Society for the Study of English (ESSE) Conference 2022 Mainz"
from 29 August 2022 to 2 September 2022.

–

per order of the Organisation Committee

Organising Team ESSE 2022 | European Society for the Study of English (ESSE) Conference 2022 Mainz

Appendix 9

Certificate for Presentation at LELPGC21

THE UNIVERSITY
of EDINBURGH

This certifies that

Qiaoling He

has presented a talk as part of the 2021 Linguistics and
English Language Postgraduate Conference (LELPGC21) at
the University of Edinburgh on June 10th, 2021

Nadine Dietrich

Nadine Dietrich
Chair

Appendix 10

Certificate for Presentation at 3rd New Trends in Foreign

Language Teaching Conference

This is to certify that

Qiaoling He

has presented the paper entitled

A Study of Accuracy in English Questions Formation for Chinese Learners of English

at the international online conference "3rd New Trends in Foreign Language Teaching",
held in May 19th – 21st, 2021

Signed:

Dr Raúl Ruiz-Cecilia
Chair of the Organising Committee

Dr Maria Isabel Orega
Chair of the Scientific Committee

Appendix 11

Certificate for Presentation at Jornada 2020 URV

UNIVERSITAT
ROVIRA I VIRGILI

DEPARTAMENT D'ESTUDIS ANGLESOS I ALEMANYS

Av. Catalunya, 35
43002 Tarragona - Espanya
Tel. 977 559 755
Fax 977 299 488
E-mail: secdeaia@urv.cat

Dra. Isabel Oltra-Massuet
isabel.oltra@urv.cat
+34 977 29 94 51

10 de març 2020

VISTIPLAU

Isabel Oltra Massuet, en qualitat de supervisora de tesis, confirmo que estic d'acord que la meva doctoranda, **Qiaoling He**, presenti el seu treball en curs a les properes Jornades del Doctorand.

MARIA ISABEL
OLTRA
MASSUET

Digitally signed by
MARIA ISABEL
OLTRA MASSUET
Date: 2020.03.10
18:10:52 +01'00'

Dra. Isabel Oltra-Massuet

Professora Associada - *Serra Húnter*

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Qiaoling He

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