GESTURE AND THE ACQUISITION OF L2 ENGLISH TENSE AND ASPECT

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Gesture and the Acquisition of L2 English Tense and Aspect

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CERTIFICATE OF ORIGINALITY

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Abstract

There has been growing interest in the overlapping area between second language acquisition (SLA) and gesture. In the overlapping area, there is a need for more research that quantitatively measures the effects of pedagogical gestures on L2 learning. To fill the gap, the present study carried out a true experiment that adopted a pretest-treatment-immediate posttest-delayed posttest design. Specifically, the experiment examined the effects of a pedagogical deictic gesture on L1 Chinese learners' acquisition of the L2 English past tense *-ed* and the effects of a pedagogical metaphoric gesture on the learners' acquisition of the L2 English progressive aspect *-ing* (Research Question 1). Given that the pedagogical gestures spatialize the temporal concepts of the past tense and the progressive aspect, they belong to "temporal gestures" and are termed as "pedagogical temporal gestures" in the present study. The 90 adult participants in the study were randomly assigned to three treatment conditions, each condition with 30 participants: two experimental conditions (i.e., verbal instruction with pedagogical gestures and verbal instruction without pedagogical gestures) and one control condition (i.e., no treatment during the experiment). At each testing time, an untimed grammaticality judgment test (UGJT) and an elicited imitation test (EIT) (Ellis, 2005) were conducted to respectively measure the participants' explicit knowledge (or perception) and implicit knowledge (or production) of the target structures. Statistical analyses of the UGJT and EIT scores showed no significant difference between the instruction + gesture and the instruction only groups, indicating that the pedagogical temporal gestures did not significantly enhance the acquisition of the L2 English tense and aspect.

In addition, to explain or complement the quantitative results from the experiment, the present study conducted follow-up semi-structured interviews with the participating learners who received verbal instruction with pedagogical gestures. The interview questions were about the learners' perceptions of pedagogical gestures (Research Question 2). The interview data were analyzed qualitatively through content analysis. Thus, the whole study adopted a mixed methods design, specifically, an explanatory

sequential design. Content analyses of the semi-structured interview responses revealed that the participants were overwhelmingly in favor of the pedagogical gestures because the gestures helped them understand the abstract temporal concepts of the target structures through the concrete spatial hand movements.

Integrating the quantitative results for Research Question 1 and the qualitative results for Research Question 2 generates interesting findings. On the one hand, the qualitative results for Research Question 2 indicate the efficacy of the pedagogical gestures in improving the learners' conceptualizations of tense-aspect. The improvement in conceptualizations was not measured by the language tests (i.e., UGJT and EIT), but the benefit may not be negligible.

On the other hand, the quantitative results for Research Question 1 suggest the inefficacy of the pedagogical gestures in improving the learners' perception and production of tense-aspect. Similarly, Nakatsukasa (2013, 2021) found limited facilitating effects of a pedagogical deictic gesture on learners' acquisition of the L2 English past tense (although the validity of the gesture is questionable). By contrast, some other previous studies showed efficacy of pedagogical gestures in improving learners' perception and/or production of some other L2 target structures, including vocabulary (García-Gámez, Cervilla, Casado, & Macizo, 2021; Huang, Kim, & Christianson, 2018; Tellier, 2008), locative prepositions (Nakatsukasa, 2013, 2016), and pronunciation (Iizuka, Nakatsukasa, & Braver, 2020; Li, Baills, & Prieto, 2020; Morett & Chang, 2015).

Synthesizing the differential effects of pedagogical gestures discovered in different studies, I propose that the effectiveness of a pedagogical gesture can to some extent depend on the concreteness of the corresponding target structure. If the target structure has concrete meaning (e.g., vocabulary and locative prepositions) or concrete form (e.g., pronunciation), then the gesture can directly convey the concrete meaning or form and improve learners' acquisition. If the target structure has abstract meaning (e.g., tense-aspect), then the gesture needs to concretize and spatialize the meaning. In this case, only conceptualization of the target structure can be enhanced, and learners'

form-meaning mapping of the target structure cannot be enhanced.

The findings of the present study not only fill the research gaps, but also generate pedagogical and theoretical implications. Pedagogical implications include: the implicit L2 knowledge and the progressive aspect can be weak areas to L2 learners of English; functions of gestures for teaching abstract targets include facilitating memorizing, concretizing abstract concepts, facilitating inferring and generalizing, and being more engaging and convenient than other means; gestures can significantly improve the acquisition of target structures with concrete meanings or forms, and can also improve conceptualization of abstract concepts. Theoretical implications include: the findings provide empirical evidences for the theoretical propositions regarding the interrelationships among gesture, thought, and SLA (including "Gesture-for-Conceptualization Hypothesis" [Kita, Alibali, & Chu, 2017], "gesture as a medium of SLA" [Gullberg, 2006, 2014; Gullberg, de Bot, & Volterra, 2008], and "the boundaries of gesture-speech integration during language comprehension" [Kelly, 2017]), and the findings also provide an example for the disconnected relationship between thought and language forms.

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List of Abbreviations

EFL	English-as-a-foreign-language
EIT	elicited imitation test
SLA	second language acquisition
UGJT	untimed grammaticality judgment test

Chapter 1: Introduction

1.1 Research Background

The present study explores gesture and the acquisition of L2 English tense and aspect. Specifically, it measures the effects of teachers' pedagogical gestures on L2 English learners' acquisition of the target tense and aspect, and investigates learners' perceptions of the pedagogical gestures. The present study is concerned with the research areas of gesture, second language acquisition (SLA), and tense-aspect. This section presents the research background for the present study, by introducing the three research areas.

1.1.1 Gesture Research

Gestures are common in daily life, and they play a significant role in communication and interaction. Gestures are described as "spatio-visual phenomena influenced by contextual and socio-psychological factors, and also closely tied to sophisticated speaker-internal, linguistic processes" (Gullberg, de Bot, & Volterra, 2008, p. 149).

Gesture research is a rich field, concerned with disciplines such as psychology, education, linguistics, communication, neuroscience, anthropology, history, art history, performance studies, computer science, music, theatre, and dance (International Society for Gesture Studies, 2021), and there has been much interdisciplinary research among these areas. For example, in the overlapping area between psychology and linguistics, the interrelationships among gesture, speech, and mind have been explored (e.g., Church & Goldin-Meadow, 1986; de Ruiter, 2000, 2007; Goldin-Meadow, 1999, 2003; Goldin-Meadow & Alibali, 2013; McNeill, 1992, 2005). In the overlapping area between education and communication, gestures have emerged as a pedagogical method that contributes to multimodal interactions during teaching and learning (e.g., Hudson, 2011; Lim, 2021; Matsumoto & Dobs, 2017; McCafferty, 2006; Nakatsukasa, 2013, 2016, 2021; Peltier & McCafferty, 2010; Sime, 2008; Smotrova, 2014; Smotrova

& Lantolf, 2013; Tellier, 2008; van Compernolle & Smotrova, 2014; W. Wang & Lowen, 2016; Zhao, 2007). Gesture research broadens and deepens our understanding of cognition and communication.

1.1.2 Second Language Acquisition (SLA) and Gesture Research

Second language acquisition (SLA) research is a sub-area of linguistics, and it is also concerned with education (specifically, second language teaching and learning). Previous linguistics and SLA studies have predominantly focused on verbal language (Nijmegen Gesture Centre, 2021), and the overlapping area between SLA and gesture has been gaining interest in recent years, adding new findings to SLA.

1.1.3 Tense-Aspect and Gesture Research

Tense-aspect research is a specific area of linguistics, and L2 tense-aspect acquisition research is a specific topic of SLA. Tense is about the location of an event in time (e.g., in the past, at present, or in the future), and aspect is about the internal temporal characteristic of an event (e.g., completeness as conveyed by the perfect aspect, or incompleteness as conveyed by the progressive aspect). Tense and aspect exist in all the natural languages. The importance of tense-aspect research lies in that it offers insights into how languages encode and describe events from the perspective of time. It also reveals different perceptions and conceptualizations of time by speakers of different languages. Tense-aspect is an indispensable area in linguistics, SLA, and language teaching and learning (Jin, 2021). Like SLA, previous studies in tense-aspect have also mainly focused on verbal language (e.g., Andersen & Shirai, 1994; Bardovi-Harlig, 2000; Comrie, 1976; Klein, 1994; Klein & Perdue, 1997; C. S. D. Li, 2011; P. Li, 1990; P. Li & Bowerman, 1998; P. Li & Shirai, 2000; Salaberry & Shirai, 2002; Shirai & Andersen, 1995; Smith, 1991; Vendler, 1957).

A few pioneering studies that explored tense-aspect through the lens of gesture have generated new findings that are unavailable from verbal language. For example, Matsumoto and Dobs (2017) identified pedagogical gestures as interactional resources

that facilitated the classroom teaching and learning of L2 English tense and aspect. Nakatuskasa's intervention studies (2013, 2016, 2021) found the differential effects of gestures on the acquisition of different L2 English grammar structures (i.e., significant facilitating effects on the acquisition of locative prepositions, but limited facilitating effects on the acquisition of the simple past). Saddour (2017) described how L2 French speakers' gestures concomitant with their oral production of L2 French tense and aspect (gestures concomitant with oral production of temporality in verbal language are called "temporal gesture") changed as their L2 French proficiency improved. These studies shed light on the spatio-visual dimension of L2 tense-aspect acquisition and delved into the psycholinguistic processes behind, complementing previous tense-aspect research that has mainly focused on verbal language.

1.2 The Present Study

There exist some flaws in the pioneering studies that explored the overlapping area between L2 tense-aspect acquisition and gesture. Therefore, there is a need for studies which adopt more rigorous designs to examine previous findings and to contribute more discoveries. Thus, the present study was designed. In this section, the two research questions for the present study, together with the respective research methods, are presented. Next, the significance of the present study, which lies in its theoretical and pedagogical implications, is described. The flaws and gaps in previous research, which motivated the present study, are reviewed in detail in Section 2.2 "Empirical Studies". The research methods are explained in detail in Chapter 3 "Methodology".

1.2.1 Research Questions

Research Question 1. Do pedagogical gestures facilitate English-as-a-foreign-language (EFL) learners' acquisition of the target English tense and aspect?

Research Question 1 is the main research question for the present study. It aims to quantitatively measure the effects of pedagogical gestures on EFL learners' acquisition of the target English tense and aspect. Specifically, it focuses on the effects of the

pedagogical deictic gesture and pedagogical metaphoric gesture (i.e., the two types of pedagogical gestures) on the learners' acquisition of the English simple past[1] and past progressive[2], respectively. The general design is a true experiment that follows the procedure of pretest—treatment—immediate posttest—delayed posttest. Four groups of EFL learners participated: a pilot group, an experimental group that received treatment in the form of verbal instruction plus pedagogical gestures, an experimental group that received treatment in the form of verbal instruction without pedagogical gestures, and a control group that received no treatment. Data for the learners' acquisition of the target English tense and aspect were collected through tests at three times during the true experiment: pretest, immediate posttest, and delayed posttest. The results of the tests were quantitatively analyzed.

Research Question 2. How do EFL learners perceive the pedagogical gestures for teaching the target English tense and aspect?

Research Question 2 aims to ascertain the EFL learners' perceptions of the teachers' pedagogical gestures. The learners' perceptions are qualitative data, which were collected through semi-structured interviews and analyzed through content analysis. The findings for Research Question 2 provide explanations for the results for Research Question 1.

1.2.2 Significance: Theoretical and Pedagogical Implications

The present study has both theoretical and pedagogical implications. The theoretical implication lies in the general interrelationships among gesture, language, and mind (e.g., whether and how the three constructs coordinate and synergize during the process of learning). The first pedagogical implication lies in the effects of

[1] The "simple past" and the "past tense" refer to the same linguistic structure. The "simple past" includes the past tense plus the simple aspect (the simple aspect is also called the zero aspect [Celce-Murcia & Larsen-Freeman, 1999]), and the "past tense" only includes the past tense. The two terms are used interchangeably in the thesis.

[2] The "past progressive" includes the past tense plus the progressive aspect. The corresponding pedagogical metaphoric gesture is for the progressive aspect in particular, and the focus is on the progressive aspect. In the thesis, when referring to the target structure, the "past progressive" and the "progressive aspect" are used interchangeably.

pedagogical gestures on EFL learners' acquisition of the target English tense and aspect. The second pedagogical implication lies in learners' perspectives of pedagogical gestures and the expected practices of pedagogical gestures on the part of teachers.

1.3 Thesis Outline

Chapter 1, the present chapter, begins the thesis by delineating the larger research background which consists of gesture research, SLA research, and tense-aspect research. Then it introduces the present study, by presenting and explaining the two research questions in connection with flaws and gaps in previous studies and the research methods adopted by the present study. Finally, it describes the theoretical and pedagogical implications of the present study.

Chapter 2 first defines the key constructs adopted in the present study, including gesture, tense and aspect, and temporal gesture, and then introduces the target structures to be investigated (i.e., the English simple past and the corresponding deictic gesture, and the English past progressive and the corresponding metaphoric gesture). Next, the chapter continues to review in detail the empirical studies pertaining to two research topics: first, pedagogical gesture; second, learners' perceptions of gestures. The research gaps related to the two research topics are respectively pointed out, which motivate the two research questions. The last part of Chapter 2 develops the theoretical framework for the present study, by describing the interrelationships among gesture, speech, and mind. It introduces Growth Point Theory, a classic theory that describes the interrelationships, and it also introduces other studies that reflect the interrelationships.

Chapter 3 first explains the research design in connection with the research questions, and then describes in detail the participants, instruments (including two types of tests and semi-structured interview), treatment, procedure, and data analysis.

Chapter 4 presents the respective findings for the two research questions, i.e., quantitative findings (i.e., descriptive and inferential statistics) for Research Question 1 and qualitative findings for Research Question 2.

Chapter 5 first discusses the results presented in Chapter 4, in connection with

previous studies and relevant theories. Then it draws conclusions for the present study, generating pedagogical and theoretical implications and pointing out the limitations of the present study and the directions for future research.

Chapter 2: Literature Review

This chapter first introduces the key constructs involved in the present study (Section 2.1), and then reviews the relevant empirical studies, with explanations about how the previous studies inform the present study (Section 2.2), and finally presents the theoretical framework (Section 2.3).

2.1 Key Constructs

The key constructs involved in the present study include gesture, tense and aspect, temporal gesture (i.e., a combination of gesture and tense-aspect), and the target structures (i.e., the English simple past and the pedagogical deictic gesture, and the English past progressive and the pedagogical metaphoric gesture). The following sub-sections review the literature on these key constructs, in connection with the present study.

2.1.1 Gesture

2.1.1.1 Construct

"Nonverbal behaviour" refers to "behavioural elements of communication, such as facial expressions, eye movements, and body postures" (W. Wang & Loewen, 2016, pp. 460-461), and "gesture" is defined as "a manifestly expressive action that enacts imagery (not necessarily by the hands or hands alone) and is generated as part of the process of speaking" (McNeill, 2012, p. 4). The definition by McNeill (2012) is in a broad sense. Under this definition, "gesture" is similar to "nonverbal behaviour". In a narrow sense, "gesture" is described as the spontaneous, synchronous, and meaningful hand and arm movements produced by people when they speak (McNeill, 1992, 2005). The present study focuses on "gesture" in a narrow sense.

2.1.1.2 Different Types of Gestures

Classifications

Kendon (1988) described different types of gestures, and McNeill (1992, 2005) arranged them along “Kendon’s continuum”. Based on McNeill (2005) and Urbanski and Stam (2023), Table 2.1 below presents the different types of gestures along the continuum, according to whether the speech is present, optional, or absent. In addition, the table also extracts corresponding descriptions and examples for the different types of gestures.

Table 2.1 The continuum for different types of gestures

	Gesticulations (co-speech gestures)	**Speech-linked gestures**	**Emblems**	**Pantomime**	**Sign language**
Relationship to speech (McNeill, 2005; Urbanski & Stam, 2023)	obligatory presence of speech	obligatory presence of speech	optional presence of speech	obligatory absence of speech	obligatory absence of speech
Description	"motion that embodies a meaning relatable to the accompanying speech" (McNeill, 2005, p. 5); co-expressive with speech (McNeill, 2005; Urbanski & Stam, 2023)	"fill a speech gap…especially when the speaker is having difficulty finding a word, and they complete the sentence" (Urbanski & Stam, 2023, p. 3)	"conventionalized signs" (McNeill, 2005, p. 5) "culturally specific" (Urbanski & Stam, 2023, p. 3)	"dumb show, a gesture or sequence of gestures conveying a narrative line, with a story to tell, produced without speech" (McNeill, 2005, p. 5)	"typically for the deaf" "have their own linguistic structures" (McNeill, 2005, p. 5)
Example	"The speaker was saying, 'and he goes up through the pipe this time' …Co-expressively with 'up' her hand rose upward; co-expressively with 'through' her fingers spread outward to create an interior space." (McNeill, 2005, p. 23)	"Sylvester went [gesture of an object flying out laterally]" (McNeill, 2005, p. 5)	"thumbs-up or the ring (first finger and thumb tips touching, other fingers extended) for 'OK.'" (McNeill, 2005, p. 5)	"mimes such as Marcel Marceau" (Urbanski & Stam, 2023, p. 4)	American Sign Language (ASL)

Among the different types of gestures, gesticulations (co-speech gestures) are the most frequent one in daily use, and they are also of the primary concern in gesture research (McNeill, 2005). The gestures that the present study examines (i.e., the two gestures that respectively accompany the English simple past and past progressive in speech) also fall into gesticulations (co-speech gestures). They co-express the temporal concepts, together with speech.

McNeill and Levy (1982) and McNeill (1992) proposed four major types of gestures, i.e., "The Iconic-Metaphoric-Deictic-Beat Quartet" (McNeill, 2005, p. 38). The four types belong to gesticulations (co-speech gestures) (McNeill, 2005). Table 2.2 below presents the descriptions and examples for the four types. As mentioned just now, the two gestures that the present study examines are also gesticulations (co-speech gestures). Specifically, one gesture is a deictic gesture, and the other gesture is a metaphoric gesture. They are included as examples for deictic gestures and metaphoric gestures in Table 2.2 (see the underlined parts in the table). The present study investigates L2 English tense-aspect teaching and learning, and previous studies have identified deictic and metaphoric gestures that teachers used for teaching L2 English tense-aspect (for a detailed review on this, see Section 2.2.1.1 "Qualitative Observations in Classroom"). To explore the effects of the gestures, the present study aligns with previous studies and adopts the deictic and metaphoric gestures.

Table 2.2 The "Iconic-Metaphoric-Deictic-Beat Quartet"

	Iconic	**Metaphoric**	**Deictic**	**Beat**
Description	pictorially depicting concrete referents	pictorially representing abstract ideas	pointing to locations **Concrete pointing**: "pointing at physically present objects or locations" (McNeill, 2005, p. 40) **Abstract pointing**: Pointing at abstract referents, "to present a nonspatial meaning" (McNeill, 2005, p. 40)	"flicks of the hand(s) up and down or back and forth that seem to 'beat' time along with the rhythm of speech", signally that what is being said is "important with respect to the larger discourse" (McNeill, 2005, p. 40)
Example	(the same example for "gesticulations [co-speech gestures]" in Table 2.1 above) "The speaker was saying, 'and he goes up through the pipe this time' …Co-expressively with 'up' her hand rose upward; co-expressively with 'through' her fingers spread outward to create an interior space." (McNeill, 2005, p. 23)	Example 1. A speaker seems to be holding an object, but she means presenting something abstract (e.g., an idea) (McNeill, 2005). Example 2. A speaker makes cyclic movements to show that an action is ongoing (i.e., the metaphoric gesture for the English progressive aspect, which is explored in the present study).	**Concrete pointing**: A child points to a toy in the corner. **Abstract pointing**: Example 1. An adult talks about and compares two situations, pointing to the left to indicate one situation, and pointing to the right to indicate the other situation.	When a speaker is "marking the introduction of new characters, summarizing the action, introducing new themes, etc.", his hand flicks (McNeill, 1992, p. 15).

	Example 2. A speaker points to the central place to indicate the present, to the left to indicate the past (i.e., the deictic gesture for the English past tense, which is explored in the present study), and to the right to indicate the future.

Pedagogical Gesture

"Pedagogical gesture refers to gestures used for instructional purposes" (Tellier & Yerian, 2023, p. 100), "often produced with conscious awareness with the intent of teaching" (Urbanski & Stam, 2023, p. 4). As Tellier and Yerian (2023) noted, this is a functional definition, and under this definition, pedagogical gestures can include a wide range of gesture types, including those reviewed in the section above (e.g., iconic, metaphoric, deictic, and beat). The present study adopts two gestures (i.e., a deictic gesture and a metaphoric gesture) as pedagogical gestures, and thus they are termed as "pedagogical deictic gesture" and "pedagogical metaphoric gesture".

Generally, across different subjects (including Mathematics, Physics, Chemistry, Language, and Music), teachers' appropriate uses of meaning-making pedagogical gestures can enhance students' learning, as suggested by various studies (Lim, 2021). Specifically, when it comes to SLA, pedagogical gestures also play a significant part in effectively mediating L2 teaching and learning (Lantolf & Thorne, 2006), which represents gesture's role as "a medium of SLA", as reviewed in Section 2.1.1.4 "The Three-dimensional Roles of Gesture in SLA".

Pedagogical gesture is the central topic of the present study, and the present study explores it in terms of two foci: the effects of pedagogical gestures (through a quantitative experiment) and learners' perceptions of pedagogical gestures (through qualitative interviews). For a detailed review of previous research in the two foci, see Section 2.2.1 "The Effects of Pedagogical Gestures" and Section 2.2.2 "Learners' Perceptions of Pedagogical Gestures".

L1 Gesture and L2 Gesture

Gesture is related to language development (Mayberry & Nicoladis, 2000). Gestures that accompany first language (L1) speech are called L1 gestures, and gestures that accompany second language (L2) speech are called L2 gestures. Gestures vary across different languages and cultures (Gullberg, 2006), so one's L1 gestures and L2

gestures can be different. Regarding L2 gesture, it plays an important role in L2 proficiency (Gullberg et al., 2008; Stam & McCafferty, 2008) and should be studied as an object of L2 acquisition in its own right (Gullberg, 2006, 2014; Gullberg et al., 2008), and this represents gesture's role as "an object of SLA", as reviewed in Section 2.1.1.4 "The Three-dimensional Roles of Gesture in SLA".

L1 gestures and L2 gestures can be different, and there are also cases in which they are similar. The present study makes use of similar L1 and L2 gestures. The present study examines the effects of the pedagogical deictic gesture on Chinese learners' acquisition of the L2 English past tense, as well as the effects of the pedagogical metaphoric gesture on the learners' acquisition of the L2 English progressive aspect. Chinese and English have different tense-aspect systems. To facilitate L1 Chinese learners' acquisition of L2 English tense and aspect, I identified from literature the common gesture referring to the past in both Chinese and English (i.e., the deictic gesture of pointing to the left), as well as the common gesture representing the progressive aspect in both Chinese and English (i.e., the metaphoric gesture of cyclic movements) (for a detailed review on this, see Section 2.1.2 "Tense and Aspect", Section 2.1.3 "Temporal Gesture", and Section 2.1.4 "Target Structures"). The similar L1 and L2 gestures can help bridge the gap between the different L1 and L2 tense-aspect systems.

2.1.1.3 The Three-dimensional Roles of Gesture in Second Language Acquisition

Gesture has become an area of interest in SLA in recent decades. According to Gullberg (2006, 2014) and Gullberg et al. (2008), gestures are of relevance to SLA, for the following three reasons. The three reasons also represent the three-dimensional roles of gesture in SLA.

Gesture as an Object of SLA

First, gestures can be different cross-culturally and cross-linguistically, and can be treated as an object of L2 acquisition in its own right in terms of both comprehension

and production (i.e., gesture as SLA itself) (Gullberg, 2006, 2014; Gullberg et al., 2008), which has been mentioned in Section "L1 Gesture and L2 Gesture" above. In this case, L2 gesture is an L2 target, which is like an L2 grammatical structure or an L2 word. Examples of the acquisition of L2 gestures have emerged from empirical studies. For instance, So (2010) discovered that the L2 English gesture frequency of bilinguals (their L1 is Mandarin Chinese) resembles the L1 English gesture frequency of English monolinguals. R. Wang (2019) found that Chinese learners' L2 English progressive aspect gestures integrate the features of both L1 Chinese progressive aspect gestures and L1 English progressive aspect gestures.

Gesture as a Reflection of SLA

Second, gestures are closely linked to language and speech, and can offer valuable insights into the processes of L2 acquisition, like grappling with expressive difficulties, L1 influence, interlanguage, and planning and processing difficulties (i.e., gesture as a reflection of SLA) (Gullberg, 2006, 2014; Gullberg et al., 2008). For example, Saddour (2017) and Sun and Zhang (2018) indicated that L2 gestures reveal the cognitive processes underlying L2 speech. L2 gestures also reveal L2 speakers' patterns of thinking for speaking ("thinking for speaking" refers to thinking that occurs on-line in the process of speaking [Slobin, 1991]) (Stam, 2018), and L2 gestures over time reveal longitudinal changes in the L2 speakers' patterns of thinking for speaking along with their L2 acquisition (Stam, 2006, 2010, 2015, 2016).

Gesture as a Medium of SLA

Third, gestures, as input, can contribute to L2 comprehension and learning (i.e., gesture as a medium of SLA, or in other words, the effect of gesture on SLA) (Gullberg, 2006, 2014; Gullberg et al., 2008). To illustrate, previous research has identified gesture as a pedagogical medium that produces facilitating effects on SLA (e.g., Nakatsukasa, 2013, 2016; Tellier, 2008. For a detailed review of the studies on this topic, see Section 2.2.1 "Focus 1: The Effects of Pedagogical Gestures"). The present study explores

pedagogical gestures and L2 tense-aspect learning, which falls into the dimension of gesture as a medium of SLA.

2.1.2 Tense and Aspect

2.1.2.1 Constructs

Conceptualization of time in cognition can be expressed by verbal language through multiple means: pragmatic means, lexical means, and morphological means (i.e., tense and aspect markings on verbs) (Bardovi-Harlig, 2000). Previous studies of L2 temporality acquisition have clearly shown the multiple means through which temporality is expressed in languages and the order of emergence of these temporal means in the process of second language acquisition. To synthesize relevant findings (Bardovi-Harlig, 2000; Dietrich, Klein, & Noyau, 1995; Klein & Perdue, 1997), at the earliest stage of SLA, L2 learners have no systematic use of tense-aspect morphology and rely on pragmatic means such as following chronological narrative orders. Later, lexical means emerge, which can take the forms of adverbials (e.g., "then"), connectives (e.g., "and"), and verbs (e.g., "start" "finish"). At this stage, verbs are in base forms and not morphologically marked. After the lexical stage, morphological means (i.e., tense-aspect morphology) succeed. These means are first used unsystematically and irregularly, then gradually become more appropriate, and finally stabilize and progress towards nativelikeness.

Tense concerns when an event happens and is "a deictic category that places a situation in time with respect to some other time, usually the moment of speech" (Salaberry & Shirai, 2002, p. 2). Tenses in English include the past tense, the present tense, and the future tense. Though many scholars do not consider future as a tense in English, the present study includes the future tense to avoid confusion to participants.

Aspect concerns how an event unfolds and, thus, represents "the different perspectives which a speaker can take and express with regard to the temporal course of some event, action, process, etc." (Klein, 1994, p. 16). Aspect is expressed through inherent lexical semantics of verbs (i.e., lexical aspect) and morphosyntactic verb

endings (i.e., grammatical aspect) (Smith, 1991). Grammatical aspects in English include the simple aspect, the perfect aspect, the progressive aspect, and the perfect progressive aspect. The simple aspect is the zero aspect, in which the speaker only considers the tense of an event rather than the status of the event itself. The perfect aspect represents the status of an event as being complete. The progressive aspect encodes the status of an event as being ongoing and incomplete. The perfect progressive aspect shows that an event continues until the time of speech and may continue further to the future.

The tense-aspect system in English consists of tenses, aspects, and tense-aspect conflations, as summarized in Table 2.3. Tense-aspect systems are a highly challenging domain of L2 grammar for learners to acquire, because they differ across languages.

Table 2.3 Tenses, aspects, and tense-aspect conflations in English

Aspect / **Tense**	**Past**	**Present**	**Future**
Simple	Simple past	Simple present	Simple future
Perfect	Past perfect	Present perfect	Future perfect
Progressive	Past progressive	Present progressive	Future progressive
Perfect progressive	Past perfect progressive	Present perfect progressive	Future perfect progressive

2.1.2.2 Tense and Aspect in Chinese and English

Different languages conceptualize time differently, which are realized through their distinctive means to express temporality such as tense and aspect morphology. As far as tense (i.e., the location of an event in time) is concerned, English has different tenses, as illustrated above, but Chinese is a "classic tenseless language" (Binnick, 1991, p. 446) that lacks grammaticized tense (Comrie, 1976) and anchors events by other means such as adverbials.

As regards aspect (i.e., perspectives on the internal structure of an event), there are both similarities and differences between the two languages. Chinese has a richer set of

grammatical aspect markers (e.g., the perfective aspect marker "了" [*le*], and the imperfective aspect markers "在" [*zai*] and "着" [*zhe*] which are similar to the *V-ing* marking English's progressive aspect), while English, comparatively poor in grammatical aspect morphology, replies more on lexis and periphrasis to express aspect (Duncan, 2002).

If L2 conceptualizations of time are rather different from those of L1, then L2 learners need to reconceptualize time in their mind and readjust the tense-aspect system, which is cognitively challenging (Matsumoto & Dobs, 2017). L2 learners tend to maintain their L1 thinking patterns when producing L2 (McNeill & Duncan, 2000). Considering the differences between the Chinese and English tense-aspect systems, L2 English tense and aspect can be difficult grammatical features for Chinese learners to acquire.

2.1.3 Temporal Gesture

2.1.3.1 Construct

Conceptualization of time in cognition can be expressed by verbal language such as tense and aspect morphology, and can also be conveyed by nonverbal means such as gesture. People first conceptualize abstract time as concrete space in mind, and then map the concrete spatial representations onto gestures. These gestures are called "temporal gestures" (Cooperrider, Núñez, & Sweetser, 2014).

Temporal gestures can offer valuable data, which may be unavailable from verbal language. For example, speakers of many languages conceptualize past as behind ego and future as in front of ego. Speakers of Aymara, however, take the opposite direction. When they talk about past, they gesture to the front, and when they talk about future, they gesture to the back. Such conceptualization of time is only revealed by temporal gesture (Núñez & Sweetser, 2006).

Temporal gestures are related to teaching temporality in verbal language. Previous studies have found a variety of gestures used by teachers to teach the English tense-aspect in the classroom. These gestures, on the one hand, are temporal gestures that

reflect the teachers' conceptualizations of time, and, on the other hand, are pedagogical gestures that help students build up conceptualizations of time. These gestures are summarized in Section 2.2.1.1 "Qualitative Observations in Classroom" below. The pedagogical gestures adopted in the present study (i.e., the pedagogical deictic gesture and the pedagogical metaphoric gesture) are also temporal gestures, and therefore are also called "pedagogical temporal gestures".

2.1.3.2 Chinese and English Temporal Gestures for the Past Tense

Section 2.1.2.2 "Tense and Aspect in Chinese and English" compares Chinese and English in terms of tense and aspect. Apart from tense-aspect morphology, there are other linguistic resources that can communicate conceptualizations of time. In terms of tense, although the Chinese language is tenseless, Chinese speakers do have conceptualizations of the past, the present, and the future. Linguistic resources that encode conceptualizations of time include nouns, verbs, adjectives, and adverbs, which conceptualize time along three spatial axes: sagittal (front-back), vertical (up-down), and lateral (left-right). The linguistic resources and their corresponding conceptualizations of time can also be embodied in temporal gestures. These temporal gestures are deictic gestures: to locate past, present, and future in space.

Sagittal Axis (Front-back)

Along the sagittal axis, Chinese frequently uses "front" in reference to the past (e.g., "以前" [the time in front]) and "back" to the future (e.g., "以后" [the time at back]), and sometimes uses "front" to refer to the future (e.g., "前途" [the road ahead]) and "back" to the past (e.g., "回顾" [look back]). By contrast, English only uses "front" to refer to the future (e.g., "the future ahead") and "back" to the past (e.g., "look back"). These sagittal linguistic time expressions affect Chinese and English speakers' production and comprehension of sagittal temporal gestures.

In terms of the sagittal linguistic influences on the production of sagittal temporal gestures, Gu (2018) and Gu, Zheng, and Swerts (2019) found that Chinese speakers

produce both past-in-front/future-at-back and future-in-front/past-at-back temporal gestures, which is in line with the sagittal linguistic time expressions in Chinese. They also found that Chinese speakers tend to perform the past-in-front/future-at-back gestures when the gestures are accompanying past-in-front/future-at-back linguistic time expressions. Regarding English speakers' production of sagittal temporal gestures, classroom observations in Hudson (2011) and Matsumoto & Dobs (2017) revealed that native English teachers produce the deictic gesture of pointing-back to refer to the English past tense , and a native English teacher in Matsumoto & Dobs (2017) produces the deictic gesture of pointing-to-the-front to refer to the English future tense (for more details, see Section 2.2.1.1 "Qualitative Observations in Classroom"), which is consistent with the sagittal linguistic time expressions in English. Section 2.3.3.2 "Language Influences Gesture: 'Language Architecture'" below will mention again the influences of linguistic time expressions on the production of temporal gestures, including the corresponding examples from Gu (2018), Gu et al. (2019), Hudson (2011), and Matsumoto and Dobs (2017) mentioned here.

Apart from affecting the production of sagittal temporal gestures, the sagittal linguistic time expressions also influence the comprehension of sagittal temporal gestures, as discovered by Ng, Goh, Yap, Tse, and So (2017). As mentioned above, both Chinese and English have sagittal linguistic time expressions which conceptualize time along the sagittal axis. In Chinese, "back" can refer to either past or future, and "front" can also refer to either past or future. By contrast, in English, "back" only refers to the past and "front" only refers to the future. Ng et al. (2017) found that to Chinese speakers, the pointing-back gesture can mean either past or future, and the pointing-to-the-front gesture can also mean either past or future; to English speakers, the pointing-back gesture only means the past and the pointing-to-the-front gesture only means the future. The findings show that Chinese and English speakers' comprehension of sagittal temporal gestures aligns with the corresponding sagittal linguistic time expressions. Section 2.3.3.3 "Gesture-Speech Integration and Boundaries during Language Comprehension: 'Integrated Systems Hypothesis'" below will review the mutual

influences between gesture and speech (i.e., in addition to the influence of language on gesture, as reviewed here) during gesture-speech comprehension and return to the example from Ng et al. (2017) mentioned here.

Vertical Axis (Up-down)

Along the vertical axis, Chinese commonly uses "above" to refer to the past (e.g., "上周" [the week above]) and "below" to the future (e.g., "下周" [the week below]). On the other hand, English, although also uses vertical expressions of time (e.g., "move a meeting up" [Boroditsky, 2008, p. 427], "hand down knowledge from generation to generation" [Boroditsky, Fuhrman, & McCormick, 2011, p. 123]), such uses are rare (Boroditsky, 2008; Boroditsky et al., 2011; H. Li, 2017). The vertical linguistic time expressions influence the speakers' production and comprehension of vertical temporal gestures.

Regarding the influences of vertical linguistic time expressions on the production of vertical temporal gestures, Gu, Mol, Hoetjes, and Swerts (2017) found that Chinese-English bilinguals (L1 Chinese) produce more vertical gestures when they are speaking vertical time expressions in Chinese than (1) when they are speaking time expressions in English translations (including translations of both vertical and non-spatial time expressions in Chinese), and (2) when they are speaking non-spatial time expressions in Chinese (e.g., "明天" [tomorrow]). Section 2.3.3.2 "Language Influences Gesture: 'Language Architecture'" below will return to this example.

In terms of the influences of vertical linguistic time expressions on the comprehension of vertical temporal gestures, Gu et al. (2017) investigated Chinese-English bilinguals (L1 Chinese) as well as native English speakers. As to Chinese-English bilinguals (L1 Chinese), it was discovered that they prefer vertical gestures to lateral gestures, when they are perceiving vertical time expressions in Chinese. The preference also exists when they are perceiving the vertical time expressions in the corresponding English translations, though the preference becomes less strong. On the other hand, the preference does not exist when they are perceiving non-spatial time

expressions in either Chinese or English. By contrast, as to native English speakers, it was found that they prefer lateral gestures to vertical gestures, when they are perceiving English translations of both vertical and non-spatial time expressions in Chinese.

To synthesize Gu et al.'s (2017) findings about Chinese-English bilinguals' production and comprehension of vertical temporal gestures, the between-language comparisons (i.e., Chinese vs. English) showed the long-term language-specific influences, and the within-language comparisons (i.e., vertical vs. non-spatial time expressions) showed the short-term (i.e., online) linguistic-choice influences. Thus, both between-language and within-language differences influence the production and comprehension of vertical temporal gestures.

Lateral Axis (Left-right)

Along the lateral axis, Chinese only uses "left" and "right" together as "left-right" after a specific time point, to refer to the time earlier or later than the time point (i.e., around the time point) (e.g., "九点左右" [9 o'clock left-right, which means earlier or later than 9 o'clock, i.e., around 9 o'clock]) (Gu et al., 2017). In this case, "left-right" means "earlier or later than", i.e., "around". By contrast, English does not use "left" or "right" to talk about time (Gu et al., 2017; Cienki, 1998).

Compared with the sagittal axis (front-back) and the vertical axis (up-down), the lateral axis (left-right) is less used in Chinese and English time expressions. Despite this, Chinese and English speakers' production and comprehension of temporal gestures show their conceptualizations of time along the lateral axis (left-right).

In terms of the production of temporal gestures, Gu et al. (2017) found that Chinese-English bilinguals' (L1 Chinese) produce lateral gestures for time references in both Chinese and English (i.e., pointing to the left for the past, and pointing to the right for the future). Such lateral temporal gestures are also produced by L1 English speakers, although English does not construct time along the left-right axis, as discovered by Cienki (1998).

In terms of the comprehension of temporal gestures, as reviewed in Section

"Vertical Axis" above, Gu et al. (2017) compared Chinese-English bilinguals' (L1 Chinese) comprehension of vertical vs. lateral temporal gestures, and also compared native English speakers' comprehension of vertical vs. lateral temporal gestures. As for Chinese-English bilinguals' (L1 Chinese), it was discovered that when they are perceiving vertical time expressions in both Chinese and the corresponding English translations[3], they prefer vertical gestures to lateral gestures[4]. However, when they are perceiving non-spatial time expressions in either Chinese or English[5], they do not prefer vertical gestures to lateral gestures. It can be inferred that Chinese speakers' preference for vertical gestures can be largely due to the vertical linguistic time expressions. When the linguistic time expressions are non-spatial, the preference for vertical gestures does not exist, and lateral gestures are also fine to Chinese speakers. As for native English speakers, when they are perceiving English translations of both vertical and non-spatial time expressions in Chinese, they prefer lateral gestures to vertical gestures. Such a preference for lateral gestures suggests that in spite of the absence of lateral time expressions in English, English speakers do conceptualize time along the lateral axis. Based on Gu et al.'s (2017) findings regarding Chinese and English speakers' comprehension of vertical vs. lateral temporal gestures, it can be concluded that both English and Chinese speakers can conceptualize time along the lateral axis.

Considering the conceptualizations of time by Chinese and English along the sagittal, vertical, and lateral axes, it can be concluded that what is common between Chinese and English is to conceptualize time along the lateral axis: to locate the past on the left, and the future on the right. Therefore, the present study uses the deictic gesture, i.e., pointing to the left of one's body, as the pedagogical gesture for teaching the

[3] In Gu et al. (2017), the Chinese vertical time expressions are translated into English non-spatial time expressions. For example, "上周" (the week above), a Chinese vertical time expression, is translated into "last week", an English non-spatial time expression.

[4] According to Gu et al. (2017), when the Chinese-English bilinguals are perceiving the English translations of Chinese vertical time expressions (the English translations are English non-spatial time expressions), they still prefer vertical gestures to lateral gestures. This shows that the L2 English translations activate the native Chinese speakers' L1 Chinese vertical time expressions.

[5] The non-spatial time expressions in English in this case (e.g., "yesterday") do not include the English translations of Chinese vertical time expressions (e.g., "last week" for "上周" [the week above]).

English past tense in the experimental treatment lessons.

2.1.3.3 Chinese and English Temporal Gestures for the Progressive Aspect

In terms of aspect, Duncan (2002) found that L1 temporal gestures for the Chinese imperfective aspect (the "imperfective aspect" is similar to the progressive aspect) and the English progressive aspect are similar: both are temporarily extended, repeating, or agitated movements. These temporal gestures are metaphoric gestures, that is, gestures that use hand movements to pictorially represent such abstract conceptualizations of the progressive aspect as ongoingness, incompleteness, and repetitiveness.

Similar uses of L1 temporal gestures for the English progressive aspect were also found in Matsumoto and Dobs' (2017) study, in which teachers used pedagogical gestures (i.e., circular hand movements) to explain to their students the concept of the English progressive aspect. Such gestures were also found in R. Wang's (2019) study of L1 Chinese speakers who made cyclic temporal gestures when orally producing the progressive aspect in L2 English.

In view of the findings reported by these studies, the present study uses the metaphoric gesture of circular hand movements, commonly used by L1 speakers to represent the Chinese imperfective aspect and the English progressive aspect, as the pedagogical gesture for teaching the English progressive aspect in the experimental treatment lessons.

As mentioned in Section "L1 Gesture and L2 Gesture", the deictic gesture of pointing to the left is both a Chinese gesture for the past and an English gesture for the past tense, and the metaphoric gesture of cyclic movements is both the Chinese gesture for the imperfective aspect and the English gesture for the progressive aspect. The common gestures are expected to bridge the gap between the different tense-aspect systems of Chinese and English.

2.1.4 Target Structures

2.1.4.1 The English Simple Past and the Deictic Gesture

The simple past is selected as a target structure in the present study. The first reason for selecting the simple past is that the past tense proves to be difficult for learners of L2 English to acquire, although it is introduced early in the classroom. L1 Chinese learners of L2 English often forget to mark the past tense, and one reason is the influence of L1 Chinese, which lacks the grammaticized past tense (Qu, 2019).

The second reason for selecting the simple past is that a temporal gesture commonly used for the English past tense (i.e., pointing to the left), which is consistent with the conceptualization of the past in Chinese, is a typical deictic gesture. The present study aims to examine whether the deictic gesture can strengthen learners' conceptualization of the English past tense, raise their awareness of the need to mark the tense morphologically, and improve their accuracy in the production of the linguistic structure.

2.1.4.2 The English Past Progressive and the Metaphoric Gesture

The past progressive is selected as the other target structure in the present study. It combines the past tense and the progressive aspect to locate an event in the past and represent the event as ongoing and incomplete. The first reason for selecting the past progressive is that, like the past tense, the progressive aspect is also difficult for learners of L2 English to acquire (Lin, 2011). Learners of L2 English perform worse in their use of the progressive aspect than in their use of the perfect aspect, although the former is typically taught earlier in the classroom than the latter.

The second reason for selecting the past progressive is that the temporal gesture often used for the English progressive aspect (i.e., circular hand movement) is consistent with the conceptualization of the Chinese imperfective aspect and is a typical metaphoric gesture. The present study aims to examine whether the metaphoric gesture can enhance learners' conceptualization of the English progressive aspect, raise their awareness of the compulsory marking of the aspect in English, and improve their accuracy in the production of the linguistic structure.

2.2 Empirical Studies

Section 2.1 above introduces the key constructs involved in the present study. This section, Section 2.2., reviews the empirical studies pertaining to the two research topics of the present study: the effects of pedagogical gestures (Section 2.2.1) and learners' perceptions of pedagogical gestures (Section 2.2.2). Research gaps in the two topics are pointed out respectively, and corresponding research questions are proposed. After that, possible issues in previous studies are analyzed, and how the present study addresses the issues is explained.

2.2.1 Topic 1: The Effects of Pedagogical Gestures

Empirical studies of pedagogical gestures have mainly been conducted through qualitative classroom observations (reviewed in Section 2.2.1.1) and quantitative experimental measurements (reviewed in Section 2.2.2.2). The review in these two sub-sections pays special attention to the studies of pedagogical gestures for teaching L2 English tense and aspect, which are directly relevant to the present study. Section 2.2.1.3 points out the research gap, which Research Question 1 intends to fill, and Section 2.2.1.4 analyzes the flaws in previous studies and how the present study remedies the flaws.

2.2.1.1 Qualitative Observations in Classroom

There have been some studies which drew on qualitative classroom observations and identified pedagogical gestures for various L2 targets, such as word meanings or concepts (Hudson, 2011; Smotrova & Lantolf, 2013), pronunciation (Hudson, 2011), grammar (Hudson, 2011; Matsumoto & Dobs, 2017; Sime, 2008; Smotrova, 2014), syntax (van Compernolle & Smotrova, 2014), academic writing (Zhao, 2007), and L2 identity (Peltier & McCafferty, 2010).

Within the domain of L2 grammar teaching, and specifically L2 English tense and aspect teaching, there have been studies which identified some pedagogical gestures for teaching certain tenses, aspects, and tense-aspect conflations (Hudson, 2011;

Matsumoto & Dobs, 2017; Sime, 2008; Smotrova, 2014). These pedagogical gestures are temporal gestures that convert abstract conceptualizations of time into concrete spatial representations by hands. The gestures have been utilized by teachers to preempt or compensate for potential difficulties that learners have in understanding the conceptualizations of time. Table 2.4 below presents a summary of these pedagogical gestures.

Table 2.4 A summary of pedagogical gestures for teaching L2 English tense and aspect

Tense and aspect		Gesture type	Description
Tense	Past	*deictic*	pointing backward (Hudson, 2011; Matsumoto & Dobs, 2017);
			stepping backward (Hudson, 2011);
			hands on the left (Sime, 2008; Smotrova, 2014)
			moving the body to the right (i.e., to the left from students' perspective) (Matsumoto & Dobs, 2017)
	Present	*deictic*	putting hands in front of the chest (Matsumoto & Dobs, 2017)
		metaphoric	making circular motions to express habit or routine (Matsumoto & Dobs, 2017)
	Future	*deictic*	pointing to the front (Matsumoto & Dobs, 2017)
			hands on the right (Sime, 2008; Smotrova, 2014)
Aspect	Progressive	*metaphoric*	two palms facing each other like a container to mimic a period of time (Matsumoto & Dobs, 2017)
			moving hands along the transversal timeline from left (past) to right (future) to show the progression of action (Smotrova, 2014)
Tense-Aspect	Present progressive	*deictic*	Step 1. putting hands in front of the chest to indicate the present tense

Conflation		*metaphoric*	Step 2. making circular motions to indicate the continuous action of the progressive aspect (Matsumoto & Dobs, 2017)
	Past perfect	*deictic*	Step 1. moving the body to the right (i.e., to the left from students' perspective) to indicate the past tense Step 2. the right hand pointing further right to indicate the perfect aspect (Matsumoto & Dobs, 2017)

2.2.1.2 Quantitative Measurements of the Effects

There have been some studies that designed experiments to quantitatively measure the effects of pedagogical gestures on learning different L2 targets, including vocabulary, pronunciation, and grammar.

For L2 vocabulary learning, results show that pedagogical iconic gestures (i.e., gestures depicting the referents of the L2 target words) generally had significant facilitating effects. For example, Huang, Kim, and Christianson (2018) presented L2 Mandarin vocabulary with gestures, and the gestures effectively helped learners recognize the target words. Tellier (2008) found that pedagogical gestures plus the learners' reproduction of the gestures significantly enhanced the learners' memorization of L2 English vocabulary. Similarly, García-Gámez, Cervilla, Casado, and Macizo (2021) discovered the facilitating effects of both observing and performing gestures on memorizing foreign language words, and performing gestures was more effective than observing gestures. The facilitating effects in Tellier (2008) and García-Gámez et al. (2021) were shown in not only the learners' improved understanding but also their enhanced production of the target words.

On L2 pronunciation learning, the pedagogical gestures, which visualized the pronunciation contours, also produced facilitating effects. For example, the pitch gestures enhanced the acquisition of Mandarin lexical tones, as shown in the participants' better tone identification and meaning understanding (Morett & Chang, 2015). Iizuka, Nakatsukasa, and Braver (2020) examined the effects of handclapping gestures on the development of L2 Japanese segmentals, and Li, Baills, and Prieto (2020) investigated the effects of horizontal hand-sweep gestures on the acquisition of Japanese vowel-length contrasts. Both studies suggested the facilitating effects of observing and performing the gestures. A difference between the findings of the two studies is that Iizuka et al. (2020) found significant improvement in learners' perception of the segmentals but no significant improvement in their production of the segmentals, whereas Li et al. (2020) generated the opposite results: no significant improvement in

learners' perception of the vowel-length contrasts but significant improvement in their production of the vowel-length contrasts.

For L2 grammar learning, Nakatsukasa's studies (2013, 2016, 2021) investigated and compared the effects of pedagogical gestures on the acquisition of two different types of L2 English grammatical structures. She adopted iconic gestures for teaching five locative prepositions (i.e., *on*, *in*, *under*, *next to*, and *above*) (Nakatsukasa, 2013, 2016) and a deictic gesture (i.e., point-back) for teaching the past tense (Nakatsukasa, 2013, 2021). For both target structures, the learning outcomes were measured by a grammaticality judgment test[6] and an oral production test. The grammaticality judgment test results for neither target structures showed significant improvement, because the learners had already had high levels of explicit knowledge of the two target structures before the experiment. On the other hand, the oral production test results for the two target structures differed. There was significant improvement in the oral production of locative prepositions, and the iconic gestures maintained the development. There was also significant improvement in the oral production of the past tense, but the deictic gesture did not display a significant facilitating effect.

From the previous studies synthesized above, it can be seen that most pedagogical gestures can significantly facilitate the acquisition of the corresponding L2 targets, including vocabulary, pronunciation, and grammar, and such effective pedagogical gestures are mainly iconic gestures that depict the corresponding L2 targets. However, the pedagogical deictic gesture for the past tense (i.e., point-back) did not show such facilitating effect (Nakatuskasa, 2013, 2021).

With respect to the efficacy of the pedagogical gestures demonstrated in teaching L2 vocabulary, pronunciation, and grammar (i.e., locative prepositions), it was explained that the gestures visualized the L2 targets, and the visualization enhanced recognition (Huang et al., 2018; Morett & Chang, 2015), strengthened memory (Tellier, 2008), or maintained memory (Iizuka et al., 2020; Nakatsukasa, 2013, 2016). Moreover, in addition to observing gestures through the visual modality, performing gestures

[6] The grammaticality judgment test is a written perception test.

through the motor modality further improved memory (García-Gámez et al., 2021; Li et al., 2020; Tellier, 2008).

To account for the inefficacy of the pedagogical gesture shown in teaching the L2 English past tense, Nakatsukasa (2013, 2021) suggested that the past tense is different from locative prepositions. Locative prepositions refer to concrete spatial locations, and the pedagogical gestures representing them directly communicate the location meanings. The past tense, on the other hand, is an abstract temporal concept, and the pedagogical gesture used to teach it (i.e., point-back) does not directly convey the temporal meaning. Therefore, pedagogical gestures may be more effective for teaching concrete target structures than abstract target structures.

2.2.1.3 Research Gap 1 and Research Question 1

Regarding pedagogical gestures for L2 tense-aspect teaching and learning, previous studies have mainly been qualitative and descriptive analysis of classroom teaching and learning, and the major findings are the pedagogical deictic and metaphoric gestures for teaching L2 tense-aspect identified from classroom, as reviewed in Section 2.2.1.1 “Qualitative Observations in Classroom” above. It remains to be explored how effective the pedagogical gestures are, and accordingly there is a lack of quantitative studies that measure the effects of such pedagogical gestures. Quantitative measurements can also track learners’ development (Matsumoto & Dobs, 2017). Nakatsukasa’s study (2013, 2021), which quantitatively measured the effects of the pedagogical deictic gesture (i.e., point-back) on learning the L2 English past tense, seems to be the only one in this regard. Furthermore, there does not seem to be a study that quantitatively measures the effects of a pedagogical metaphoric gesture on learning the L2 English progressive aspect. To contribute more quantitative data and findings, the present study adopts a quantitative experimental design, measuring the effects of a pedagogical deictic gesture on learning the past tense, as well as the effects of a pedagogical metaphoric gesture on learning the progressive aspect. Thus, Research Question 1 is proposed and specified as Research Questions 1a and 1b below.

Research Question 1. Do pedagogical gestures facilitate English-as-a-foreign-language (EFL) learners' acquisition of the target English tense and aspect?

Research Question 1a. Does the pedagogical deictic gesture facilitate EFL learners' acquisition of the English past tense?

Research Question 1b. Does the pedagogical metaphoric gesture facilitate EFL learners' acquisition of the English progressive aspect?

2.2.1.4 Problems in Previous Studies and Solutions in the Present Study

Nakatsukasa (2013, 2021) quantitatively measured the effects of the pedagogical deictic gesture (i.e., point-back) on learning the L2 English past tense, which is pioneering. However, there is a flaw in her study, which concerns the design of the pedagogical gesture. The point-back gesture was used in the experimental treatment to represent the past. The validity of the gesture is questionable. The majority of the participants in the study were L1 Chinese speakers: 35 (59.3%) of the total 59 participants and 18 (66.7%) of the 27 participants in the experimental group that received pedagogical gestures were L1 Chinese speakers. As reviewed in Section 2.1.3.2 "Chinese and English Temporal Gestures for the Past Tense", Ng et al. (2017) found that L1 Chinese speakers conceptualize the past as either back or front, and that both the point-back and the point-front gestures can refer to the past. The point-back gesture could have been unclear to the L1 Chinese participants what the teacher meant, and consequently failed to enhance their conceptualization of the past and their acquisition of the corresponding past tense. Therefore, the finding that the pedagogical gesture has limited effects on the acquisition of the L2 English past tense is debatable. It may be more desirable to adopt a clear and comprehensible pedagogical gesture in the first place and see whether such a gesture will be effective.

To address this issue, the present study adopts another gesture for the past tense, based on the review of previous studies of temporal gesture in Section 2.1.3.2 "Chinese and English Temporal Gestures for the Past Tense". As reviewed in Section 2.1.3.2, both L1 Chinese speakers and L1 English speakers conceptualize time along the lateral

axis: left is past, and right is future. Accordingly, the present study adopts "pointing to the left" as the pedagogical gesture for representing the past tense.

The second flaw in previous research is that in the quantitative experimental studies measuring the effects of pedagogical gestures on learning various L2 targets, the number of participants tend to be inadequate to generate rigorous findings. Among the quantitative studies with between-subjects designs reviewed in Section 2.2.1.2 above, all of them had less than 30 participants per group. To address this problem, the present study has not less than 30 participants per group.

2.2.2 Topic 2: Learners' Perceptions of Pedagogical Gestures

In previous studies, methods for collecting learners' perceptions of gestures include interview (Kusanagi, 2015; Sime, 2006, 2008; Zhao, 2007) and survey (Hudson, 2011; Kusanagi, 2015). The qualitative and descriptive findings are synthesized in Section 2.2.2.1. Next, in Section 2.2.2.2, the gap in the topic is pointed out, and Research Question 2 is proposed accordingly. Finally, Section 2.2.2.3 provides explanations about how the interview questions in previous studies informed the present study.

2.2.2.1 Awareness, Perceived Functions, and Attitudes

In previous studies, learners' perceptions of pedagogical gestures can be divided into mainly three categories: learners' awareness of pedagogical gestures, their perceived functions of pedagogical gestures, and their attitudes towards pedagogical gestures.

Regarding awareness, learners in different studies expressed different degrees of awareness of pedagogical gestures. Zhao (2007) found that learners were not much aware of teachers' pedagogical gestures. Kusanagi (2015) found that in the primary research site, only a few learners expressed in interviews their consciousness of teachers' pedagogical gestures, whereas in the secondary research sites, all the learners in the survey reported that they were aware of the gestures (possibly because the interviews

did not clearly target at gestures, whereas the survey did). By contrast, Hudson (2011) and Sime (2006, 2008) discovered that learners were aware of teachers' pedagogical gestures.

In terms of learners' perceived functions of pedagogical gestures, findings are also mixed. Zhao (2007) discovered that the effectiveness of pedagogical gestures was not well perceived by learners in comparison with that of verbal instruction. On the other hand, Sime (2006, 2008) summarized from learners' interview data three types of gesture functions during classroom interaction: "cognitive functions" (including enhancing comprehension, facilitating processes of learning, and providing feedback), "emotional/affective functions" (i.e., emotional involvement of learners), and "organizational functions" (i.e., classroom organization). The "emotional/affective functions" were also identified in Kusanagi (2015, p. 298): "positive influence on liveliness, intimacy, rapport, trustworthiness, positive engagement, and motivation in learning or the learning environment".

Different from the mixed findings for awareness and perceived functions, learners' attitudes towards pedagogical gestures have generally been positive. They appreciated such gestures (Kusanagi, 2015), expressed favor for them (Hudson, 2011), and considered them as important (Hudson, 2011; Sime, 2006, 2008).

2.2.2.2 Research Gap 2 and Research Question 2

Research Question 1 measures EFL learners' acquisition of L2 English tense and aspect with the intervention of the pedagogical gestures. It is also of value to explore the learners' opinions of the pedagogical gestures. Their covert opinions can offer explanations for their learning (e.g., whether the teacher's pedagogical gestures are helpful). The findings from the opinions can complement the findings for Research Question 1. However, there seems to be little research that looks into certain pedagogical gestures through both quantitative measurements of teaching effects and qualitative interview for learners' opinions. To address this, Research Question 2 is proposed. Learners' perceptions were collected by semi-structured interviews, and

content analysis was conducted to the interview data.

Research Question 2. How do EFL learners perceive the pedagogical gestures for teaching the target English tense and aspect?

2.2.2.3 Interview Questions in Previous Studies and the Present Study

The specific interview questions designed for Research Question 2 are presented in both Section 3.3.2 and Appendix C. Following the major themes identified from learners' interview/survey data in previous studies, the interview questions in the present study cover learners' perceived functions of pedagogical gestures and their attitudes towards the gestures. In previous studies, the interview and survey aimed to investigate pedagogical gestures in general, and they did not focus on particular pedagogical gestures. In the present study, apart from covering pedagogical gestures in general, the interview questions pay special attention to the specific pedagogical gestures for teaching L2 English tense and aspect. The interview/survey findings of previous studies and those of the present study are compared to see how similarly or differently the learners in different studies perceive pedagogical gestures.

On the other hand, the interview questions in the present study do not cover learners' awareness of pedagogical gestures, which is another major theme in previous findings. In previous studies, the teachers did not intentionally draw learners' attention to pedagogical gestures in class, and researchers would like to see whether and to what extent learners were aware of the pedagogical gestures in naturalistic settings, so the interview and survey covered "awareness". By contrast, in the present study, I, who was both the teacher and the researcher, manipulated the pedagogical gestures as an independent variable and intentionally drew learners' attention to my pedagogical gestures in class, asking them to mimic me and perform the gestures. I asked the learners to perform the gestures, because previous research has suggested that performing gestures is effective in addition to observing them (García-Gámez et al., 2021; Li et al., 2020; Iizuka et al., 2020; Tellier, 2008). In this case, I already raised the learners' awareness of my pedagogical gestures, and therefore, the interview questions

in the present study do not cover whether the learners are aware of the gestures or not.

2.3 Theoretical Framework

The present study explores the effects of pedagogical gestures on the acquisition of L2 tense and aspect. In essence, it explores the relationship between gesture and SLA. Moreover, the pedagogical gestures are also temporal gestures that represent the conceptualizations of time in thought. Therefore, what the present study explores involves the relationships among gesture, thought, and SLA.

The theoretical framework of the present study consists of propositions[7] regarding the interrelationships among gesture, thought, speech, and language. Section 2.3.1 presents a proposition about the overall relationships among gesture, thought, and speech. After the overall relationships, Section 2.3.2, Section 2.3.3, and Section 2.3.4 respectively zoom in to the propositions about the specific interrelationships: (1) between gesture and thought, (2) among gesture, speech, and language, and (3) among thought, speech, and language. In each section, how the present study fits into the corresponding theoretical propositions is explained. Finally, Section 2.3.5 synthesizes the theoretical framework and the present study.

2.3.1 Gesture, Thought, and Speech: "Growth Point"

Gesture, thought, and speech are interconnected and interacting with each other. "Growth Point" is a proposition that posits the relationships among the three constructs, and it was described by McNeill (1992) as "the speaker's minimal idea unit that can develop into a full utterance together with a gesture" (p. 220). The "minimal idea unit" is thought, and "a full utterance" is speech. Accordingly, thought can develop into speech and gesture. The process of development from thought into speech and gesture is also a process of expression. Speech conveys linguistic information, and gesture presents imagistic information. Therefore, thought is co-expressed through speech and

[7] This section does not cover all the propositions about the interrelationships among gesture, thought, speech, and language. Instead, only the propositions which are relevant and can apply to the present study are selected and reviewed.

gesture dialectically. Not only speech but also gesture should be studied, so as to gain a comprehensive picture. Figure 2.1 below illustrates the relationships among gesture, thought, and speech.

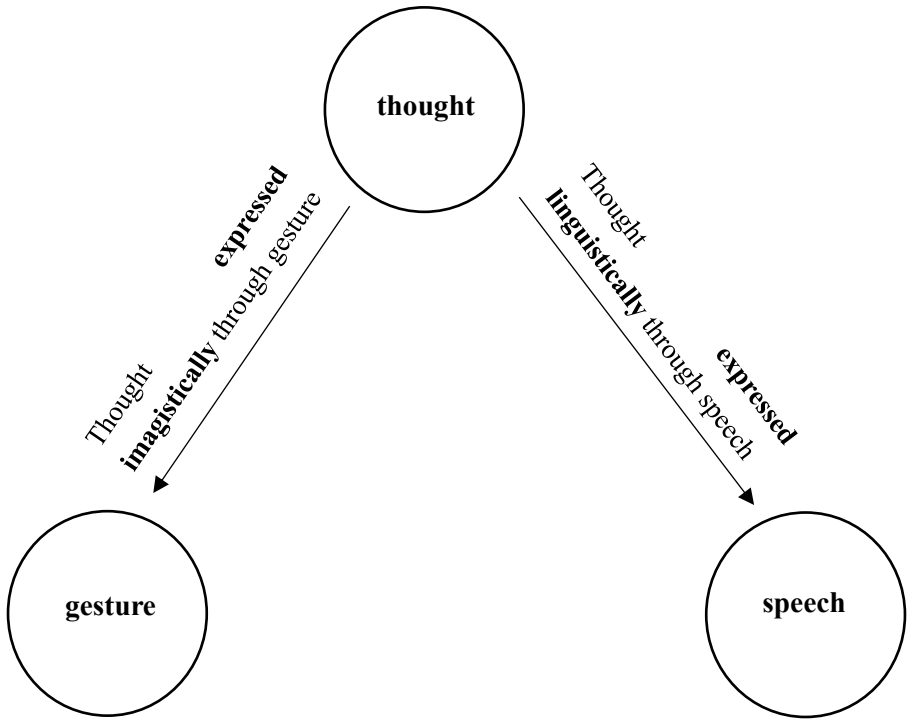


Figure 2.1 The relationships among gesture, thought, and speech

When it comes to the present study, in relation to thought, as mentioned in Section 2.1.3 “Temporal Gesture”, the gestures in the present study belong to “temporal gesture” (i.e., people first conceptualize abstract temporal concepts as concrete space in thought, and then map the concrete space onto gestures). In relation to speech, as mentioned in Section 2.1.1.2 “Different Types of Gestures”, the gestures in the present study belong to “gesticulation (co-speech gesture)” (i.e., the presence of speech is obligatory, the meaning conveyed through the gesture is relatable to speech, and the gesture is co-expressive with speech).

With reference to the relationships among gesture, thought, and speech, as posited by “Growth Point” and illustrated in Figure 2.1 above, one gesture in the present study is the deictic gesture of pointing to the left, accompanying the English past tense in

speech, and the deictic gesture and the past tense in speech co-express the temporal concept of past in thought. Likewise, the other gesture in the present study is the metaphoric gesture of cyclic movements, accompanying the English progressive aspect in speech, and the metaphoric gesture and the progressive aspect in speech co-express the temporal concept of progressiveness in thought. Figure 2.2 and Figure 2.3 below specify the relationships among gesture, thought, and speech in the present study. Figure 2.4 synthesizes Figure 2.2 and Figure 2.3.

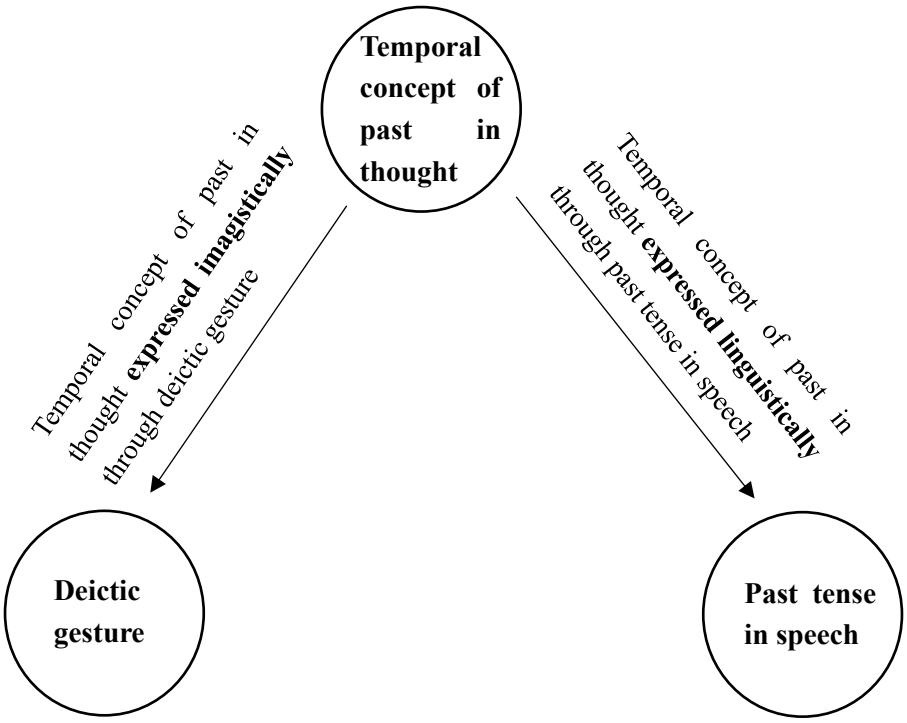


Figure 2.2 The relationships among the deictic gesture, the temporal concept of past in thought, and the past tense in speech

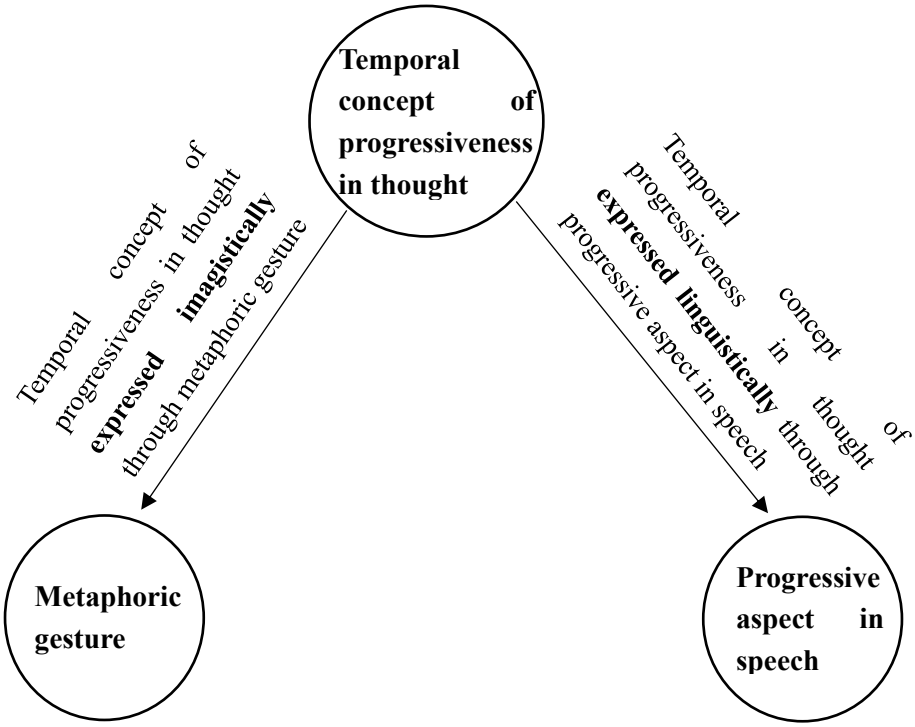


Figure 2.3 The relationships among the metaphoric gesture, the temporal concept of progressiveness in thought, and the progressive aspect in speech

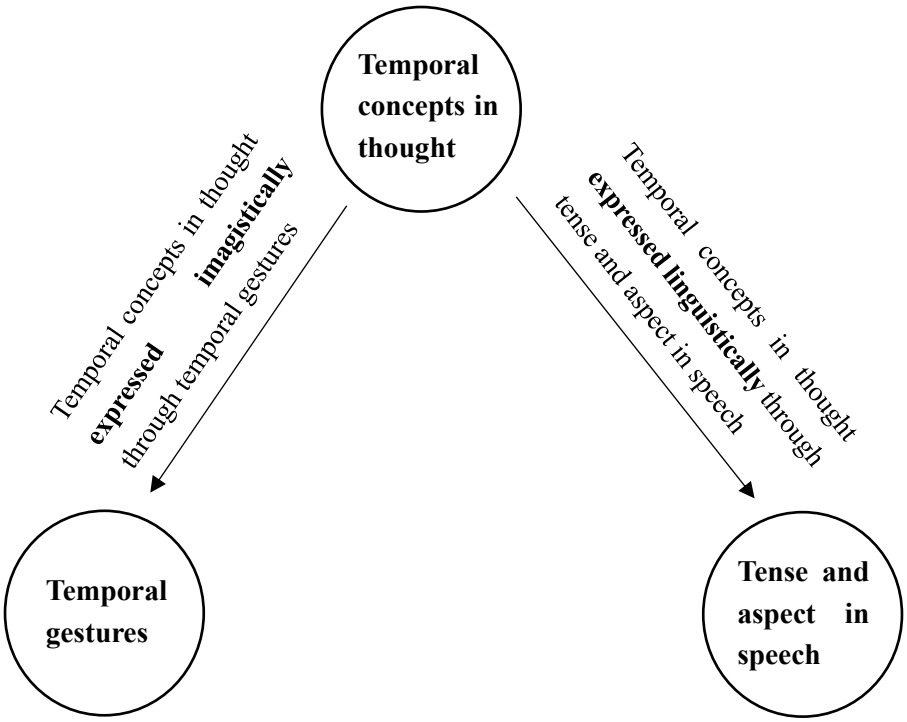


Figure 2.4 The relationships among the temporal gestures, the temporal concepts in thought, and the tense and aspect in speech

2.3.2 Gesture and Thought: "Gesture-for-Conceptualization Hypothesis"

As mentioned in Section 2.3.1 "Gesture, Thought, and Speech: 'Growth Point'" above, thought *develops into* gesture, and thought *is expressed through* gesture imagistically. There are other descriptions of the relationship between gesture and thought, such as thought *is revealed by* gesture (McNeill, 1992), thought *is reflected by* gesture (Goldin-Meadow & Alibali, 2013; McNeill, 1992), gesture *is a window into* thought (the "Window Architecture" proposed by de Ruiter [2007]; McNeill & Duncan, 2000), including the on-line thinking during L2 speaking (mentioned in Section "Gesture as a Reflection of SLA") (Stam, 2016, 2018), gesture *externalizes* thought (McNeill & Duncan, 2000), and gesture *is a material carrier of* thought (McNeill & Duncan, 2000). These descriptions are essentially similar. The present study explores pedagogical gestures for teaching L2 English tense and aspect. The pedagogical gestures are temporal gestures which externalize the temporal concepts in the teacher's thought.

In turn, gesture influences thought (Goldin-Meadow, 1999; Goldin-Meadow & Alibali, 2013; Kita, Alibali, & Chu, 2017; McNeill, 1992, 2005). Regarding how gesture influences thought, Kita et al. (2017) proposed "Gesture-for-Conceptualization Hypothesis". The hypothesis focuses on representational gestures (i.e., "gestures that depict or indicate information related to the contents of concurrent speech or thought", including iconic, metaphoric, and deictic gestures [Kita et al., 2017, p. 245]). The hypothesis argues that a speaker's representational gestures not only facilitate the communication between the speaker and the listener (i.e., external-oriented communicative function) by *externalizing* the speaker's mental representations, but also influence the speaker's own thinking and speaking (i.e., internal-oriented cognitive functions) by *schematizing* concrete spatio-motoric information as well as abstract concepts. Goldin-Meadow (1999) also regarded gesture as a thinking tool for speakers. Apart from influencing the speaker's thinking, the internal-oriented cognitive functions also influence the listener's thinking. After "Growth Point" (McNeill 1992), as reviewed and illustrated in Section 2.3.1 "Gesture, Thought, and Speech: 'Growth

Point'" above, "Gesture-for-Conceptualization Hypothesis" specifies the interrelationships between gesture and thought, as illustrated in Figure 2.5 below.

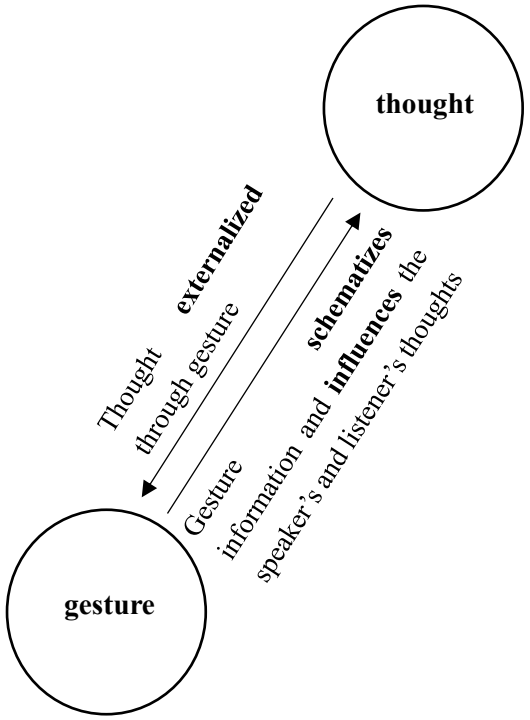


Figure 2.5 The interrelationships between gesture and thought

According to the hypothesis, the teacher's pedagogical gestures in the present study, on the one hand, are temporal gestures which externalize the temporal concepts of the English past tense and progressive aspect in the teacher's thought; on the other hand, they schematize the abstract temporal concepts, with the aim to help with the listeners' (i.e., participating learners) conceptualizations of the L2 English past tense and progressive aspect in their thoughts. This represents gesture's role as "a medium of SLA", as mentioned in Section "Gesture as a Medium of SLA", and the present study explores the effects of the medium. Figure 2.6 below illustrates the specific interrelationships between gesture and thought in the present study. Some previous empirical research (Jamalian & Tversky, 2012; Lewis & Stickles, 2017) has shown the influence of gestures on temporal concepts in thought.

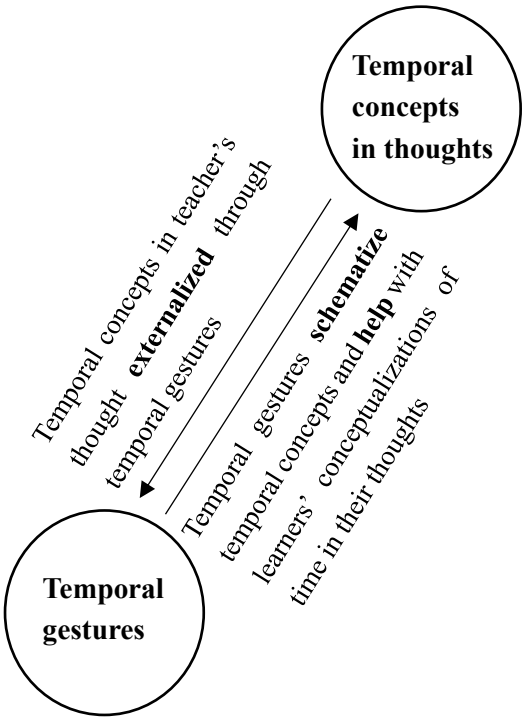


Figure 2.6 The interrelationships between temporal gestures and temporal concepts in thoughts

2.3.3 Gesture, Speech, and Language

Section 2.3.1 "Gesture, Thought, and Speech: 'Growth Point'" above reviews the overall relationships among gesture, thought, and speech. The triad includes "speech" instead of "language", because it focuses on the on-line spoken language concomitant with gesture. The present study explores the relationship between gesture and second language acquisition, and second language acquisition is not limited to speech (what second language acquisition includes is explained in detail in Section 2.3.3.4 below). This section reviews the propositions about the relationships among gesture, speech, and language (i.e., language in general, including second language acquisition), including "Gesture Complements Speech: 'Growth Point'" (Section 2.3.3.1), "Language Influences Gesture: 'Language Architecture'" (Section 2.3.3.2), "Gesture-Speech Integration and Boundaries during Language Comprehension: 'Integrated Systems Hypothesis'" (Section 2.3.3.3), and "Gesture is a Medium of Language Development" (Section 2.3.3.4).

2.3.3.1 Gesture Complements Speech: "Growth Point"

There have been a number of propositions about the interrelationships between gesture and speech. A proposition relevant to the present study is that gesture *complements* speech (McNeill, 1992). As mentioned in Section 2.3.1 "Gesture, Thought, and Speech: 'Growth Point'" above, gesture and speech co-express thought dialectically. Speech expresses linguistic information, and gesture expresses imagistic information. Based on this, gesture *complements* speech by conveying imagistic information. When the linguistic information in a speaker's speech is difficult for a listener to understand, the imagistic information in the speaker's gesture can serve as *remedy*. This proposition is illustrated in Figure 2.7 below.

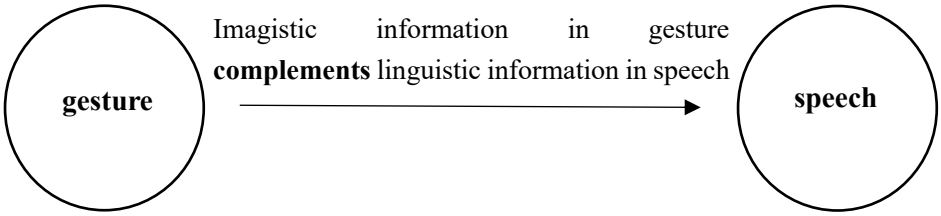


Figure 2.7 The relationship between gesture and speech

With reference to this proposition, in the present study, the teacher's pedagogical temporal gestures present the visual spatial conceptualizations of time in the teacher's thought, which *complements* the teacher's oral instruction in tense and aspect. The complementary function realizes the purpose of pedagogical gestures (i.e., "for instructional purposes", as mentioned in Section "Pedagogical Gesture" above). The relationship between gesture and speech in the present study is specified in Figure 2.8 below.

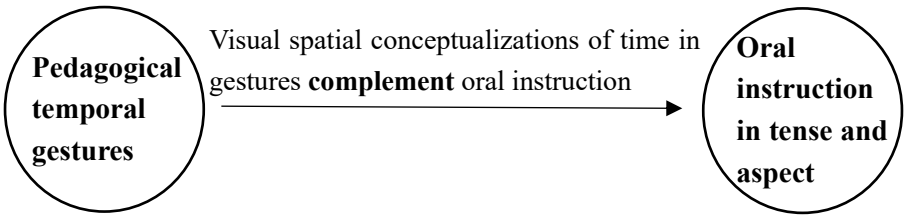


Figure 2.8 The relationship between pedagogical temporal gestures and oral instruction in tense and aspect

Apart from complementing speech, gesture can also *provide information which is absent in speech*. Goldin-Meadow and Alibali (2013) contended that some thoughts are reflected only by gesture rather than by speech, which was corroborated by classroom observations of learners' gestures in Matsumoto and Dobs' (2017) empirical study. Gesture providing information which is not expressed in speech represents another relationship between gesture and speech, i.e., *gesture-speech mismatch* (Church & Goldin-Meadow, 1986; Goldin-Meadow & Alibali, 2013).

2.3.3.2 Language Influences Gesture: "Language Architecture"

Gesture complements speech. In turn, language[8] influences gesture production. The "Language Architecture" (de Ruiter, 2007) argues that the way a language encodes information *influences* the shape of its corresponding gestures. An example from Kita and Özyürek (2003) is about the description of a cartoon scene where a cat uses a rope to "swing across" to the other side of the street. English has the verb "swing" to describe an arc-like action trajectory, whereas Japanese does not have a similar verb. Therefore, English speakers are more likely to produce an arc-like gesture than Japanese speakers, whereas Japanese speakers often produce a straight gesture. The influence of language on gesture is illustrated in Figure 2.9 below.

[8] "Language" here refers to language in general, and is not limited to speech.

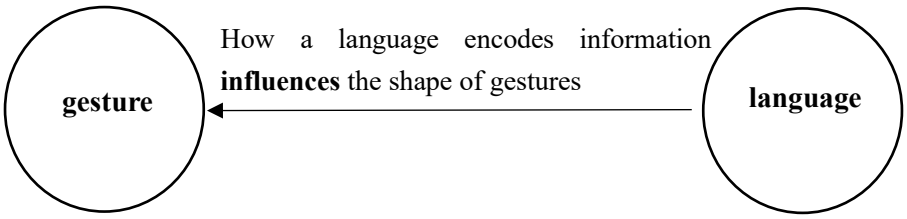


Figure 2.9 The influence of language on gesture

Temporal expressions in language also influence the production of temporal gestures. There are some typical examples from Gu (2018), Gu et al. (2017), Gu et al. (2019), Hudson (2011), and Matsumoto and Dobs (2017), as reviewed in Section 2.1.3.2 "Chinese and English Temporal Gestures for the Past Tense" above. In languages, time can be spatialized along the sagittal, vertical, and lateral axes. Along the sagittal axis, in Chinese, "front" can refer to either past or future, and "back" can also refer to either past or future. Gu (2018) and Gu et al. (2019) found that in alignment with the linguistic time expressions, Chinese speakers can produce a pointing-to-the-front gesture to mean either past or future, as well as a pointing-back gesture to mean either past or future. When they say "front" to refer to past and "back" to refer to future in their speech, they tend to perform the consistent past-in-front and future-at-back gestures. On the other hand, in English, "front" only refers to future, and "back" only refers to past. Hudson (2011) and Matsumoto and Dobs (2017) discovered that native English teachers produce temporal gestures which are consistent with the linguistic time expressions in English (i.e., a pointing-to-the-front gesture to refer to future, and a pointing-back gesture to refer to past). Along the vertical axis, Chinese sometimes uses "above" to refer to the past and "below" to the future. Gu et al. (2017) examined the influences of such time expressions on Chinese-English bilinguals' (L1 Chinese) production of temporal gestures: they produce more vertical gestures when they are speaking vertical time expressions in Chinese, than when they are speaking time expressions in English or non-spatial time expressions in Chinese. By contrast, English rarely spatializes time along the vertical axis. Figure 2.10 below illustrates the specific influence of temporal expressions in language on the production of temporal gestures.

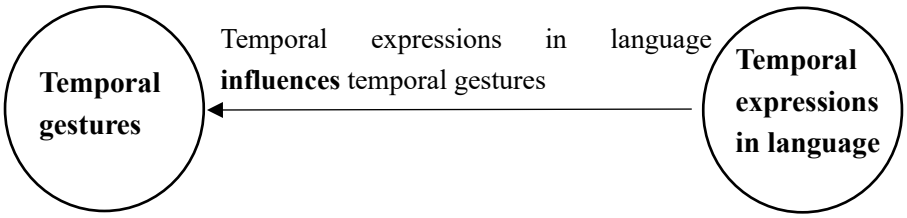


Figure 2.10 The influence of temporal expressions in language on temporal gestures

2.3.3.3 Gesture-Speech Integration and Boundaries during Language Comprehension: "Integrated Systems Hypothesis"

Section 2.3.3.1 "Gesture Complements Speech: 'Growth Point'" above is about how gesture complements speech during gesture and speech production, and Section 2.3.3.2 "Language Influences Gesture: 'Language Architecture'" above is about how language influences gesture production. These propositions suggest the mutual influences between gesture and speech during gesture-speech production.

In addition, Kelly, Özyürek, and Maris (2010) proposed the "Integrated Systems Hypothesis" (ISH), extending the mutual influences between gesture and speech (i.e., "integrated system") from gesture-speech production to gesture-speech comprehension. ISH explains two ways in which gesture and speech integrate during language comprehension[9]: they interact, both mutually (i.e., bidirectionally) and obligatorily (i.e., mandatorily), to enhance language comprehension. ISH is confirmed by the findings from the experiments conducted by Kelly et al. (2010). In the experiments, the participants took some trials. During each trial, a participant first watched a video of an action prime (e.g., a person is chopping vegetables), and then watched a video of a bimodal gesture-speech target, and finally judged whether any part of the target (gesture or speech) was related to the prime. The results showed that the participants related the targets to the primes with faster speed and higher accuracy, when the speech and gesture in a target were congruent (e.g., speech: "chop"; gesture: a chopping gesture) than when

[9] When discussing ""Integrated Systems Hypothesis", Kelly et al. (2010) and Kelly (2017) sometimes adopted "language production/comprehension". "Language" here basically refers to speech, and "language production/comprehension" and "gesture-speech production/comprehension" basically mean the same.

the speech and gesture were incongruent (e.g., speech: “chop”; gesture: a twisting gesture). This indicated that gesture and speech mutually interact and influence comprehension.

The mutual influences between gesture and speech during language comprehension are also shown in the interaction between temporal gesture and time expressions in speech. A typical example is from Ng et al. (2017), as reviewed in Section 2.1.3.2 “Chinese and English Temporal Gestures for the Past Tense”. The review of Ng et al. (2017) in Section 2.1.3.2 highlights that linguistic time expressions affect the comprehension of temporal gestures[10]. Moreover, Ng et al. (2017) also show that in turn, the comprehension of temporal gestures affects the comprehension of the online concomitant temporal speech. To understand this finding, the research methods and results of Ng et al. (2017) need to be reviewed. The researchers separately examined Chinese and English speakers. Each participant took a number of trials. During each trial, a participant first watched a video clip of a gesture (i.e., either a pointing-to-the-front or a pointing-back gesture), and then listened to a temporal word in her/his native language (e.g., “tomorrow” in English, or “明天[tomorrow]” in Chinese), and finally judged whether the auditory word was past- or future- related. When the temporal gesture and the temporal speech were congruent (e.g., a pointing-to-the-front gesture and “tomorrow” in English), the comprehending speed should be fast; when the temporal gesture and the temporal speech were incongruent (e.g., a pointing-back gesture and “tomorrow” in English), the comprehending speed should be slow. Results showed that English speakers did respond faster to congruent gesture-speech pairs than to incongruent gesture-speech pairs. By contrast, Chinese speakers’ responding speeds to the different pairs (e.g., a pointing-to-the-front gesture and “明天[tomorrow]” in Chinese, and a pointing-back gesture and “明天[tomorrow]” in Chinese) were similar,

[10] A reminder of the review of Ng et al. (2017) in Section 2.1.3.2: as mentioned in Section 2.1.3.2, both Chinese and English construct time along the sagittal axis. In Chinese, “front” can refer to either past or future, and “back” can also refer to either past or future. Accordingly, to Chinese speakers, a pointing-to-the-front gesture can mean either past or future, and a pointing-back gesture can also mean either past or future. On the other hand, in English, “front” only refers to future, and “back” only refers to past. Accordingly, to English speakers, a pointing-to-the-front gesture only means future, and a pointing-back gesture only means past.

which aligns with the linguistic time expressions in Chinese. The differential comprehending speeds resulted from the interaction between temporal gesture and temporal speech. To sum up, Ng et al. (2017) demonstrates the influence of temporal language on the comprehension of temporal gesture (reviewed in Section 2.1.3.2), as well as the influence of temporal gesture on the comprehension of temporal speech in turn (reviewed here), thus exemplifying the mutual influences between gesture and speech during language comprehension, as argued by ISH of Kelly et al. (2010).

Adopting the general spirit of ISH, Kelly (2017) further explored the gesture-speech integration during language comprehension and advanced that there are also boundaries between gesture and speech. He suggested that some aspects of language (e.g., concrete semantic, suprasegmental phonetic [11], and pragmatic) are deeply connected to gesture, while some other aspects of language (e.g., abstract semantic, segmental phonetic [12], and syntactic) tend to be independent of gesture. Such relationships between gesture and speech (i.e., connection and disconnection) during language comprehension are illustrated in Figures 2.11 and 2.12 below. In Figure 2.12, there is no line between gesture and speech to represent the disconnection between the two.

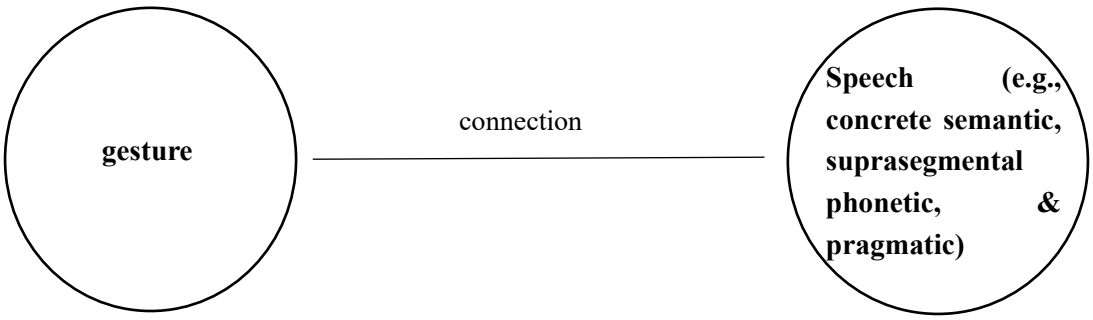


Figure 2.11 The connection between gesture and speech during language comprehension

[11] "Suprasegmental phonetic" refers to "phonemic properties of words within a sentence" (Kelly, 2017, p. 256).
[12] "Segmental phonetic" refers to "speech sounds within a word" (Kelly, 2017, p. 256).

Figure 2.12 The disconnection between gesture and speech during language comprehension

When it comes to the present study, the target structures, i.e., tense and aspect, belong to abstract semantic language components. According to Kelly (2017), when a listener (i.e., a learner in the present study) is comprehending a speaker's (i.e., the teacher in the present study) speech and gesture which concern tense-aspect, there can be boundaries between tense-aspect in speech and the corresponding pedagogical temporal gestures. Figure 2.13 below illustrates this.

Figure 2.13 The boundaries between pedagogical temporal gestures and tense-aspect in speech

The present study explores the effects of the pedagogical temporal gestures on learning tense-aspect. Given the potential boundaries between tense-aspect in speech and the pedagogical temporal gestures during the learners' comprehension, the effects should not be taken for granted. The following Section 2.3.3.4 "Gesture is a Medium of Language Development" will return to this.

2.3.3.4 Gesture is a Medium of Language Development

Section 2.3.3.1 "Gesture Complements Speech: 'Growth Point'" and Section

2.3.3.2 “Language Influences Gesture: ‘Language Architecture’” review the mutual influences between gesture and speech during gesture-speech production. On the other hand, Section 2.3.3.3 “Gesture-Speech Integration and Boundaries during Language Comprehension: ‘Integrated Systems Hypothesis’” reviews the relationships between gesture and speech (i.e., connection and disconnection) during gesture-speech comprehension. The corresponding propositions by McNeill (1992), de Ruiter (2007), Kelly et al. (2010), and Kelly (2017) focus on gesture-speech production or comprehension, and do not focus on the acquisition/development of language[13] in general.

Regarding gesture and the acquisition/development of language in general, Gullberg (2006, 2014) and Gullberg et al. (2008) advanced some propositions. As reviewed in Section 2.1.1.3 “The Three-dimensional Roles of Gesture in SLA”, gesture is an object of SLA, a reflection of SLA, and a medium of SLA (Gullberg, 2006, 2014; Gullberg et al., 2008). The roles of gesture in language development in general (i.e., not limited to second language development) are the same (Gullberg et al., 2008). The present study focuses on gesture as a medium of SLA, and the relationship of “medium” between gesture and language is illustrated in Figure 2.14 below.

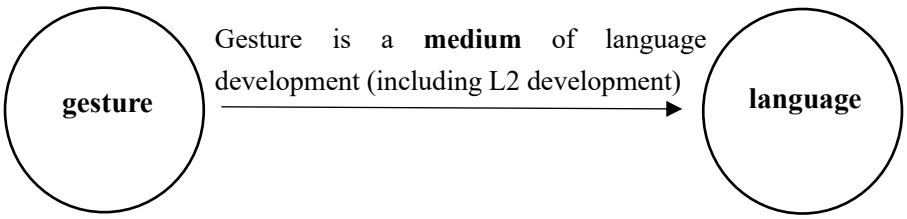


Figure 2.14 The relationship between gesture and language

Specifically, in the present study, Research Question 1 explores the effects of the teacher’s pedagogical temporal gestures on the learners’ acquisition of the L2 English past tense (*-ed*) and progressive aspect (*-ing*). The effect was examined through assessing the learners’ acquisition of *-ed* and *-ing*, and acquisition consists of explicit

[13] “Language” here refers to language in general, and is not limited to speech.

and implicit knowledge of *-ed* and *-ing*. Explicit knowledge was assessed through the Untimed Grammaticality Judgment Test (UGJT, a language perception test), where the participants judged the grammaticality of a set of written sentences with *-ed* and *-ing*. Implicit knowledge was assessed through the Elicited Imitation Test (EIT, a language production test), where the participants orally reproduced a set of aural sentences with *-ed* and *-ing*[14]. In other words, Research Question 1 examines whether the teacher's pedagogical temporal gestures can improve the learners' perception[15] and production of *-ed* and *-ing*.

The specific relationship between gesture and language in the present study is illustrated in Figure 2.15 below. As mentioned in Section 2.3.3.3 "Gesture-Speech Integration and Boundaries during Language Comprehension: 'Integrated Systems Hypothesis'", there can be potential boundaries between tense-aspect in speech and the pedagogical temporal gestures during the learners' comprehension, so the effect of the gestures on learning tense-aspect should not be taken for granted. Moreover, this is a gap where there seem to be limited empirical findings, and the present study aims to fill this gap. Given these, the line in the figure is presented as a dashed line.

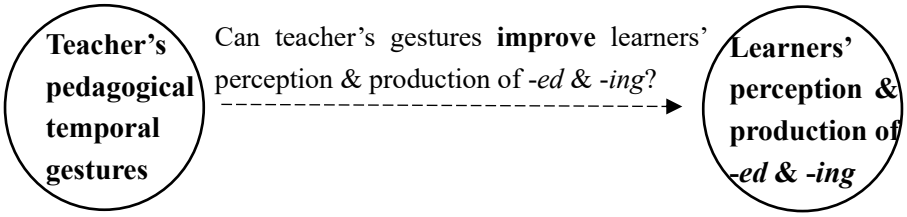


Figure 2.15 The relationship between the teacher's pedagogical temporal gestures and the learners' acquisition of L2 English tense and aspect

[14] The participants' oral production of the sentences was elicited by the structured test. The oral production in this case is different from a speaker's natural on-line speech concomitant with gesture (i.e., the "speech" in the triad of "gesture-thought-speech").

[15] The learners' explicit knowledge of *-ed* and *-ing* is operationalized as their perception of *-ed* and *-ing* (specifically, their perception of *-ed* and *-ing* refers to their judgment of the grammaticality of the UGJT written sentences with *-ed* and *-ing*).
On the other hand, Research Question 2 of the present study is about learners' perceptions of pedagogical gestures, which refer to their opinions of pedagogical gestures.

To conclude this section (Section 2.3.3 "Gesture, Speech, and Language"), there is a point that is worth attention: whose gesture and whose speech/language. Regarding "gesture *complements* speech" (Section 2.3.3.1), according to McNeill (1992) and as illustrated in Figures 2.7 and 2.8, it is the speaker/teacher's gesture that complements the speaker/teacher's own speech. Regarding "language *influences* gesture" (Section 2.3.3.2), according to de Ruiter (2007) and as illustrated in Figures 2.9 and 2.10, it is also the speaker's language that influences the speaker's own gesture. Similarly, regarding "gesture-speech *integration* and *boundaries* during language comprehension" (Section 2.3.3.3), according to Kelly (2017) and as illustrated in Figures 2.11, 2.12, and 2.13, the connection and disconnection refer to the relationships between the speaker/teacher's gesture and the speaker/teacher's own speech. On the other hand, regarding "gesture is *a medium of* language development" (Section 2.3.3.4), according to Gullberg (2006) and as illustrated in Figures 2.14 and 2.15, it is the teacher's gesture that is a medium of the learners' language development[16].

2.3.4 Thought, Speech, and Language: "Thinking for Speaking Hypothesis"

As mentioned in Section 2.3.3 "Gesture, Speech, and Language" above, in the triad of "gesture-thought-speech", "speech" focuses on the on-line spoken language concomitant with gesture. Different from "speech", "language" is a general concept, which consists of spoken as well as written language. In the present study, the relationship between gesture and speech and the relationship between gesture and language are different, so the two relationships are reviewed separately in Section 2.3.3 "Gesture, Speech, and Language" above. By contrast, the relationship between thought and speech and the relationship between thought and language are similar, so the two relationships are reviewed together in this section.

As reviewed in Section 2.3.1 "Gesture, Thought, and Speech: 'Growth Point'", according to "Growth Point" (McNeill, 1992), thought is expressed linguistically through speech. In connection with the present study, temporal concepts in thought are

[16] Learners' gesture is not a concern of the present study.

expressed linguistically through temporal expressions in speech. This also applies to language in general (i.e., thought is expressed linguistically through language, and temporal concepts in thought are expressed linguistically through temporal expressions in language).

In turn, speech, as well as language in general, influences thought. As mentioned in Section "Gesture as a Reflection of SLA", L2 gestures reveal L2 speakers' patterns of thinking for speaking (Stam, 2018). "Thinking for speaking" refers to thinking that occurs on-line in the process of speaking (Slobin, 1991). Thinking-for-speaking hypothesis argues that different languages have different linguistic codes, which require and generate different patterns of thinking (McNeill & Duncan, 2000; Slobin, 1987). The hypothesis can explain why many bilingual speakers believe when they shift languages, they also shift patterns of thinking (McNeill & Duncan, 2000).

Thinking-for-speaking hypothesis (Slobin, 1987, 1991) and Whorf's linguistic relativity hypothesis (Whorf, 1956) are not identical (McNeill & Duncan, 2000), but related and different (Stam, 2023). The first distinction between the two hypotheses is about the scope of thinking that is influenced: thinking-for-speaking hypothesis only concerns thinking which is organized for speaking, whereas Whorf's linguistic relativity hypothesis concerns all kinds of thinking, including those involved in non-linguistic tasks (Stam, 2023). The second distinction between the two hypotheses is about the nature of thinking that is influenced: thinking-for-speaking hypothesis concerns on-line thinking during the process of speaking, whereas Whorf's linguistic relativity hypothesis concerns general habitual thoughts (McNeill & Duncan, 2000). To sum up, thinking-for-speaking hypothesis focuses on the on-line thinking organized for the simultaneous speaking, whereas Whorf's linguistic relativity hypothesis covers habitual thoughts involved in general tasks.

In connection with the present study, according to thinking-for-speaking hypothesis and Whorf's linguistic relativity hypothesis, temporal expressions in speech, as well as temporal expressions in language, influence temporal concepts in thought. An example of the influence of language on thought is (the example is also mentioned

in Section 2.1.3.2 “Chinese and English Temporal Gestures for the Past Tense”): Chinese uses “above” to refer to the past and “below” to the future, so Chinese speakers conceptualize time along a vertical axis; English rarely uses vertical expressions to refer to time, so English speakers seldom conceptualize time along a vertical axis (Borghi, 2014; Boroditsky, 2001).

Figure 2.13 below illustrates the interrelationships between thought and speech (and language in general), and Figure 2.14 below illustrates the interrelationships between temporal concepts in thought and temporal expressions in speech (and language in general).

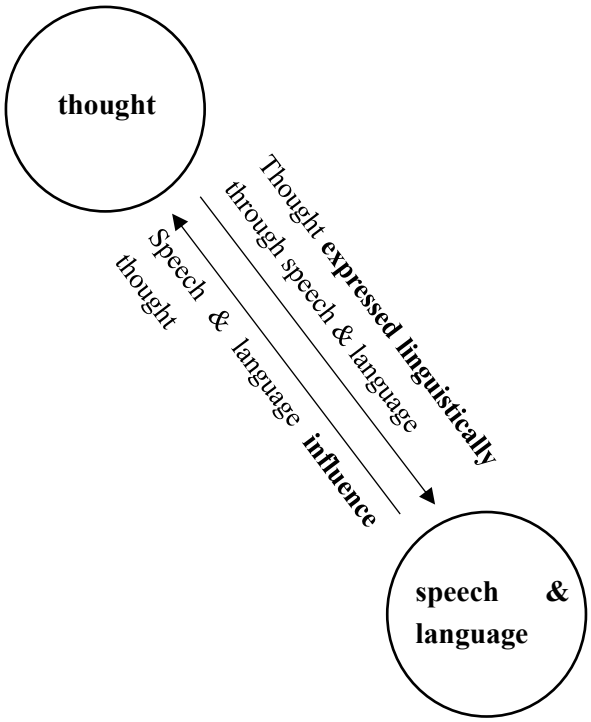


Figure 2.16 The interrelationships between thought and speech (and language in general)

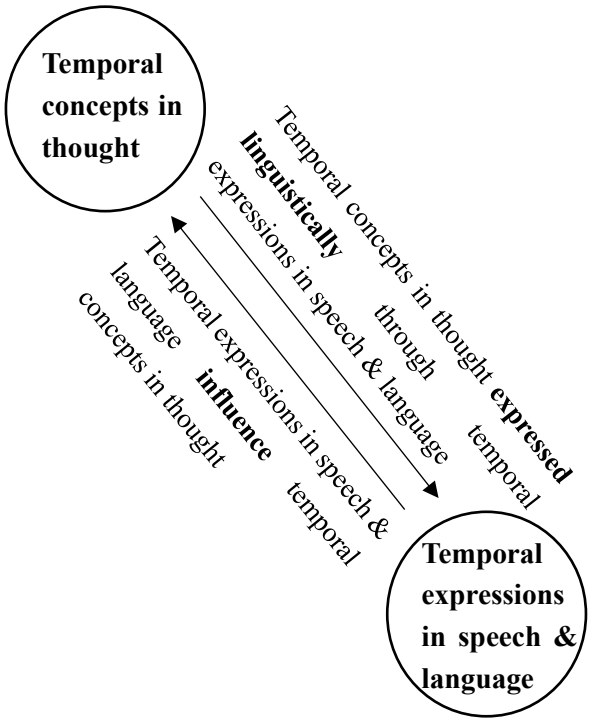


Figure 2.17 The interrelationships between temporal concepts in thought and temporal expressions in speech (and language in general)

As mentioned in Section 2.3.3.2 "Gesture and Language: 'Language Architecture'", Research Question 1 of the present study examines the influences of the teacher's pedagogical temporal gestures on the learners' acquisition of the L2 English past tense and progressive aspect (the acquisition is specified as perception and production of *-ed* and *-ing*). The influence can be directly from the pedagogical temporal gestures to the perception and production of *-ed* and *-ing*, as illustrated in Figure 2.15 "The relationship between the teacher's pedagogical temporal gestures and the learners' acquisition of L2 English tense and aspect" above. The influence can also be first from the pedagogical temporal gestures to the temporal concepts in thought, and then from the temporal concepts in thought to the perception and production of *-ed* and *-ing*, as illustrated in Figure 2.18 below. Given that the influence from temporal concepts in thought to perception and production of *-ed* and *-ing* awaits exploration, the line representing the influence is presented as a dashed line.

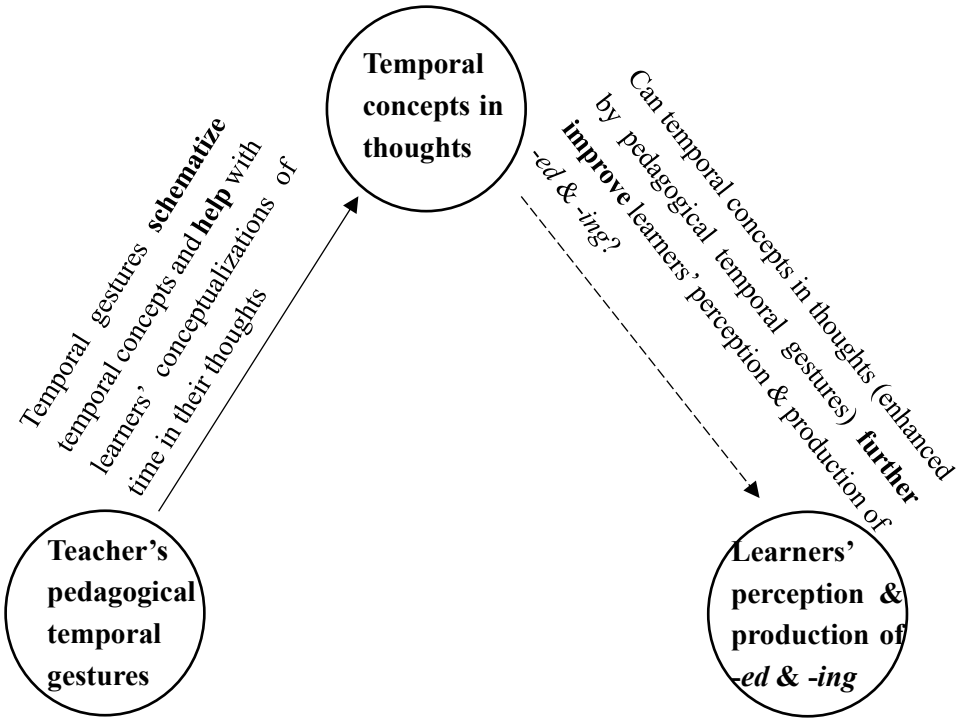


Figure 2.18 The relationship between temporal concepts in thought and learners' perception and production of *-ed* and *-ing*

Note. The line on the left, which illustrates the influence from pedagogical temporal gestures to temporal concepts in thought, is extracted from Figure 2.6 "The interrelationships between temporal gestures and temporal concepts in thought" above.

2.3.5 Synthesis: Theoretical Framework and the Present Study

The theoretical framework consists of a proposition about the overall relationships among gesture, thought, and speech, as well as some other propositions about the specific interrelationships (1) between gesture and thought, (2) among gesture, speech, and language, and (3) among thought, speech, and language. After presenting the theoretical framework, it is now time to synthesize it with the present study. To do so, this section extracts the most pertinent propositions, and integrates them with Research Question 1 (the core research question) of the present study.

Figure 2.19 below presents the synthesis. In the figure, ①, ②, and ③ indicate the order of the interactional steps among the three constructs. Step ①: according to "Growth Point" (McNeill 1992), temporal concepts in the teacher's thought are externalized through the teacher's pedagogical temporal gestures. Step ②: according to "Gesture-for-Conceptualization Hypothesis" (Kita et al., 2017), the teacher's

pedagogical temporal gestures schematize the temporal concepts and help with the learners' conceptualizations of time in their thoughts. Step ③: there can be two approaches for this step. One approach is directly from the teacher's pedagogical temporal gestures to the learners' perception and production of *-ed* and *-ing*, i.e., the former may (or may not) improve the latter. The other approach follows Step ②, i.e., after the teacher's pedagogical gestures help with the learners' conceptualizations of time in their thoughts, the enhanced conceptualizations of time may (or may not) further improve the learners' perception and production of *-ed* and *-ing*. This approach originates from the teacher's pedagogical temporal gestures, transits via the learners' conceptualizations of time, and finally reaches the learners' perception and production of *-ed* and *-ing*.

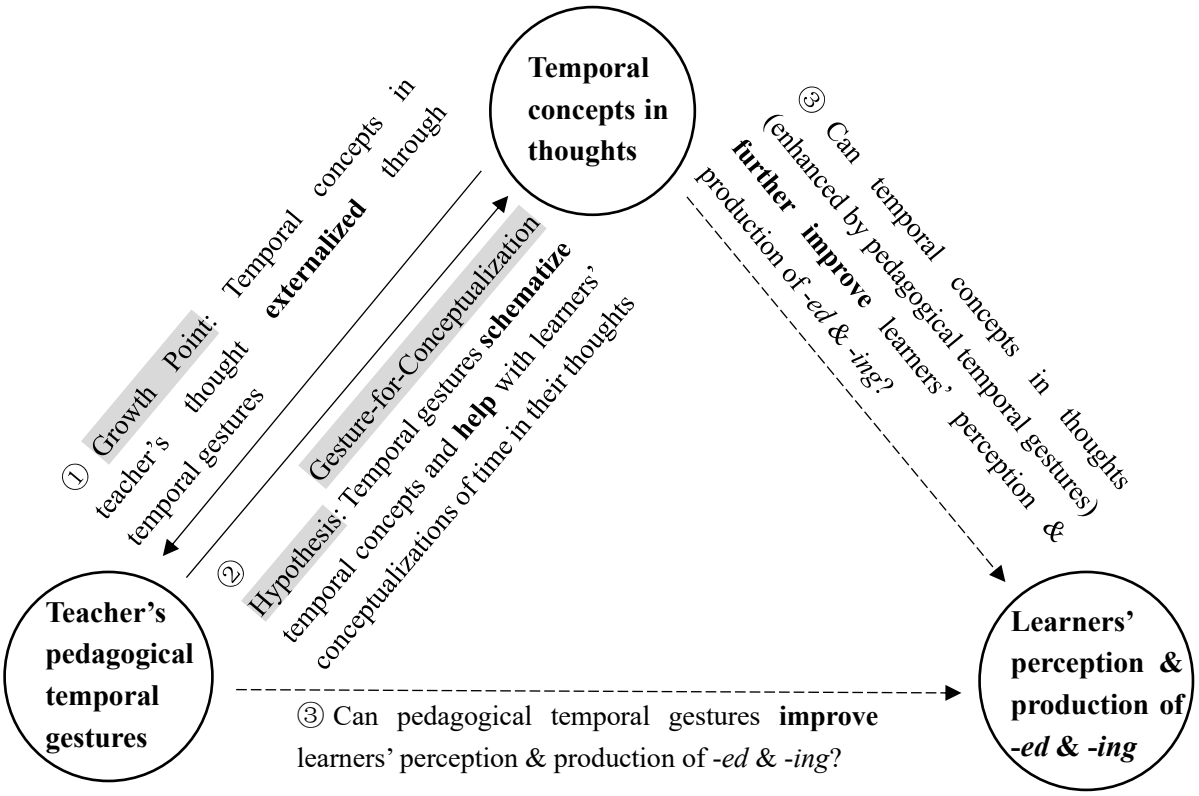


Figure 2.19 Synthesis: Theoretical framework and the present study

Step ① and Step ② both have supporting theoretical propositions, as marked with grey background in Figure 2.16 above. Therefore, the two steps tend to be certain,

and the corresponding lines for them are presented as solid lines. By contrast, Step ③ seems to have no supporting theoretical propositions (neither from the pedagogical temporal gestures to the perception and production of *-ed* and *-ing*, nor from the temporal concepts in thought to the perception and production of *-ed* and *-ing*)[17]. Moreover, there seems to be little relevant empirical research. Therefore, Step ③ seems to be uncertain, and the corresponding lines are presented as dashed lines accompanied by questions. Research Question 1 of the present study aims to address Step ③, and the findings for Research Question 1 are expected to generate not only pedagogical implications (i.e., the effects of pedagogical temporal gestures on the acquisition of L2 tense and aspect) but also theoretical implications (i.e., the interrelationships among gesture, thought, and SLA).

2.4 Summary of Chapter 2

This chapter reviews the literature for the present study. It starts with the key constructs involved in the present study (including gesture, tense and aspect, temporal gesture, and target structures which combine tense, aspect, and the corresponding temporal gestures). Next, it reviews the relevant empirical studies of pedagogical gestures, which are categorized into two foci (the effects of pedagogical gestures, and learners' perceptions of pedagogical gestures). Previous studies in the two foci respectively inform the two research questions of the present study. Finally, it presents the theoretical framework for the present study, which consists of theoretical propositions regarding the interrelationships among gesture, thought, speech, language, and SLA.

[17] As reviewed in Section 2.3.3 "Gesture, Speech, and Language", according to "Growth Point", gesture complements speech, and according to "Language Architecture", language influences gesture. However, there seems to be no theoretical proposition that can predict the influence of gesture on SLA in the present study.
As reviewed in Section 2.3.4 "Thought, Speech, and Language: 'Thinking-for-Speaking Hypothesis'", according to "Growth Point", thought is expressed through speech and language, and according to "thinking-for-speaking hypothesis", speech and language influence thought. However, there seems to be no theoretical proposition that can predict the influence of thought on SLA in the present study.

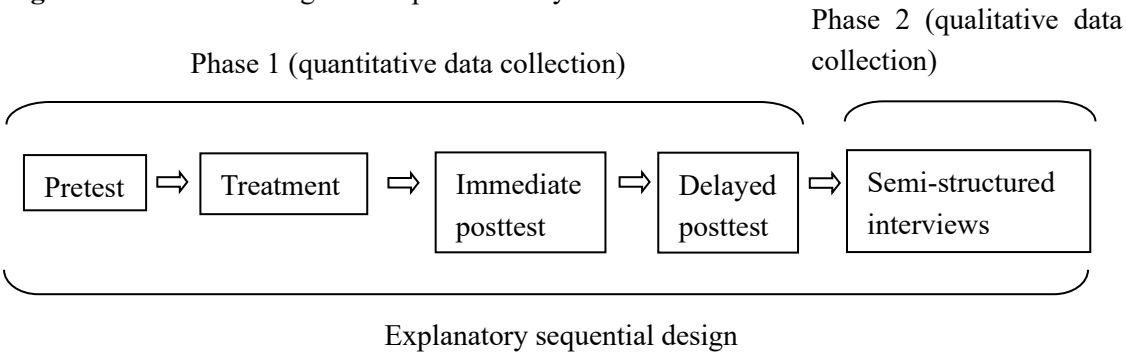
Chapter 3: Methodology

3.1 Research Design

As introduced in Section 1.2.1 “Research Questions” and analyzed in Section 2.2 “Empirical Studies”, quantitative research methods are used for Research Question 1, and qualitative research methods are used for Research Question 2. Thus, the present study adopts a mixed methods design. According to Creswell (2015), some basic mixed methods designs include convergent parallel design, exploratory sequential design, and explanatory sequential design. The convergent parallel design collects quantitative and qualitative data in parallel and combines the two sets of data to achieve triangulation. The exploratory sequential design first collects qualitative data to design a survey or an experiment, and then uses the survey or experiment to collect quantitative data. The explanatory sequential design first collects quantitative data, and then collects qualitative data to further explore the quantitative results (Hu, 2019).

The present study consists of two phases. The first phase is the true experiment that followed the procedure of pretest—treatment—immediate posttest—delayed posttest. The results from the tests were quantitatively analyzed for Research Question 1. The second phase occurred after the true experiment. In the second phase, semi-structured interviews were carried out for Research Question 2 to discover the participants’ opinions, and the qualitative data of opinions provide explanations for the quantitative results from the true experiment. The two phases as a whole adopted the explanatory sequential design. Figure 3.1 illustrates the design. The main body of the present study is the true experiment, where the participants were randomly assigned to groups, which generated equivalent groups.

Figure 3.1 Research design of the present study



3.2 Participants

The research site is a college in an eastern city in Mainland China, an EFL context. It is one of the leading colleges that provide secondary school graduates with occupational education. One reason for choosing the school as the research site is that it was accessible to me. Another reason is that occupational college students generally have weaker academic performance, including English proficiency, than university students. They can have larger room for improvement in English, including the target structures (i.e., the English simple past and past progressive) which are taught in primary and secondary school years in Mainland China.

The college has more than 10,000 students. The participants are 110 students (15 males and 95 females) recruited from Year 1. The college has two campuses. One campus has mainly faculties of science, technology, and engineering, where male students are of the majority. The other campus has mainly faculties of arts, social science, and business, where female students are of the majority. The present study was conducted in the latter campus, which was more logistically convenient than the former campus, and therefore the female participants are of the majority. Only Year 1 students in the college has English as a formal course, and according to the teachers in the college, Year 1 students are the most motivated ones to learn English. Therefore, I chose Year 1 students to be the participants.

Among the 110 participants, 20 participants were assigned to the pilot group, and the other 90 participants were assigned to the two experimental groups and the control group. The pilot group did not participate in the experiment. Before the experiment, the

three versions of the tests I designed were administered to the pilot group on three consecutive days respectively, to pilot the tests. The two experimental groups and the control group participated in the experiment.

The participants were aged 19 to 20 years old. Their L1 is Chinese. Their mean length of English language learning is 9.5 years. Before the experiment, they took the Oxford Placement Test (Oxford University Press and University of Cambridge Local Examinations Syndicate, 2001), which measured their general English proficiency. Among the 90 participants of the three groups that participated in the experiment, 31 participants (i.e., 34.44% of the participants) were measured to be at the lower intermediate level, and 59 participants (i.e., 65.56% of the participants) were measured to be at the elementary level. One-way between-subjects ANOVA of the three groups' scores in the Oxford Placement Test showed that there was no significant difference among the three groups, $F(2, 87) = .978$, $p = .380$, confirming that the three groups were of similar general English proficiency levels before the experiment. Moreover, the participants learned the two target structures (i.e., the English simple past and past progressive) during their primary and secondary school years.

3.3 Instruments

3.3.1 Tests of Explicit and Implicit Knowledge of the Target Structures

To address Research Question 1, i.e., to examine the effects of pedagogical gestures on EFL learners' acquisition of the target English tense and aspect (i.e., the simple past and the past progressive), three parallel tests were administered to measure the participants' knowledge of the target structures, respectively before, immediately after, and two weeks after the treatment delivered in the true experiment.

When talking about the nature of linguistic knowledge, positions such as Universal Grammar (UG) and connectionist, despite their disagreements, have an agreement that there is a clear distinction between explicit knowledge and implicit knowledge[18].

[18] Explicit and implicit knowledge are not mutually exclusive. Instead, there can be combinations of the two types of knowledge in learners' minds (Ellis, 2023). Different types of knowledge, from the most explicit knowledge to the most implicit knowledge, constitute a continuum. Meanwhile, the two broad types, i.e., explicit knowledge and implicit knowledge, need to be separately discussed.

Accordingly, there is a need to distinguish learners' L2 linguistic knowledge as explicit knowledge and implicit knowledge (Ellis, 2005). This also applies to grammatical knowledge as a domain of linguistic knowledge. Therefore, it is important to include measures of both explicit grammatical knowledge and implicit grammatical knowledge in experimental studies (Ellis, 2005; Ellis, Loewen, & Erlam, 2006; MacWhinney, 2020). Previous experimental studies of the acquisition of L2 grammar tended to separately measure the two types of knowledge with different types of tests (e.g., Ellis et al., 2006; Fu & Li, 2019, 2022; Nakatsukasa, 2013, 2016, 2021; Yang, 2008; Yang & Lyster, 2010).

Ellis (2005) proposed a continuum of tests for measuring explicit and implicit knowledge. The continuum ranging from the test of the most explicit knowledge to the test of the most implicit knowledge consists of metalanguage test, untimed grammaticality judgment test (UGJT), timed grammaticality judgment test, oral narrative test, and imitation test (in other words, elicited imitation test, i.e., EIT). The tests selected for the present study are UGJT and EIT. UGJT was used to measure the participants' explicit knowledge of the target English tense and aspect, and EIT was used to measure their implicit knowledge of the target structures as drawn on their spontaneous oral production. At each testing time, both UGJT and EIT were administered. The details of UGJT and EIT are described below.

3.3.1.1 The Untimed Grammaticality Judgment Test

The UGJT is a written receptive test to measure learners' metalinguistic knowledge of L2 grammar (Loewen, 2009), and has been frequently used in previous experimental studies (e.g., Ellis et al., 2006; Fu & Li, 2019, 2022; Nakatsukasa, 2013, 2016, 2021; Qu, 2019).

In the present study, the UGJT consists of 20 written sentences, of which 10 target the simple past and the other 10 target the past progressive. The order of the 20 sentences is randomized. Among the 10 targeting the simple past, there are six ungrammatical and four grammatical sentences, and all the 10 target verbs are regular

verbs. Among the 10 targeting the past progressive, there are also six ungrammatical and four grammatical sentences. Participants were required to judge the grammaticality of the sentences. If a participant judged a sentence as ungrammatical, then s/he was required to correct the grammatical error. The requirement to correct the grammatical error is meant to elicit the participants' explicit knowledge to the greatest extent, and to ascertain whether the participants make the judgment according to their explicit knowledge of the target structures (Fu & Li, 2019, 2022; Nakatsukasa, 2016, 2021). The participants were allowed to spend as much time as they needed to complete the UGJT. They did the UGJT together in a classroom.

As to the scoring of the UGJT, if a participant made a correct judgment (i.e., judged a grammatical sentence as grammatical, or judged an ungrammatical sentence as ungrammatical), s/he would be awarded 1 point. If a participant made an incorrect judgment (i.e., judged a grammatical sentence as ungrammatical, or judged an ungrammatical sentence as grammatical), s/he would receive 0 point. For an ungrammatical sentence, after a participant correctly judged it as ungrammatical, if s/he continued to provide the correct target form, s/he would be awarded an additional 1 point. If s/he provided the target form with a spelling error (e.g., "studyed" for "studied" and "paintted" for "painted"), 0.5 point would be given. The full score for the simple past UGJT sentences is 16, and the full score for the past progressive UGJT sentences is also 16. I scored all the UGJT test papers, and another researcher, who is a PhD candidate in Applied English Linguistics, scored 20% of the UGJT test papers. The percentage for the inter-rater agreement was .99, which is the inter-rater reliability.

I designed the UGJT for the present study. During the process of designing, I consulted authoritative grammar books, including Carter and McCarthy (2006), Celce-Murcia and Larsen-Freeman (1999), DeCapua (2008), Greenbaum (1996), Larsen-Freeman and Celce-Murcia (2016), Quirk, Greenbaum, Leech, and Svartvik (1985), and Zhang (2009), for the usages of the simple past and the past progressive. I also consulted the participants' textbooks to ensure that all the words and sentence structures in the tests had been taught to them. To further establish the validity of the test, I had

the test items checked by three experienced researchers and a native speaker. I also had them checked by a frontline teacher to revise the words and sentence structures that the participants might not know. Moreover, I had them finally checked by a few Year 1 students in the college who were not involved in the main study to revise the words and sentence structures that the participants might not know.

The 20 target verbs were all covered during the treatment. The same 20 verbs were used to create the three parallel versions of the UGJT. Using three versions instead of one single version aims to reduce practice effect. To check whether the three versions are equivalent in terms of the level of difficulty, before the experiment, the three versions of the UGJT were administered to the pilot group on three consecutive days respectively. One-way within-subjects ANOVA of the pilot group's scores for the simple past UGJT sentences at the three testing times showed that there was no significant difference across the three testing times, $F(2, 38) = .469$, $p = .629$, $\eta_p^2 = .024$, indicating that the three versions of the simple past UGJT sentences are of similar levels of difficulty. One-way within-subjects ANOVA of the pilot group's scores for the past progressive UGJT sentences at the three testing times showed that there was no significant difference across the three testing times, $F(2, 38) = .530$, $p = .593$, $\eta_p^2 = .027$, indicating that the three versions of the past progressive UGJT sentences are also of similar levels of difficulty. See Appendix A for the three versions of the UGJT. During the experiment, the three versions of the UGJT were counterbalanced within the three groups and across the three testing times, as presented in Table 3.1 below. Each group of participants were evenly divided into three subgroups.

Table 3.1 Counterbalancing the three versions of the UGJT

		Pretest	Immediate posttest	Delayed posttest
Group 1	**Sub-group 1**	Version 1	Version 2	Version 3
	Sub-group 2	Version 2	Version 3	Version 1
	Sub-group 3	Version 3	Version 1	Version 2
Group 2	**Sub-group 1**	Version 1	Version 2	Version 3
	Sub-group 2	Version 2	Version 3	Version 1
	Sub-group 3	Version 3	Version 1	Version 2
Group 3	**Sub-group 1**	Version 1	Version 2	Version 3
	Sub-group 2	Version 2	Version 3	Version 1
	Sub-group 3	Version 3	Version 1	Version 2

3.3.1.2 The Elicited Imitation Test

The EIT is an oral productive test to measure learners' spontaneous oral production of L2 grammar (Erlam, 2006; Spada, Shiu, & Tomita, 2015) and has been commonly used in previous experimental studies (e.g., Ellis et al., 2006; Fu & Li, 2019, 2022).

In the present study, the EIT consists of 20 aural sentences, of which 10 target the simple past and the other 10 target the past progressive. The order of the 20 sentences is randomized. Among the 10 targeting the simple past, there are six ungrammatical and four grammatical sentences, and all the 10 target verbs are regular verbs. Among the 10 targeting the past progressive, there are also six ungrammatical and four grammatical sentences. The 20 EIT sentences have the same 20 target verbs as used in the UGJT. Using the same 20 target verbs in EIT and UGJT aims to examine the participants' corresponding implicit knowledge and explicit knowledge of the target structures of the same verbs. Moreover, the pronunciation of the regular past tense *-ed* of some verbs can be non-salient. To make it clearer to judge whether a participant orally produces *-ed*, only verbs that end with /t/ or /d/ (i.e., those verbs whose *-ed* is saliently pronounced as /id/) were selected.

To do the test, a participant first listened to a sentence. After the sentence, s/he heard the pre-recorded instruction "judge" which asked her/him to judge whether the meaning conveyed by the sentence applied to her/him. The participant made the judgment by writing on the answer sheet a "√" to indicate "yes", a "×" to indicate

"no", or a "○" to indicate "not sure". There were five seconds for the participant to make the judgment. The judgment step aims to direct the participant's attention to the meaning conveyed by the sentence. After the five seconds, a participant heard the pre-recorded instruction "repeat" which asked her/him to orally reproduce the sentence in correct English. If the participant detected no grammatical error in the sentence, then s/he orally repeated the sentence as it was. If the participant detected a grammatical error in the sentence, then s/he orally corrected and reproduced the sentence in correct English. There were ten seconds for the participant to orally reproduce the sentence. The time limit requires the participants to reproduce the sentence as quickly as possible. This requirement aims to impose time pressure on the participants, which helps elicit the participants' spontaneous oral production and the underlying implicit knowledge (Suzuki & DeKeyser, 2015). The time arrangement of five seconds for judgment and ten seconds for reproduction is based on previous research (Suzuki & DeKeyser, 2015) and test piloting with the pilot group, which showed that five seconds for judgment and ten seconds for reproduction are neither too short nor too long for the participants. To complete the EIT, a participant listened to, judged, and reproduced the 20 EIT items one by one.

Before the administration of the EIT, I recorded the test instructions and the 20 sentences as an audio file and sent the file to all the examiners. I also explained to all the participants together how to do the EIT and provided them with some examples to practice. When the EIT began, the participants came into individual rooms one by one. The examiner in each room further checked whether the participant was clear about how to do the EIT, and if necessary, further explained the instructions to the participant and gave her/him some examples to practice. After ensuring that the participant was clear about how to do the EIT, the examiner administered the test by playing the file on a computer to the participant, audio recording the participant' oral responses.

Following the scoring method adopted by Ellis et al. (2006), if a participant orally reproduced a sentence in the correct tense and aspect, s/he would be awarded 1 point; otherwise, 0 point would be given. If s/he produced the target tense and aspect with a

pronunciation error (e.g., “was walking” for “was watching” and “planned” for “painted”), 0.5 point would be given. The full score for the simple past EIT sentences is 10, and the full score for the past progressive EIT sentences is also 10. If a participant corrected her/his initial response, then only the initial response would count. This is because EIT is meant to measure implicit knowledge, which is reflected through initial response. The self-correction, however, may involve explicit knowledge. I scored all the EIT audio recordings, and the second rater, i.e., the same second rater for the UGJT, scored 20% of the EIT audio recordings. The percentage for the inter-rater agreement was .94, which is the inter-rater reliability. When there was a disagreement on whether a participant orally reproduced a sentence in the correct tense and aspect, the other researcher and I discussed and reached a consensus.

I designed the EIT for the present study. The designing process is the same as that of the UGJT. The 20 target verbs were all covered during the treatment. The same 20 verbs were used to create the three parallel versions of the EIT. Using three versions instead of one single version aims to reduce practice effect. Like the UGJT, to check whether the three versions are equivalent in terms of the level of difficulty, before the experiment, the three versions of the EIT were administered to the pilot group on three consecutive days respectively. One-way within-subjects ANOVA of the pilot group’s scores for the simple past EIT sentences at the three testing times showed that there was no significant difference across the three testing times, $F(2, 38) = 2.041$, $p = .144$, $\eta_p^2 = .097$, indicating that the three versions of the simple past EIT sentences are of similar levels of difficulty. One-way within-subjects ANOVA of the pilot group’s scores for the past progressive EIT sentences at the three testing times showed that there was no significant difference across the three testing times, $F(2, 38) = .199$, $p = .821$, $\eta_p^2 = .010$, indicating that the three versions of the past progressive EIT sentences are also of similar levels of difficulty. See Appendix B for the three versions of the EIT. During the experiment, the three versions of the EIT were counterbalanced within the three groups and across the three testing times, as presented in Table 3.2 below. Each group of participants were evenly divided into three subgroups.

Table 3.2 Counterbalancing the three versions of the EIT

		Pretest	Immediate posttest	Delayed posttest
Group 1	**Sub-group 1**	Version 1	Version 2	Version 3
	Sub-group 2	Version 2	Version 3	Version 1
	Sub-group 3	Version 3	Version 1	Version 2
Group 2	**Sub-group 1**	Version 1	Version 2	Version 3
	Sub-group 2	Version 2	Version 3	Version 1
	Sub-group 3	Version 3	Version 1	Version 2
Group 3	**Sub-group 1**	Version 1	Version 2	Version 3
	Sub-group 2	Version 2	Version 3	Version 1
	Sub-group 3	Version 3	Version 1	Version 2

3.3.2 Semi-structured Interview

In the present study, Research Question 2 is about the EFL learners' perceptions of the pedagogical gestures used to teach the target English tense and aspect. To address this question, after the delayed posttest, I conducted semi-structured interviews with all the 30 participants in the group that received pedagogical gestures in the experiment. Interview is an effective method to collect participants' perceptions and can reveal their covert opinions which can account for their overt behaviours as observed, thus achieving complementarity between overt behaviours and covert opinions.

The interviews were semi-structured to allow sufficient flexibility to the interviewees to express their thoughts freely (Richards, 2003). The interviews consisted of open questions (Questions 1-3, and 5), semi-structured questions (Questions 4 and 9), and structured questions (Questions 6-8). The questions are listed in Table 3.3 below and in Appendix C as well. In Table 3.3 below, the middle column "Key words (category)" lists the key words for the interview questions, which are also the predetermined categories for data analysis. The interviews began with asking the participants to recall the treatment lessons (Questions 1-3), and then explored their perceptions of the gestures in terms of effectiveness and functions (Questions 4 and 5), importance, interest, and attitude (Questions 6-8), and finally expanded to gestures in their previous learning experiences (Question 9). The scope of the questions was broad at the beginning, covering the treatment lessons as a whole (Questions 1 and 2), and

then the scope narrowed down to the gestures (Questions 3-8), and in the end, the scope broadened again, to the participants' previous learning experiences (Question 9).

Table 3.3 The semi-structured interview questions

Question type	**Question**	**Key words (category)**	**Main idea**	**Scope**
Q1-3: Open	1. What is your deepest impression of the treatment lessons?	Deepest impression	Q1-3: Recall of factual information of the treatment lessons	Q1, 2: Treatment lessons, broad
	2. What did you learn from the treatment lessons?	Learned what		
	3. What gestures did you learn from the treatment lessons?	Learned what gestures		Q3-8: Zooming in to and focusing on gestures
Q4: Semi-structured	4. Do you think the teacher's gestures are effective for helping you learn the target English tense and aspect?	Effectiveness	Q4, 5: Perceived effectiveness and functions of the gestures	
	If yes, then how did the gestures help you learn the target English tense and aspect?	How the gestures helped learning		
Q5: Open	5. If you can think of some other functions of the teacher's gestures, then what are the functions?	Other Functions		
Q6-8: Structured	6. Do you think the teacher's gestures are important?	Importance	Q6-8: Perceived importance of, interest in, and attitude towards the gestures	
	7. Do you think the teacher's gestures are interesting?	Interest		
	8. What is your attitude	Attitude		

	towards the teacher's gestures? Positive, negative, or neutral?			
Q9: Semi-structured	9. In your previous learning experiences, how frequently did your teachers use gestures during class?	Previous gesture frequency	Q9: Expansion to previous learning experiences	Q9: Broadening to previous learning experiences
	If you can recall any gestures teachers used during class, then what are the functions of the gestures?	Previous gesture functions		

One interview was carried out individually with each interviewee in a classroom. During the interviews, L1 Chinese was used so that the participants could express their opinions freely. To capture the participants' gesture production during the interviews, especially when they answered Question 3 (to see whether they could correctly reproduce the gestures taught in the treatment lessons), each interview was video recorded. Altogether 30 recordings were collected. Each interview lasted around 10 minutes.

3.4 Treatment

The treatment conditions of the true experiment are summarized in Table 3.4 below. The participants were randomly assigned to three treatment conditions: two experimental conditions and one control condition. In one of the two experimental conditions (i.e., instruction + gesture group), the participants received verbal instruction accompanied by pedagogical gestures. In the other experimental condition (i.e., instruction only group), the participants received verbal instruction without pedagogical gestures. The control condition involved neither the verbal instruction nor the pedagogical gestures.

Table 3.4 The treatment conditions

Groups	Treatment
Instruction + gesture (*n* = 30)	Verbal instruction + pedagogical gestures
Instruction only (*n* = 30)	Verbal instruction only
Control (*n* = 30)	No treatment

The treatment for each of the two experimental conditions was conducted in two lessons, each lasting 45 minutes. The two lessons were delivered on two separate days. Given that time and tense-aspect are abstract notions for the participants to understand, and that the medium of instruction in the college is Chinese, the treatment lessons were delivered in Chinese. I was the instructor in the present study and delivered the treatment lessons to the instruction + gesture and the instruction only groups.

Appendix D presents the PPT slides of the treatment lessons for the instruction + gesture group. The first part of the treatment for the instruction + gesture group was designed to establish the concepts of tenses, aspects, and the system of tense-aspect conflations, to explain the respective meanings of these concepts, and to zoom in onto the concepts and meanings of the two target structures (i.e., the simple past and the past progressive). The specific contents in part 1 include: first, the concept of tense, the three tenses in English (i.e., the present tense, the past tense, and the future tense[19]), and the respective gestures for the three tenses; second, the concept of aspect, the aspects in English (i.e., the simple aspect, the progressive aspect, the perfect aspect, and the perfect progressive aspect), and the gesture for the progressive aspect; third, the system of tense-aspect conflations; fourth, the target structures (i.e., the simple past and the past progressive) and the gestures for the target structures. The gestures were taught in the instruction + gesture group. I explained the concepts, produced the corresponding gestures, and asked the participants to mimic the gestures. My verbal explanations of the concepts and meanings simplified the literature on tense-aspect (see Section 2.1.2 "Tense and Aspect" for details) to make them approachable to the students.

Based on previous research, the pedagogical gesture for the past tense is putting a

[19] Some scholars argue that English does not have a future tense. To avoid potential confusion on the part of the participants, it was presented that English has a future tense.

hand to the left of the body, which is a deictic gesture. The past progressive conflates the past tense and the progressive aspect, and accordingly the pedagogical gesture for the past progressive conflates the pedagogical gesture for the past tense and the pedagogical gesture for the progressive aspect. The pedagogical gesture for the past progressive is putting a hand to the left of the body (i.e., the deictic gesture to indicate the past tense), plus moving the hand circularly (i.e., the metaphoric gesture to indicate the progressive aspect). Figure 3.2 presents the two pedagogical gestures visually.

Figure 3.2 The pedagogical gestures for the target structures

The deictic gesture, for the simple past

The deictic gesture + the metaphoric gesture, for the past progressive

Following the introduction of the concepts and the explanation of their meanings in the first part, the second part of the treatment was designed to guide the students to review the forms of the target structures: *-ed* for the simple past and *was/were + V-ing* for the past progressive. The students learned the forms of the two target structures during their secondary school years. I asked them to recollect the forms. In the instruction + gesture group, the verbal instruction on the forms was accompanied by the pedagogical gestures for the target structures.

After the students were taught the concepts, meanings, and forms related to the target structures, they were given the opportunity in the third part of the treatment to use the simple past and the past progressive in context. Specifically, the students were guided to review some time adverbials they learned previously, which indicate a past context and thus obligate the use of the simple past. Then the students were guided to practice the use of the tense in a translation exercise. They were also asked to identify the differences between the simple past and the past progressive. One such difference is that the simple past indicates a completed past action, whereas the past progressive

indicates an incomplete past action. Another difference is that when two past actions co-occur in a sentence, the verb describing the longer action should take the past progressive, whereas the verb describing the shorter action should take the simple past. The students then practiced the use of the past progressive in a translation exercise. Like the previous stages in the treatment lessons, for the instruction + gesture group, the verbal instruction was accompanied by the pedagogical gestures for the simple past and the past progressive.

The preceding paragraphs elaborate on how the treatment was conducted in one experimental condition (i.e., the instruction + gesture group). In the other experimental condition (i.e., the instruction only group), the verbal instruction was the same as that of the instruction + gesture group, but the instruction only group received no pedagogical gesture. The feasibility of refraining from gesturing when teaching the instruction only group has been demonstrated by previous quasi-experimental studies (Nakatsukasa, 2013, 2016, 2021), where the researcher as the instructor reported that "I put my hands down next to the side of my body to avoid gesturing" (Nakatsukasa, 2013, p. 49). In the same way, I refrained from gesturing in the instruction only group.

3.5 Procedure

I contacted the principal of the college, and he agreed that I could conduct the research project in the college. Then I contacted the relevant faculty leaders and teachers. I introduced my project to them and told them how I needed them to do to assist me. After that, the corresponding teacher and the frontline teachers disseminated my recruitment of participants to their students. The participants would be awarded extra grades to their English subject and have their English improved through the tests and treatment. Finally, 110 students participated in the project and completed all the required tests, treatment lessons, and interviews.

Before the data collection, the ethics approval was obtained from The Hong Kong Polytechnic University. Before the experiment, each participant got an information sheet, which informed that this was a research project on English language learning,

teaching, and communication, that the experimental treatment lessons and some of the tests would be recorded, and that some of the participants would be invited for an interview after the experiment and the interview would be recorded. The participants were also informed that they would participate voluntarily, and that they could withdraw at any time without penalty of any kind. Each participant signed the consent form to indicate their consent, as required by the research ethics regulations of The Hong Kong Polytechnic University. See Appendix E for the information sheet, and Appendix F for the consent form.

After signing the consent form, the participants took the Oxford Placement Test (Oxford University Press and University of Cambridge Local Examinations Syndicate, 2001) which measured their general English proficiency. Next, as mentioned in Section 3.2 “Participants”, the three versions of the UGJT and the EIT were administered to the pilot group on three consecutive days respectively, to pilot the tests. After this, the experiment started, and the instruction, instruction + gesture, and control groups participated in the experiment. As mentioned in Section 3.1 “Research Design”, the experiment followed the procedure of pretest—treatment—immediate posttest—delayed posttest. The instruction and instruction + gesture groups attended the treatment lessons, respectively receiving instruction without and with pedagogical gestures. There was a two-week interval between the immediate posttest and the delayed posttest. After the experiment, there were interviews for the instruction + gesture group at the end of the process of the data collection. Quantitative data of the participants’ acquisition of the L2 English tense and aspect were collected at the three times of tests, and qualitative data of their perceptions of the pedagogical gestures were collected in the interviews. After the interviews, the participants of the pilot and the control groups attended two make-up lessons which were the same as the treatment lessons for the instruction + gesture group during the experiment. Table 3.5 outlines the procedure of the entire data collection process.

Table 3.5 Data collection procedure

Stages	Weeks	Participating groups	Activities	Types of data
Before experiment	Week 1	All the participants	Participants were informed of the project and signed the consent form	
			Oxford Placement Test	Quantitative measurements of the participants' general English proficiency
		Pilot	Piloting the three versions of the UGJT and EIT	
During experiment	Week 2	Instruction, instruction + gesture, and control	Pretest	Quantitative measurements of the participants' acquisition of the L2 English tense and aspect
	Week 3	Instruction and instruction + gesture	Day 1: 1st 45-minute treatment lesson	
			Day 2: 2nd 45-minute treatment lesson	
		Instruction, instruction + gesture, and control	Immediate posttest	Quantitative measurements of the participants' acquisition of the L2 English tense and aspect
	Week 6	Instruction, instruction + gesture, and control	Delayed posttest	Quantitative measurements of the participants' acquisition of the L2 English tense and aspect
After	Week	Instruction +	Interviews	Qualitative interviews

experiment	7	gesture		exploring the participants' perceptions of the pedagogical gestures
	Week 8	Pilot and control	Two make-up lessons	

As mentioned in Section 3.3.1.2 "The Elicited Imitation Test" above, a participant entered a room to do the EIT individually with the examiner in the room. One such individual testing session lasted around 10 minutes. Given that there were 110 participants, and that all of them needed to do the EIT at three times (i.e., pretest, immediate posttest, and delayed posttest), and also given the time limit, I recruited six teachers and twelve Year 2 students as examiners to assist me. I sent them the testing materials, trained them how to administer the tests, and gave them detailed and clear written instructions for their easy reference. At each testing time, to arrange the individual testing sessions, I coordinated with the administrative staff for the available rooms, with the teachers and Year 2 students for the available examiners among them and their available time slots, and with the participants for their available time slots. There were altogether 330 individual testing sessions, among which 107 were conducted by me, and the other 223 were conducted by the other examiners.

3.6 Data Analysis

3.6.1 Analyses in Relation to Research Question 1

To answer Research Question 1 on the effects of pedagogical gestures on the EFL learners' acquisition of the target English tense and aspect, descriptive and inferential statistical analyses were conducted with SPSS 27 (IBM, 2020) on the participants' scores for the UGJT and the EIT. A 3 (instruction + gesture vs. instruction only vs. control) × 3 (pretest vs. immediate posttest vs. delayed posttest) two-way mixed-model repeated measures ANOVA was respectively run on the simple past UGJT scores, the simple past EIT scores, the past progressive UGJT scores, and the past progressive EIT scores, to determine if there were significant differences across the treatment conditions

and the testing times.

When there was a significant interaction effect between time and treatment, simple main effects analyses were conducted for all levels of time at each level of treatment and for all levels of treatment at each level of time. When there was a significant simple main effect, simple comparisons followed. Specifically, when there was a significant simple main effect of time, to find out where the significant difference(s) lay among all levels of time at a certain level of treatment, *post hoc* simple comparisons of all levels of time were performed. Simple main effects and *post hoc* simple comparisons of time were performed by doing a one-way within-subjects ANOVA at each level of treatment. When there was a significant simple main effect of treatment, to find out where the significant difference(s) lay among all levels of treatment at a certain level of time, simple pairwise comparisons of all levels of treatment were performed. Simple main effects and simple pairwise comparisons of treatment were performed by /EMMEANS syntax commands in SPSS. Bonferroni was adopted for adjustments for multiple pairwise comparisons in both *post hoc* simple comparisons and simple pairwise comparisons. The comparisons among the time levels were made to gauge the effectiveness of the treatments, and the comparisons among the treatment conditions were made to assess the efficiency of the different treatments.

For all the inferential statistical tests in the present study, the alpha was set at .05 (2-tailed). η_p^2 was calculated as the effect sizes of the main effects and interaction effects in the two-way mixed-model ANOVAs, and also as the effect sizes of the simple main effects in the one-way within-subjects ANOVAs and /EMMEANS analyses. When .01 $\leqslant$ η_p^2 $<$ .06, it was interpreted as a small effect size; when .06 $\leqslant$ η_p^2 $<$ .14, it was interpreted as a medium effect size; when η_p^2 $\geqslant$ .14, it was interpreted as a large effect size. In all the two-way mixed-model ANOVAs and one-way within-subjects ANOVAs in the present study, Mauchly's test of sphericity was used to check whether the assumption of sphericity was violated. When it was violated (i.e., $p < .05$), Greenhouse-Geisser adjusted results were adopted.

3.6.2 Analyses in Relation to Research Question 2

Semi-structured interview data for Research Question 2 were collected to reveal the EFL learners' perceptions of the pedagogical gestures, as well as to provide explanations for the findings for Research Question 1. I aimed to look for the opinions recurrently mentioned by the participants and find out the more significant opinions with higher mentioning frequencies. Content analysis can achieve this (Cohen, Manion, and Morrison, 2018), and therefore was adopted as the data analysis method for Research Question 2.

I first transcribed the recordings of the 30 semi-structured interviews verbatim, producing 30 transcriptions. Then, in each transcription, I marked the part that was relevant to each interview question with the key words of the interview question, and the key words are the predetermined categories (see Table 3.3 above for the key words [categories]).

Next, for the structured questions (Questions 6-8) and the structured parts of the semi-structured questions (i.e., the former halves of Questions 4 and 9), I assigned a code to each type of participants' responses. To enhance validity, I adopted member check during data analysis, asking the participants whether my summarizing their responses into codes was accurate. Then I counted the frequency of each code and calculated the corresponding percentage. The frequency of each code was the number of participants who gave the same type of responses, and the corresponding percentage was calculated as the frequency divided by 30, which was the total number of interviewees. See Table 3.6 below for the questions and the corresponding types of participants' responses (codes). Only the types of participants' responses (codes) for Question 8 (positive attitude, negative attitude, and neutral attitude) were devised in advance. Those for Questions 6, 7, 4, and 9 were not devised in advance, but were identified from the recurrent participants' responses.

Table 3.6 Structured questions and structured parts of the semi-structured questions, and the corresponding types of participants' responses (codes)

Question type	**Question**	**Key words (category)**	**Types of participants' responses (codes)**
Q6-8: Structured	6. Do you think the teacher's gestures are important?	Importance	6.1 Important 6.2 Somewhat important
	7. Do you think the teacher's gestures are interesting?	Interest	7.1 Interesting 7.2 Not very interesting
	8. What is your attitude towards the teacher's gestures? Positive, negative, or neutral?	Attitude	8.1 Positive 8.2 Somewhat positive 8.3 Neutral
Q4 and Q9: Semi-structured (structured parts underlined)	4. <u>Do you think the teacher's gestures are effective for helping you learn the target English tense and aspect?</u> If yes, then how did the gestures help you learn the target English tense and aspect?	Effectiveness	4a.1 Effective 4a.2 Somewhat effective 4a.3 Not very effective
	9. <u>In your previous learning experiences, how frequently did your teachers use gestures during class?</u> If you can recall any gestures teachers used during class, then what are the functions of the gestures?	Previous gesture frequency	9a.1 Rarely 9a.2 Sometimes 9a.3 Often

For the open questions (Questions 1-3, and 5) and the open parts of the semi-structured questions (i.e., the latter halves of Questions 4 and 9), I read the participants' relevant responses, generated codes from the recurrent responses, checked with the participants, and calculated the frequency and percentage of each code. See Table 3.7 below for the questions and the corresponding types of participants' responses (codes) and example quotations.

Table 3.7 Open questions and open parts of the semi-structured questions, and the corresponding types of participants' responses (codes) and example quotations

Question type	Question	Key words (Category)	Types of participants' responses (codes) and example quotations
Q1-3, and 5: Open	1. What is your deepest impression of the treatment lessons?	Deepest impression	1.1 Tense-aspect concepts (e.g., "Previously, I assumed that there were many discrete tenses, which confused me a lot, and I did not know that they are actually tense-aspect conflations. From the treatment lessons, I learned the tense-aspect concepts in a clear and systematic way.") 1.2 Tense-aspect usage (e.g., "For an action that was completed instantly, the simple past should be used. For an action that was ongoing, the past progressive should be used.") 1.3 Gestures (e.g., "The gestures facilitated my memorizing tense-aspect.")
	2. What did you learn from the treatment lessons?	Learned what	2.1 Tenses, aspects, and tense-aspect conflations (e.g., "Tenses include past, present, and future. In each tense, we have aspects, which include simple, perfect, progressive, and perfect progressive.") 2.2 Tenses, aspects, and corresponding gestures (e.g., "Pointing to the left refers to the past tense, pointing to the right refers to the future tense, and cyclic movements refer to the progressive aspect.")
	3. What gestures did you learn from	Learned what	3.1 Reproduced the deictic gesture for the simple past (pointing to the left)

	the treatment lessons?	gestures	and the metaphoric gesture for the past progressive (pointing to the left + cyclic movements)
	5. If you can think of some other functions of the teacher's gestures, then what are the functions?	Other Functions	5.1 Generalization (e.g., "The gestures can be generalized to other tense-aspect forms, such as future progressive.")
			5.2 Engaged students (e.g., "The gestures are engaging, making students participate in class actively.")
			5.3 More convenient than time axis (e.g., "Compared with a time axis which has three dots to indicate past, present, and future, gestures are more convenient to use.")
Q4 and Q9: Semi-structured (open parts underlined)	4. Do you think the teacher's gestures are effective for helping you learn the target English tense and aspect? If yes, then how did the gestures help you learn the target English tense and aspect?	How the gestures helped learning	4b.1 Concretized the abstract time concepts (e.g., "Time concepts are not concrete. The gestures concretized the time concepts and made them vivid.")
			4b.2 Facilitated memorizing tense-aspect (e.g., "The gestures are interesting and impressive. Next time when I need to think about tense-aspect, I will first think of the gestures. The gestures helped me memorize tense-aspect.")

		4b.3 Facilitated understanding tense-aspect (e.g., “The gestures are concrete and helped me understand the abstract tense-aspect.”)
9. In your previous learning experiences, how frequently did your teachers use gestures during class? If you can recall any gestures teachers used during class, then what are the functions of the gestures?	Previous gesture functions	9b.1 Facilitated memorizing (e.g., “My geography teacher’s gestures in class facilitated my memorizing cyclone.”)
		9b.2 Concretized abstract concepts (e.g., “In primary school, my maths teacher’s gestures for ‘1 + 1 = 2’ concretized the abstract calculation.)
		9b.3 Facilitated understanding (e.g., “My physics teacher’s gestures facilitated my understanding of how planets move.)
		9b.4 Attracted attention (e.g., “Sometimes students might be absent-minded. A teacher’s gestures could attract their attention.”)
		9b.5 Facilitated inferring (e.g., “In physics, the left-hand rule and the right-hand rule facilitated

	inferring the directions.”
	9b.6 Interesting (e.g., “Gestures made class interesting, and students became more willing to learn.”)
	9b.7 Enlivened class (e.g., “My chemistry teacher liked using gestures, which enlivened class.”)
	9b.8 Engaged students (e.g., “The teacher made gestures, and students imitated the gestures and participated in class.”)
	9b.9 More engaging and convenient than other means (e.g., “Students made gestures by themselves, which is more engaging and convenient than multimedia.”)

3.7 Summary of Chapter 3

This chapter first describes the research design adopted in the present study, which is the explanatory sequential design. Then the participants are introduced. After that, the instruments (i.e., the tests of explicit and implicit knowledge of the target structures [for Research Question 1] and the semi-structured interview [for Research Question 2]), the treatment lessons, and the procedure are described in detail. Finally, the chapter elaborates on how data analyses were conducted for the two research questions respectively.

Chapter 4: Results

4.1 Results for Research Question 1

Research Question 1 is about the effects of the pedagogical gestures on the EFL learners' acquisition of the English tense and aspect. It is specified as two sub research questions: the effects of the pedagogical deictic gesture on the learners' acquisition of the English simple past, and the effects of the pedagogical metaphoric gesture on the learners' acquisition of the English past progressive. Section 4.1.1 below presents the results for the first sub research question, in terms of the UGJT results about the acquisition of explicit knowledge and the EIT results about the acquisition of implicit knowledge, and Section 4.1.2 below presents the results for the second sub research question, also in terms of the UGJT results about the acquisition of explicit knowledge and the EIT results about the acquisition of implicit knowledge. Section 4.1.3 summarizes the results for the two sub research questions.

4.1.1 The Effects of the Pedagogical Deictic Gesture on the Learners' Acquisition of the English Simple Past

4.1.1.1 The Simple Past UGJT Results

The means and standard deviations of the simple past UGJT scores are presented in Table 4.1, and the means are graphically plotted in Figure 4.1.

Table 4.1 Means and standard deviations of the simple past UGJT scores

	Pretest		Immediate posttest		Delayed posttest	
	M	*SD*	*M*	*SD*	*M*	*SD*
Instruction only	14.317	2.148	15.583	0.911	15.633	1.224
Instruction + gesture	13.267	2.970	15.600	0.578	15.250	0.963
Control	13.883	2.818	13.917	2.349	14.333	2.695

Note. There were 30 participants in each group, and all the 90 participants participated in all the three times of tests.

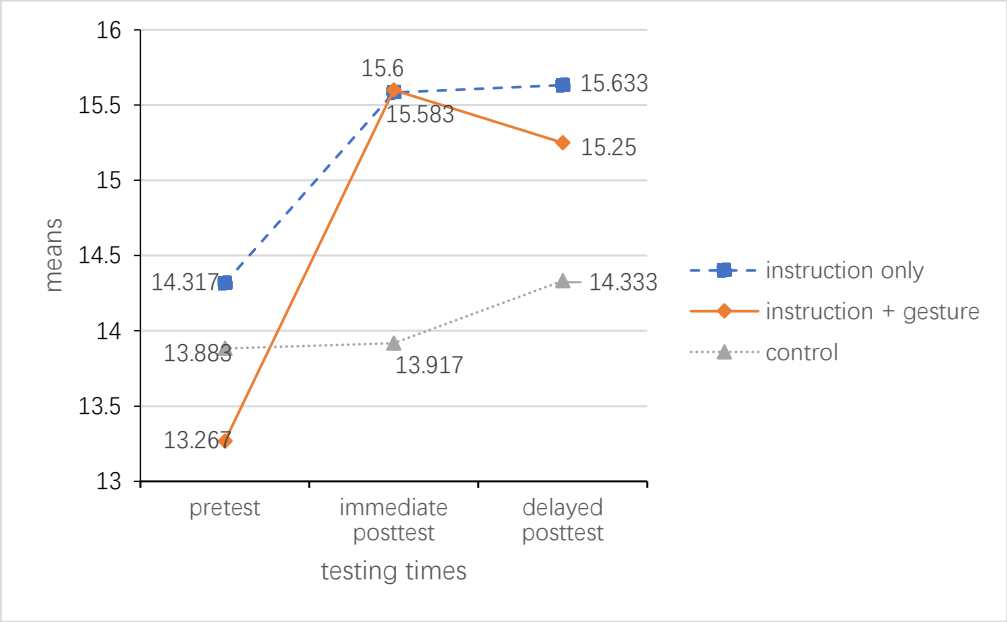


Figure 4.1 Group means of the simple past UGJT scores across the treatment (instruction only, instruction + gesture, and control) and time (pretest, immediate posttest, and delayed posttest) conditions

In terms of the effect of the pedagogical deictic gesture on the learners' acquisition of the explicit knowledge of the simple past, ANOVA of the simple past UGJT scores revealed that there was a significant main effect of time averaged across treatment levels, $F(1.510, 131.405) = 23.579$, $p < .001$, $\eta_p^2 = .213$ (a large effect size), a significant main effect of treatment averaged across time levels, $F(2, 87) = 3.342$, $p = .040$, $\eta_p^2 = .071$ (a medium effect size), and a significant interaction effect between time and treatment, $F(3.021, 131.405) = 5.350$, $p = .002$, $\eta_p^2 = .110$ (a medium effect size). Mauchly's test of sphericity showed that the assumption of sphericity was violated ($p < .001$), and Greenhouse-Geisser adjusted results were adopted.

There was a significant simple main effect of time in instruction only group, $F(2, 58) = 11.429$, $p < .001$, $\eta_p^2 = .283$ (a large effect size). *Post hoc* simple comparisons showed that immediate posttest score ($M = 15.583$, $SE = .166$) was significantly higher than pretest score ($M = 14.317$, $SE = .392$), $p = .004$, that delayed posttest score ($M = 15.633$, $SE = .224$) was also significantly higher than pretest score, $p = .001$, and that there was no significant difference between immediate posttest score and delayed

posttest score, p = 1.000. There was also a significant simple main effect of time in instruction + gesture group, $F(1.258, 36.479) = 15.670$, $p < .001$, η_p^2 = .351 (a large effect size). Mauchly's test of sphericity showed that the assumption of sphericity was violated ($p < .001$), and Greenhouse-Geisser adjusted results were adopted. *Post hoc* simple comparisons showed that immediate posttest score (M = 15.600, SE = .106) was significantly higher than pretest score (M = 13.267, SE = .542), p = .001, that delayed posttest score (M = 15.250, SE = .176) was also significantly higher than pretest score, p = .002, and that there was no significant difference between immediate posttest score and delayed posttest score, p = .361. There was no significant simple main effect of time in control group, $F(2, 58) = 1.461$, $p = .240$, η_p^2 = .048 (a small effect size). Table 4.2 below summarizes the inferential statistical analysis results of the simple past UGJT scores, in terms of the simple main effects and *post hoc* simple comparisons of all levels of time at each level of treatment.

Table 4.2 Summary of the inferential statistical analysis results of simple main effects and *post hoc* simple comparisons of all levels of time at each level of treatment (simple past, UGJT)

Instruction only	Instruction + gesture	Control
Large effect (η_p^2 = .283)	**Large effect (η_p^2 = .351)**	**ns**
Immediate > Pre	*Immediate > Pre*	
Delayed > Pre	*Delayed > Pre*	
Immediate ≈ Delayed	*Immediate ≈ Delayed*	

Note. In each column of the table, words in boldface show the simple main effect of all levels of time at a certain level of treatment ("ns" means "no significant difference", and "large effect" means "a significant difference with a large effect size"), and below "large effect" are words in italics which show the pairwise comparisons of all levels of time at a certain level of treatment. Words with the grey background show the information that can be extracted for the direct comparison between instruction only and instruction + gesture treatments.

There was no significant simple main effect of treatment at pretest, $F(2, 87)$ = 1.172, p = .315, η_p^2 = .026 (a small effect size), which confirmed that the three groups were of equal levels of acquisition of the explicit knowledge of the English simple past prior to treatment. There was a significant simple main effect of treatment at the

immediate posttest, $F(2, 87) = 12.597$, $p < .001$, $\eta_p^2 = .225$ (a large effect size). Simple pairwise comparisons showed that instruction only group ($M = 15.583$, $SE = .272$) was significantly higher than control group ($M = 13.917$, $SE = .272$), $p < .001$, that instruction + gesture group ($M = 15.600$, $SE = .272$) was also significantly higher than control group, $p < .001$, and that there was no significant difference between instruction only group and instruction + gesture group, $p = 1.000$. There was also a significant simple main effect of treatment at delayed posttest, $F(2, 87) = 4.144$, $p = .019$, $\eta_p^2 = .087$ (a medium effect size). Simple pairwise comparisons showed that instruction only group ($M = 15.633$, $SE = .328$) was significantly higher than control group ($M = 14.333$, $SE = .328$), $p = .019$, that there was no significant difference between instruction + gesture group ($M = 15.250$, $SE = .328$) and control group, $p = .154$, and that there was no significant difference between instruction only group and instruction + gesture group, $p = 1.000$. Table 4.3 below summarizes the inferential statistical analysis results of the simple past UGJT scores, in terms of the simple main effects and simple pairwise comparisons of all levels of treatment at each level of time.

Table 4.3 Summary of the inferential statistical analysis results of simple main effects and simple pairwise comparisons of all levels of treatment at each level of time (simple past, UGJT)

Pretest	Immediate posttest	Delayed posttest
ns	**Large effect (η_p^2 = .225)**	**medium effect (η_p^2 = .087)**
	Instruction only > Control	*Instruction only > Control*
	Instruction + gesture > Control	*Instruction + gesture ≈ Control*
	Instruction only ≈ Instruction + gesture	*Instruction only ≈ Instruction + gesture*

Note. In each column of the table, words in boldface show the simple main effect of all levels of treatment at a certain level of time ("ns" means "no significant difference", "large effect" means "a significant difference with a large effect size", and "medium effect" means "a significant difference with a medium effect size"), and below "large effect" and "medium effect" are words in italics which show the pairwise comparisons of all levels of treatment at a certain level of time. Words with the grey background show the information that can be extracted for the direct comparison between instruction only and instruction + gesture treatments.

4.1.1.2 The Simple Past EIT Results

The means and standard deviations of the simple past EIT scores are presented in Table 4.4, and the means are graphically plotted in Figure 4.2.

Table 4.4 Means and standard deviations of the simple past EIT scores

	Pretest		Immediate posttest		Delayed posttest	
	M	*SD*	*M*	*SD*	*M*	*SD*
Instruction only	3.900	2.799	6.733	2.843	7.000	2.798
Instruction + gesture	3.600	2.752	7.050	2.111	7.133	2.173
Control	4.483	2.680	5.133	3.159	5.550	3.196

Note. There were 30 participants in each group, and all the 90 participants participated in all the three times of tests.

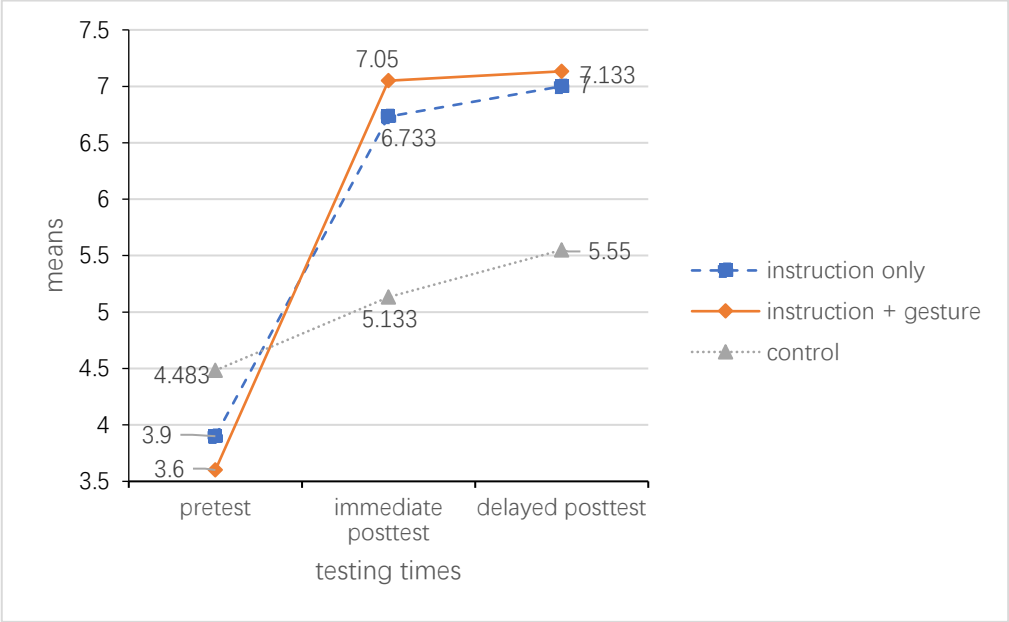


Figure 4.2 Group means of the simple past EIT scores across the treatment (instruction only, instruction + gesture, and control) and time (pretest, immediate posttest, and delayed posttest) conditions

In terms of the effect of the pedagogical deictic gesture on the learners' acquisition of the implicit knowledge of the simple past, ANOVA of the simple past EIT scores revealed that there was a significant main effect of time averaged across treatment levels, $F(1.720, 149.639) = 93.179$, $p < .001$, $\eta_p^2 = .517$ (a large effect size), no significant main effect of treatment averaged across time levels, $F(2, 87) = 1.151$, $p = .321$, $\eta_p^2 = .026$ (a small effect size), and a significant interaction effect between time and treatment, $F(3.440, 149.639) = 10.169$, $p < .001$, $\eta_p^2 = .189$ (a large effect size). Mauchly's test of sphericity showed that the assumption of sphericity was violated ($p < .001$), and Greenhouse-Geisser adjusted results were adopted.

There was a significant simple main effect of time in instruction only group, $F(1.564, 45.368) = 38.351$, $p < .001$, $\eta_p^2 = .569$ (a large effect size). Mauchly's test of sphericity showed that the assumption of sphericity was violated ($p = .010$), and Greenhouse-Geisser adjusted results were adopted. *Post hoc* simple comparisons showed that immediate posttest score ($M = 6.733$, $SE = .519$) was significantly higher than pretest score ($M = 3.900$, $SE = .511$), $p < .001$, that delayed posttest score ($M =$

7.000, *SE* = .511) was also significantly higher than pretest score, $p < .001$, and that there was no significant difference between the immediate posttest score and the delayed posttest score, $p = .994$. There was also a significant simple main effect of time in instruction + gesture group, $F(2, 58) = 74.287$, $p < .001$, $\eta_p^2 = .719$ (a large effect size). *Post hoc* simple comparisons showed that immediate posttest score ($M = 7.050$, $SE = .385$) was significantly higher than pretest score ($M = 3.600$, $SE = .503$), $p < .001$, that delayed posttest score ($M = 7.133$, $SE = .397$) was also significantly higher than pretest score, $p < .001$, and that there was no significant difference between the immediate posttest score and the delayed posttest score, $p = 1.000$. There was also a significant simple main effect of time in control group, $F(2, 58) = 4.707$, $p = .013$, $\eta_p^2 = .140$ (a large effect size). *Post hoc* simple comparisons showed that there was no significant difference between immediate posttest score ($M = 5.133$, $SE = .577$) and pretest score ($M = 4.483$, $SE = .489$), $p = .314$, that delayed posttest score ($M = 5.550$, $SE = .583$) was significantly higher than pretest score, $p = .021$, and that there was no significant difference between the immediate posttest score and the delayed posttest score, $p = .479$. Table 4.5 below summarizes the inferential statistical analysis results of the simple past EIT scores, in terms of the simple main effects and *post hoc* simple comparisons of all levels of time at each level of treatment.

Table 4.5 Summary of the inferential statistical analysis results of simple main effects and *post hoc* simple comparisons of all levels of time at each level of treatment (simple past, EIT)

Instruction only	Instruction + gesture	Control
Large effect (η_p^2 = .569)	**Large effect (η_p^2 = .719)**	**Large effect (η_p^2 = .140)**
Immediate > Pre	*Immediate > Pre*	*Immediate ≈ Pre*
Delayed > Pre	*Delayed > Pre*	*Delayed > Pre*
Immediate ≈ Delayed	*Immediate ≈ Delayed*	*Immediate ≈ Delayed*

Note. In each column of the table, words in boldface show the simple main effect of all levels of time at a certain level of treatment ("large effect" means "a significant difference with a large effect size"), and below "large effect" are words in italics which show the pairwise comparisons of all levels of time at a certain level of treatment. Words with the grey background show the information that can be extracted for the direct comparison between instruction only and instruction + gesture treatments.

There was no significant simple main effect of treatment at pretest, $F(2, 87) = .804$, $p = .451$, $\eta_p^2 = .018$ (a small effect size), which confirmed that the three groups were of equal levels of acquisition of the implicit knowledge of the English simple past prior to treatment. There was a significant simple main effect of treatment at immediate posttest, $F(2, 87) = 4.219$, $p = .018$, $\eta_p^2 = .088$ (a medium effect size). Simple pairwise comparisons showed that there was no significant difference between instruction only group ($M = 6.733$, $SE = .500$) and control group ($M = 5.133$, $SE = .500$), $p = .079$, that instruction + gesture group ($M = 7.050$, $SE = .500$) was significantly higher than control group, $p = .024$, and that there was no significant difference between instruction only group and instruction + gesture group, $p = 1.000$. There was no significant simple main effect of treatment at delayed posttest, $F(2, 87) = 3.049$, $p = .052$, $\eta_p^2 = .066$ (a medium effect size). Table 4.6 below summarizes the inferential statistical analysis results of the simple past EIT scores, in terms of the simple main effects and simple pairwise comparisons of all levels of treatment at each level of time.

Table 4.6 Summary of the inferential statistical analysis results of simple main effects and simple pairwise comparisons of all levels of treatment at each level of time (simple past, EIT)

Pretest	Immediate posttest	Delayed posttest
ns	**medium effect (η_p^2 = .088)** *Instruction only ≈ Control* *Instruction + gesture > Control* *Instruction only ≈ Instruction + gesture*	**ns**

Note. In each column of the table, words in boldface show the simple main effect of all levels of treatment at a certain level of time ("ns" means "no significant difference", and "medium effect" means "a significant difference with a medium effect size"), and below "medium effect" are words in italics which show the pairwise comparisons of all levels of treatment at a certain level of time. Words with the grey background show the information that can be extracted for the direct comparison between instruction only and instruction + gesture treatments.

4.1.2 The Effects of the Pedagogical Metaphoric Gesture on the Learners' Acquisition of the English Past Progressive

4.1.2.1 The Past Progressive UGJT Results

The means and standard deviations of the past progressive UGJT scores are presented in Table 4.7, and the means are graphically plotted in Figure 4.3.

Table 4.7 Means and standard deviations of the past progressive UGJT scores

	Pretest		Immediate posttest		Delayed posttest	
	M	*SD*	*M*	*SD*	*M*	*SD*
Instruction only	7.150	2.320	15.050	1.647	14.283	2.738
Instruction + gesture	6.300	2.020	15.483	0.760	15.233	1.223
Control	6.567	2.645	9.617	3.197	8.517	3.250

Note. There were 30 participants in each group, and all the 90 participants participated in all the three times of tests.

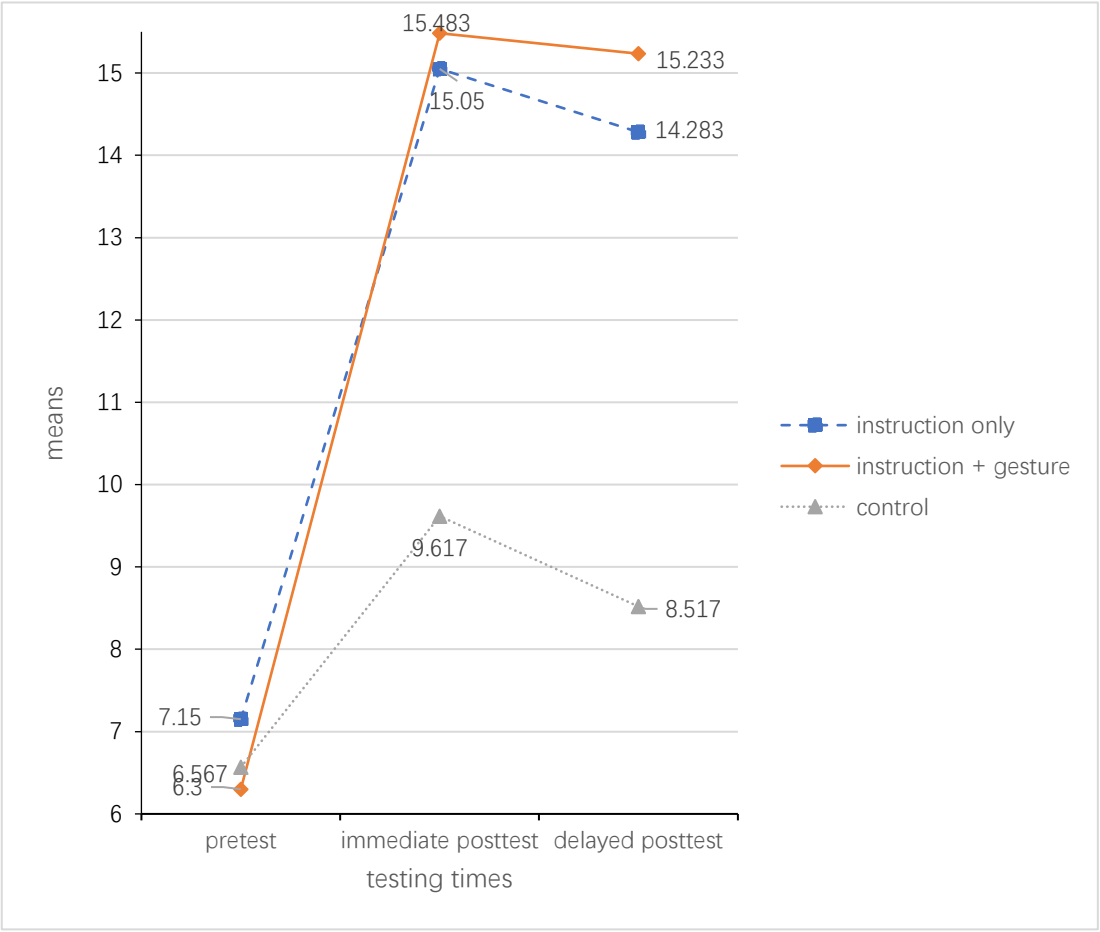


Figure 4.3 Group means of the past progressive UGJT scores across the treatment (instruction only, instruction + gesture, and control) and time (pretest, immediate posttest, and delayed posttest) conditions

In terms of the effect of the pedagogical metaphoric gesture on the learners' acquisition of the explicit knowledge of the past progressive, ANOVA of the past progressive UGJT scores revealed that there was a significant main effect of time averaged across treatment levels, $F(1.764, 153.449) = 370.717$, $p < .001$, $\eta_p^2 = .810$ (a large effect size), a significant main effect of treatment averaged across time levels, $F(2, 87) = 48.954$, $p < .001$, $\eta_p^2 = .529$ (a large effect size), and a significant interaction effect between time and treatment, $F(3.528, 153.449) = 36.031$, $p < .001$, $\eta_p^2 = .453$ (a large effect size). Mauchly's test of sphericity showed that the assumption of sphericity was violated ($p = .002$), and Greenhouse-Geisser adjusted results were adopted.

There was a significant simple main effect of time in instruction only group, $F(2, 58) = 148.201$, $p < .001$, $\eta_p^2 = .836$ (a large effect size). *Post hoc* simple comparisons showed that immediate posttest score ($M = 15.050$, $SE = .301$) was significantly higher than pretest score ($M = 7.150$, $SE = .424$), $p < .001$, that delayed posttest score ($M = 14.283$, $SE = .500$) was also significantly higher than pretest score, $p < .001$, and that there was no significant difference between immediate posttest score and delayed posttest score, $p = .217$. There was also a significant simple main effect of time in instruction + gesture group, $F(1.309, 37.947) = 493.481$, $p < .001$, $\eta_p^2 = .944$ (a large effect size). Mauchly's test of sphericity showed that the assumption of sphericity was violated ($p < .001$), and Greenhouse-Geisser adjusted results were adopted. *Post hoc* simple comparisons showed that immediate posttest score ($M = 15.483$, $SE = .139$) was significantly higher than pretest score ($M = 6.300$, $SE = .369$), $p < .001$, that delayed posttest score ($M = 15.233$, $SE = .223$) was also significantly higher than pretest score, $p < .001$, and that there was no significant difference between immediate posttest score and delayed posttest score, $p = .485$. There was also a significant simple main effect of time in control group, $F(2, 58) = 16.268$, $p < .001$, $\eta_p^2 = .359$ (a large effect size). *Post hoc* simple comparisons showed that immediate posttest score ($M = 9.617$, $SE = .584$) was significantly higher than pretest score ($M = 6.567$, $SE = .483$), $p < .001$, that delayed posttest score ($M = 8.517$, $SE = .593$) was also significantly higher than pretest score, $p = .007$, and that there was no significant difference between immediate posttest score and delayed posttest score, $p = .089$. Table 4.8 below summarizes the inferential statistical analysis results of the past progressive UGJT scores, in terms of the simple main effects and *post hoc* simple comparisons of all levels of time at each level of treatment.

Table 4.8 Summary of the inferential statistical analysis results of simple main effects and *post hoc* simple comparisons of all levels of time at each level of treatment (past progressive, UGJT)

Instruction only	Instruction + gesture	Control
Large effect (η_p^2 = .836)	**Large effect (η_p^2 = .944)**	**Large effect (η_p^2 = .359)**
Immediate > Pre	*Immediate > Pre*	*Immediate > Pre*
Delayed > Pre	*Delayed > Pre*	*Delayed > Pre*
Immediate ≈ Delayed	*Immediate ≈ Delayed*	*Immediate ≈ Delayed*

Note. In each column of the table, words in boldface show the simple main effect of all levels of time at a certain level of treatment ("large effect" means "a significant difference with a large effect size"), and below "large effect" are words in italics which show the pairwise comparisons of all levels of time at a certain level of treatment. Words with the grey background show the information that can be extracted for the direct comparison between instruction only and instruction + gesture treatments.

There was no significant simple main effect of treatment at pretest, $F(2, 87) = 1.034$, $p = .360$, $\eta_p^2 = .023$ (a small effect size), which confirmed that the three groups were of equal levels of acquisition of the explicit knowledge of the English past progressive prior to treatment. There was a significant simple main effect of treatment at the immediate posttest, $F(2, 87) = 71.205$, $p < .001$, $\eta_p^2 = .621$ (a large effect size). Simple pairwise comparisons showed that instruction only group ($M = 15.050$, $SE = .387$) was significantly higher than control group ($M = 9.617$, $SE = .387$), $p < .001$, that instruction + gesture group ($M = 15.483$, $SE = .387$) was also significantly higher than control group, $p < .001$, and that there was no significant difference between instruction only group and instruction + gesture group, $p = 1.000$. There was also a significant simple main effect of treatment at delayed posttest, $F(2, 87) = 60.821$, $p < .001$, $\eta_p^2 = .583$ (a large effect size). Simple pairwise comparisons showed that instruction only group ($M = 14.283$, $SE = .466$) was significantly higher than control group ($M = 8.517$, $SE = .466$), $p < .001$, that instruction + gesture group ($M = 15.233$, $SE = .466$) was also significantly higher than control group, $p < .001$, and that there was no significant difference between instruction only group and instruction + gesture group, $p = .459$. Table 4.9 below summarizes the inferential statistical analysis results of the

past progressive UGJT scores, in terms of the simple main effects and simple pairwise comparisons of all levels of treatment at each level of time.

Table 4.9 Summary of the inferential statistical analysis results of simple main effects and simple pairwise comparisons of all levels of treatment at each level of time (past progressive, UGJT)

Pretest	Immediate posttest	Delayed posttest
ns	**Large effect (η_p^2 = .621)**	**Large effect (η_p^2 = .583)**
	Instruction only > Control	*Instruction only > Control*
	Instruction + gesture > Control	*Instruction + gesture > Control*
	Instruction only ≈ Instruction + gesture	*Instruction only ≈ Instruction + gesture*

Note. In each column of the table, words in boldface show the simple main effect of all levels of treatment at a certain level of time ("ns" means "no significant difference", and "large effect" means "a significant difference with a large effect size"), and below "large effect" are words in italics which show the pairwise comparisons of all levels of treatment at a certain level of time. Words with the grey background show the information that can be extracted for the direct comparison between instruction only and instruction + gesture treatments.

4.1.2.2 The Past Progressive EIT Results

The means and standard deviations of the past progressive EIT scores are presented in Table 4.10, and the means are graphically plotted in Figure 4.4.

Table 4.10 Means and standard deviations of the past progressive EIT scores

	Pretest		Immediate posttest		Delayed posttest	
	M	*SD*	*M*	*SD*	*M*	*SD*
Instruction only	1.150	1.035	6.017	2.598	5.767	2.300
Instruction + gesture	1.200	1.518	6.067	2.487	6.233	2.046
Control	1.650	1.457	3.283	1.977	3.367	2.141

Note. There were 30 participants in each group, and all the 90 participants participated in all the three times of tests.

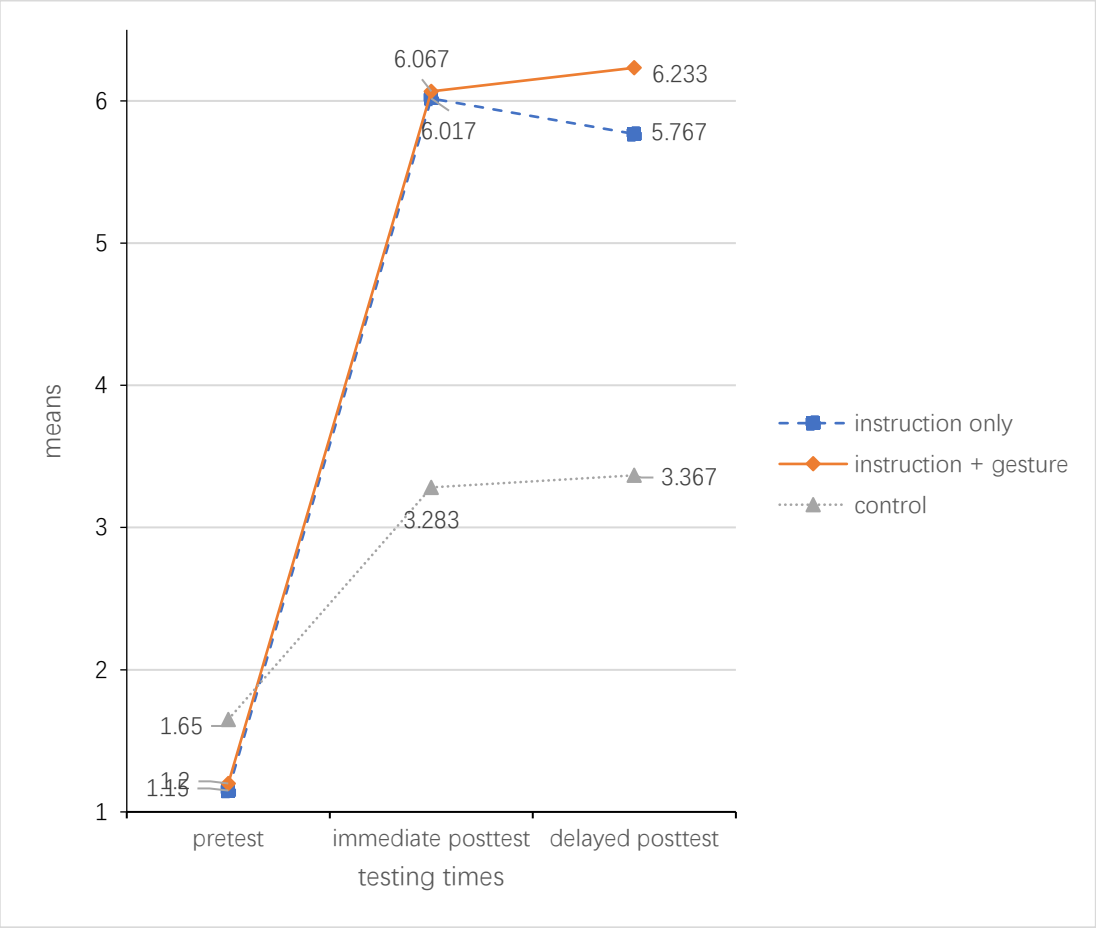


Figure 4.4 Group means of the past progressive EIT scores across the treatment (instruction only, instruction + gesture, and control) and time (pretest, immediate posttest, and delayed posttest) conditions

In terms of the effect of the pedagogical metaphoric gesture on the learners' acquisition of the implicit knowledge of the past progressive, ANOVA of the past progressive EIT scores revealed that there was a significant main effect of time averaged across treatment levels, $F(1.841, 160.178) = 234.023$, $p < .001$, $\eta_p^2 = .729$ (a large effect size), a significant main effect of treatment averaged across time levels, $F(2, 87) = 9.628$, $p < .001$, $\eta_p^2 = .181$ (a large effect size), and a significant interaction effect between time and treatment, $F(3.682, 160.178) = 18.468$, $p < .001$, $\eta_p^2 = .298$ (a large effect size). Mauchly's test of sphericity showed that the assumption of sphericity was violated ($p = .021$), and Greenhouse-Geisser adjusted results were adopted.

There was a significant simple main effect of time in instruction only group, $F(1.552, 45.015) = 127.000$, $p < .001$, $\eta_p^2 = .814$ (a large effect size). Mauchly's test of sphericity showed that the assumption of sphericity was violated ($p = .009$), and Greenhouse-Geisser adjusted results were adopted. *Post hoc* simple comparisons showed that immediate posttest score ($M = 6.017$, $SE = .474$) was significantly higher than pretest score ($M = 1.150$, $SE = .189$), $p < .001$, that delayed posttest score ($M = 5.767$, $SE = .420$) was also significantly higher than pretest score, $p < .001$, and that there was no significant difference between immediate posttest score and delayed posttest score, $p = .936$. There was also a significant simple main effect of time in instruction + gesture group, $F(2, 58) = 115.295$, $p < .001$, $\eta_p^2 = .799$ (a large effect size). *Post hoc* simple comparisons showed that immediate posttest score ($M = 6.067$, $SE = .454$) was significantly higher than pretest score ($M = 1.200$, $SE = .277$), $p < .001$, that delayed posttest score ($M = 6.233$, $SE = .373$) was also significantly higher than pretest score, $p < .001$, and that there was no significant difference between immediate posttest score and delayed posttest score, $p = 1.000$. There was also a significant simple main effect of time in control group, $F(2, 58) = 17.353$, $p < .001$, $\eta_p^2 = .374$ (a large effect size). *Post hoc* simple comparisons showed that immediate posttest score ($M = 3.283$, $SE = .361$) was significantly higher than pretest score ($M = 1.650$, $SE = .266$), $p < .001$, that delayed posttest score ($M = 3.367$, $SE = .391$) was also significantly higher than pretest score, $p < .001$, and that there was no significant difference between immediate posttest score and delayed posttest score, $p = 1.000$. Table 4.11 below summarizes the inferential statistical analysis results of the past progressive EIT scores, in terms of the simple main effects and *post hoc* simple comparisons of all levels of time at each level of treatment.

Table 4.11 Summary of the inferential statistical analysis results of simple main effects and *post hoc* simple comparisons of all levels of time at each level of treatment (past progressive, EIT)

Instruction only	Instruction + gesture	Control
Large effect (η_p^2 = .814)	**Large effect (η_p^2 = .799)**	**Large effect (η_p^2 = .374)**
Immediate > Pre	*Immediate > Pre*	*Immediate > Pre*
Delayed > Pre	*Delayed > Pre*	*Delayed > Pre*
Immediate ≈ Delayed	*Immediate ≈ Delayed*	*Immediate ≈ Delayed*

Note. In each column of the table, words in boldface show the simple main effect of all levels of time at a certain level of treatment ("large effect" means "a significant difference with a large effect size"), and below "large effect" are words in italics which show the pairwise comparisons of all levels of time at a certain level of treatment. Words with the grey background show the information that can be extracted for the direct comparison between instruction only and instruction + gesture treatments.

There was no significant simple main effect of treatment at pretest, $F(2, 87) = 1.241$, $p = .294$, $\eta_p^2 = .028$ (a small effect size), which confirmed that the three groups were of equal levels of acquisition of the implicit knowledge of the English past progressive prior to treatment. There was a significant simple main effect of treatment at the immediate posttest, $F(2, 87) = 13.555$, $p < .001$, $\eta_p^2 = .238$ (a large effect size). Simple pairwise comparisons showed that instruction only group ($M = 6.017$, $SE = .433$) was significantly higher than control group ($M = 3.283$, $SE = .433$), $p < .001$, that instruction + gesture group ($M = 6.067$, $SE = .433$) was also significantly higher than control group, $p < .001$, and that there was no significant difference between instruction only group and instruction + gesture group, $p = 1.000$. There was also a significant simple main effect of treatment at delayed posttest, $F(2, 87) = 15.146$, $p < .001$, $\eta_p^2 = .258$ (a large effect size). Simple pairwise comparisons showed that instruction only group ($M = 5.767$, $SE = .395$) was significantly higher than control group ($M = 3.367$, $SE = .395$), $p < .001$, that instruction + gesture group ($M = 6.233$, $SE = .395$) was also significantly higher than control group, $p < .001$, and that there was no significant difference between instruction only group and instruction + gesture group, $p = 1.000$.

Table 4.12 below summarizes the inferential statistical analysis results of the past progressive EIT scores, in terms of the simple main effects and simple pairwise comparisons of all levels of treatment at each level of time.

Table 4.12 Summary of the inferential statistical analysis results of simple main effects and simple pairwise comparisons of all levels of treatment at each level of time (past progressive, EIT)

Pretest	Immediate posttest	Delayed posttest
ns	**Large effect (η_p^2 = .238)**	**Large effect (η_p^2 = .258)**
	Instruction only > Control	*Instruction only > Control*
	Instruction + gesture > Control	*Instruction + gesture > Control*
	Instruction only ≈ Instruction + gesture	*Instruction only ≈ Instruction + gesture*

Note. In each column of the table, words in boldface show the simple main effect of all levels of treatment at a certain level of time ("ns" means "no significant difference", and "large effect" means "a significant difference with a large effect size"), and below "large effect" are words in italics which show the pairwise comparisons of all levels of treatment at a certain level of time. Words with the grey background show the information that can be extracted for the direct comparison between instruction only and instruction + gesture treatments.

4.1.3 Summary of the Results for Research Question 1

Similar findings can be generated from the inferential statistical analysis results for the effects of time reported in Section 4.1.1.1 "The Simple Past UGJT Results", Section 4.1.1.2 "The Simple Past EIT Results", Section 4.1.2.1 "The Past Progressive UGJT Results", and Section 4.1.2.2 "The Past Progressive EIT Results". Firstly, both the instruction only group and the instruction + gesture group significantly improved over time with large effect sizes in the simple past UGJT, the simple past EIT, the past progressive UGJT, and the past progressive EIT. Both groups significantly improved from pretest to immediate posttest, and the improvement was retained at delayed posttest. Secondly, the effect sizes of the instruction only group and those of the instruction + gesture group are similar. The effect sizes of the instruction + gesture group are all slightly larger than those of the instruction only group in the simple past UGJT, the simple past EIT, and the past progressive UGJT. On the other hand, the effect size of the instruction only group is slightly larger than that of the instruction + gesture

group in the past progressive EIT. Therefore, instruction only and instruction + gesture are similar in terms of treatment effectiveness.

Similar findings can also be generated from the inferential statistical analysis results for the effects of treatment reported in the above four sections. At each testing time in the simple past UGJT, the simple past EIT, the past progressive UGJT, and the past progressive EIT, there was no significant difference between the instruction only group and the instruction + gesture group. Therefore, apart from the similarity in treatment effectiveness as shown in the effects of time, instruction only and instruction + gesture are also similar in terms of treatment efficiency.

Based on these results, it can be concluded that to facilitate the acquisition of the explicit and implicit knowledge of the simple past and the acquisition of the explicit and implicit knowledge of the past progressive, instruction only and instruction + gesture are similar in terms of both treatment effectiveness and treatment efficiency. Verbal instruction alone can significantly facilitate the acquisition of the target English tense and aspect, whereas the additional nonverbal deictic and metaphoric gestures do not further significantly facilitate the acquisition.

4.2 Results for Research Question 2

Research Question 2 is about how the learners perceived the pedagogical gestures. The data were collected through semi-structured interviews, which consisted of structured questions, semi-structured questions, and open questions. Section 4.2.1 below presents the results for the structured interview questions and the structured parts of the semi-structured interview questions. Section 4.2.2 below presents the results for the open interview questions and the open parts of the semi-structured interview questions. Section 4.2.3 summarizes the results for all the interview questions.

4.2.1 Results for the Structured Interview Questions and the Structured Parts of the Semi-structured Interview Questions

For the structured questions (Questions 6-8) and the structured parts of the semi-

structured questions (i.e., the former halves of Questions 4 and 9), Table 4.13 below presents the frequency and percentage of each type of participants' responses (code) in the right column.

Table 4.13 Frequency and percentage of each type of participants' responses (code) (structured interview questions and structured parts of the semi-structured interview questions)

Question type	Question	Key words (category)	Frequency and percentage of each type of participants' responses (code)
Q6-8: Structured	6. Do you think the teacher's gestures are important?	Importance	6.1 Important (25, 83.3%) 6.2 Somewhat important (5, 16.7%)
	7. Do you think the teacher's gestures are interesting?	Interest	7.1 Interesting (27, 90%) 7.2 Not very interesting (3, 10%)
	8. What is your attitude towards the teacher's gestures? Positive, negative, or neutral?	Attitude	8.1 Positive (24, 80%) 8.2 Somewhat positive (1, 3.3%) 8.3 Neutral (5, 16.7%)
Q4 and Q9: Semi-structured (structured parts underlined)	4. Do you think the teacher's gestures are effective for helping you learn the target English tense and aspect? If yes, then how did the gestures help you learn the target English tense and aspect?	Effectiveness	4a.1 Effective (27, 90%) 4a.2 Somewhat effective (2, 6.7%) 4a.3 Not very effective (1, 3.3%)
	9. In your previous learning experiences, how frequently did your teachers use gestures during class? If you can recall any gestures teachers used during class, then what are the functions of the gestures?	Previous gesture frequency	9a.1 Rarely (25, 83.3%) 9a.2 Sometimes (2, 6.7%) 9a.3 Often (3, 10%)

Note. Within each bracket in the right column, frequency is before the comma, and percentage is after the comma. Words with grey background refer to the types of participants' responses (codes) with the highest frequencies and percentages.

It can be seen that the participants overwhelmingly thought that the pedagogical gestures were effective for teaching the target tense and aspect (Question 4) and that the gestures were important (Question 6) and interesting (Question 7). They generally had a positive attitude towards the pedagogical gestures (Question 8). Moreover, when it comes to their previous learning experiences, in most cases, their previous teachers rarely produced pedagogical gestures in class (Question 9).

4.2.2 Results for the Open Interview Questions and the Open Parts of the Semi-structured Interview Questions

For the open questions (Questions 1-3, and 5) and the open parts of the semi-structured questions (i.e., the latter halves of Questions 4 and 9), Table 4.14 below presents the frequency and percentage of each type of participants' responses (code) in the right column.

Table 4.14 Frequency and percentage of each type of participants' responses (code) (open interview questions and open parts of the semi-structured interview questions)

Question type	Question	Key words (Category)	Frequency and percentage of each type of participants' responses (code)
Q1-3, and 5: Open	1. What is your deepest impression of the treatment lessons?	Deepest impression	1.1 Tense-aspect concepts (14, 46.7%) 1.2 Tense-aspect usage (11, 36.7%) 1.3 Gestures (2, 6.7%)
	2. What did you learn from the treatment lessons?	Learned what	2.1 Tenses, aspects, and tense-aspect conflations (28, 93.3%) 2.2 Tenses, aspects, and corresponding gestures (2, 6.7%)
	3. What gestures did you learn from the treatment lessons?	Learned what gestures	3.1 Reproduced the deictic gesture for the simple past (pointing to the left) and the metaphoric gesture for the past progressive (pointing to the left + cyclic movements) (30, 100%)
	5. If you can think of some other functions of the teacher's gestures, then what are the functions?	Other Functions	5.1 Generalization (8, 26.7%) 5.2 Engaged students (3, 10%) 5.3 More convenient than time axis (2, 6.7%)
Q4 and Q9: Semi-structured (open parts underlined)	4. Do you think the teacher's gestures are effective for helping you learn the target English tense and aspect?		
	If yes, then how did the gestures help you learn the target English tense and aspect?	How the gestures helped learning	4b.1 Concretized the abstract time concepts (27, 90%)

		4b.2 Facilitated memorizing tense-aspect (7, 23.3%)
		4b.3 Facilitated understanding tense-aspect (5, 16.7%)
9. In your previous learning experiences, how frequently did your teachers use gestures during class?		
If you can recall any gestures teachers used during class, then what are the functions of the gestures?	Previous gesture functions	9b.1 Facilitated memorizing (13, 43.3%)
		9b.2 Concretized abstract concepts (7, 23.3%)
		9b.3 Facilitated understanding (6, 20%)
		9b.4 Attracted attention (4, 13.3%)
		9b.5 Facilitated inferring (3, 10%)
		9b.6 Interesting (2, 6.7%)
		9b.7 Enlivened class (2, 6.7%)
		9b.8 Engaged students (2, 6.7%)
		9b.9 More engaging and convenient than other means (2, 6.7%)

Note. Within each bracket in the right column, frequency is before the comma, and percentage is after the comma.
Words with grey background refer to the types of participants' responses (codes) with the highest frequencies and percentages.

Regarding the interview codes in the right column, see Table 3.7 for corresponding example responses from participants.

From the participants' responses to interview questions 1 and 2, it can be seen that when they were not explicitly directed to the topic of gestures, the majority of them recalled tense-aspect concepts, usage, and conflations, and a minority of them recalled the gestures. Their responses to interview question 3 showed that all of them accurately reproduced the two gestures. As presented in Section 4.2.1 above, most of them regarded the gestures as effective for helping them learn the two target structures. Their answers to the latter half of interview question 4 explained how the gestures helped, i.e., concretized the abstract time concepts, and facilitated understanding and memorizing tense-aspect. Apart from helping them learn the two target structures, their answers to interview question 5 listed some other functions of the gestures, i.e., generalizing to other tense-aspect conflations and engaging students. Compared with a time axis, the temporal gestures seemed more convenient to use. As shown in Section 4.2.1 above, among their previous teachers, there were not many who frequently produced gestures in class. Despite this, they thought of many functions of the pedagogical gestures they had encountered before. Some functions are the same as those of the two pedagogical gestures in the present study. Some other functions include attracting attention, facilitated inferring, and enlivening class.

4.2.3 Summary of the Results for Research Question 2

Results for the structured interview questions and the structured parts of the semi-structured interview questions show that the participants mainly perceived the two gestures positively. For example, most of them thought that the two gestures were effective for helping them learn the two target structures. Results for the open interview questions and the open parts of the semi-structured interview questions reveal that although the two target structures seemed to impress them more deeply than the two corresponding gestures, all of them correctly reproduced the two gestures. They also explained how the gestures helped them learn the two target structures and thought of some other functions of the gestures. Although few of their previous teachers made gestures during class, they recalled a number of functions of pedagogical gestures.

4.3 Summary of Chapter 4

This chapter presents the results for the two research questions. Section 4.1 presents the results for Research Question 1, and Section 4.2 presents the results for Research Question 2. Section 4.1 first presents the results for the pedagogical deictic gesture on the learners' acquisition of the English simple past, and then presents the results for the pedagogical metaphoric gesture on the learners' acquisition of the English past progressive. For each target structure and the corresponding gesture, the results are specified as the UGJT results (for explicit knowledge) and the EIT results (for implicit knowledge). Results presented in Section 4.1 show that the two pedagogical gestures did not significantly facilitate the participants' acquisition of the two target structures. Section 4.2 first presents the results for the structured interview questions and the structured parts of the semi-structured interview questions, and then presents the results for the open interview questions and the open parts of the semi-structured interview questions. Results presented in Section 4.2 show that the participants overwhelmingly perceived the two pedagogical gestures positively, including that they thought the gestures helped them learn the two target structures. Moreover, they explained how the gestures helped them, and they also mentioned some other gesture functions.

Chapter 5: Discussion and Conclusion

According to the results for Research Question 1, the facilitating effects of the pedagogical deictic gesture on the learners' acquisition of the explicit and implicit knowledge of the simple past are limited, and the facilitating effects of the pedagogical metaphoric gesture on the learners' acquisition of the explicit and implicit knowledge of the past progressive are also limited. According to the results for Research Question 2, the learners are overwhelmingly in favor of the pedagogical gestures because the gestures helped them understand the abstract concepts of the L2 English tense and aspect.

This chapter first discusses and integrates the results for Research Questions 1 and 2 (Section 5.1). Next, based on the discussion, it generates pedagogical and theoretical implications (Section 5.2). Finally, it draws conclusion for the present study (Section 5.3), points out the limitations of the present study, and suggests directions for future studies (Section 5.4).

5.1 Discussion

Section 4.3 "Summary of Chapter 4", as well as the beginning of this chapter above, summarizes the results for the two research questions. This section first discusses the results for the two research questions separately (Sections 5.1.1 and 5.1.2), and then integrates the results (Section 5.1.3).

5.1.1 Research Question 1

This section first further examines the results for Research Question 1 (i.e., the limited facilitating effects of the pedagogical gestures) (Section 5.1.1.1), and then compares the results with those of previous studies (Section 5.1.1.2). Furthermore, to account for the limited facilitating effects, the results for Research Questions 1 and 2 need to be integrated. The integration of the results and the interpretation of the limited facilitating effects are presented in Section 5.1.3 "Integrating the Findings for the Two

Research Questions" below.

5.1.1.1 A Further Examination of the Limited Effects of the Pedagogical Gestures

To further examine the results for Research Question 1, the means of the two experimental groups in the four tests (i.e., the simple past UGJT, the simple past EIT, the past progressive UGJT, and the past progressive EIT) are extracted from the tables in Chapter 4 and presented in Tables 5.1, 5.2, 5.3, and 5.4 below.

Table 5.1 Means of the two experimental groups in the simple past UGJT

	Pretest	Immediate posttest	Delayed posttest
Instruction only	14.317	15.583	15.633
Instruction + gesture	13.267	15.600	15.250

Table 5.2 Means of the two experimental groups in the simple past EIT

	Pretest	Immediate posttest	Delayed posttest
Instruction only	3.900	6.733	7.000
Instruction + gesture	3.600	7.050	7.133

Table 5.3 Means of the two experimental groups in the past progressive UGJT

	Pretest	Immediate posttest	Delayed posttest
Instruction only	7.150	15.050	14.283
Instruction + gesture	6.300	15.483	15.233

Table 5.4 Means of the two experimental groups in the past progressive EIT

	Pretest	Immediate posttest	Delayed posttest
Instruction only	1.150	6.017	5.767
Instruction + gesture	1.200	6.067	6.233

UGJT (Explicit Knowledge) and EIT (Implicit Knowledge)

As mentioned in Chapter 3 "Methodology", the learners' acquisition of the explicit knowledge of the target structures was measured by UGJT, and their acquisition of the implicit knowledge of the target structures was measured by EIT. As reported in Chapter 4 "Results", regarding the effects of the pedagogical gestures, UGJT and EIT results

show similar patterns, i.e., the pedagogical gestures did not significantly improve UGJT or EIT scores.

In terms of the simple past UGJT and the past progressive UGJT, according to the inferential statistical results reported in Chapter 4, both experimental groups significantly improved from pretest to immediate posttest, and maintained the explicit knowledge at delayed posttest. There was no significant difference between the two groups, which shows that the two kinds of treatment (i.e., instruction only, and instruction + gesture) produced similar facilitating effects on the learners' acquisition of the explicit knowledge. Therefore, the similar significant improvements from pretests to posttests were largely due to the verbal instruction[20], which the two kinds of treatment had in common, and the pedagogical gestures did not make a difference. It is noteworthy that the posttest scores (both immediate and delayed posttests) of the simple past UGJT and the past progressive UGJT were close to the UGJT full score (i.e., 16). There can be potential ceiling effects[21] that limited the facilitating effects of pedagogical gestures.

When it comes to the simple past EIT and the past progressive EIT, the pattern is similar. According to the inferential statistical results reported in Chapter 4, both experimental groups also significantly improved from pretest to immediate posttest, and maintained the implicit knowledge at delayed posttest. There was no significant difference between the two groups, which indicates that the two kinds of treatment (i.e., instruction only, and instruction + gesture) produced similar facilitating effects on the learners' acquisition of the implicit knowledge, so the pedagogical gestures did not make a difference, either. Compared with the posttest scores of the simple past UGJT

[20] As reported in Chapter 4 "Results", the significant improvements also resulted from time (i.e., significant simple main effects of time). Here the focus is on the effects of treatment. Treatment consists of verbal instruction and pedagogical gestures. Here I try to tease apart the effect of verbal instruction and the effect of pedagogical gestures.

[21] In many previous studies (e.g., Nakatsukasa, 2013, 2016, 2021), the ceiling effects in UGJT existed at pretests (i.e., the participants had already had good acquisition of the explicit knowledge of the target structures before the experiment, and therefore their pretest scores were already close to the full score). By contrast, in the present study, the ceiling effects in UGJT existed not at pretests, but at posttests. Although the pretest scores seem to be close to the full score, there was still room for improvement, and the scores were significantly improved at posttests, approaching the "ceiling".

and the past progressive UGJT, the posttest scores of the simple past EIT and the past progressive EIT were less close to the corresponding EIT full score (i.e., 10), and there should be no ceiling effect. In this case, the instruction + gesture group still did not significantly outperform the instruction only group. This confirms that the pedagogical gestures did not produce significant facilitating effects on the learners' acquisition of the implicit knowledge of the target structures.

The Deictic Gesture and the Simple Past, vs. the Metaphoric Gesture and the Past Progressive

The above section "UGJT (Explicit Knowledge) and EIT (Implicit Knowledge)" first discusses the UGJT results (both the simple past and the past progressive), and then discusses the EIT results (both the simple past and the past progressive). The discussion confirms the limited effects of the pedagogical gestures on the learners' acquisition of explicit knowledge[22] and implicit knowledge of the target structures, which have been reported in Chapter 4.

It is also of value to further discuss, i.e., to compare the simple past UGJT and the past progressive UGJT results, and also to compare the simple past EIT and the past progressive EIT results, so as to see the effects of different pedagogical gestures on the acquisition of the corresponding target structures. To do the comparisons, it is useful to examine the gain scores.

Tables 5.5, 5.6, 5.7, and 5.8 below respectively present the experimental groups' means in the pretests and immediate posttests of the four tests (i.e., the simple past UGJT, the simple past EIT, the past progressive UGJT, and the past progressive EIT) (extracted from Tables 5.1, 5.2, 5.3, and 5.4 above), as well as the gain scores from pretests to immediate posttests. Given that there was no significant difference between the immediate posttests and the delayed posttests (as reported in Chapter 4), the gain scores from pretests to delayed posttests are not calculated.

[22] As discussed above, admittedly, in the case of explicit knowledge, there can be potential ceiling effects at posttests, which limited the facilitating effects of the pedagogical gestures.

Table 5.5 Gain scores of the two experimental groups in the simple past UGJT

	Pretest	Immediate posttest	Gain score
Instruction only	14.317	15.583	1.266
Instruction + gesture	13.267	15.600	2.333

Table 5.6 Gain scores of the two experimental groups in the simple past EIT

	Pretest	Immediate posttest	Gain score
Instruction only	3.900	6.733	2.833
Instruction + gesture	3.600	7.050	3.45

Table 5.7 Gain scores of the two experimental groups in the past progressive UGJT

	Pretest	Immediate posttest	Gain score
Instruction only	7.150	15.050	7.9
Instruction + gesture	6.300	15.483	9.183

Table 5.8 Gain scores of the two experimental groups in the past progressive EIT

	Pretest	Immediate posttest	Gain score
Instruction only	1.150	6.017	4.867
Instruction + gesture	1.200	6.067	4.867

Comparing Tables 5.5 and 5.7, it can be seen that the gain scores in the past progressive UGJT are higher than those in the simple past UGJT. Comparing Tables 5.6 and 5.8, it can be seen that the gain scores in the past progressive EIT are also higher than those in the simple past EIT. Accordingly, the treatment effect on the acquisition of the past progressive seems to be larger than the treatment effect on the acquisition of the simple past.

Then, it needs to be considered what resulted in the differential treatment effects. For the instruction only group (i.e., without pedagogical gestures), the gain score in the past progressive UGJT is higher than that in the simple past UGJT, and the gain score in the past progressive EIT is also higher than that in the simple past EIT. Therefore, the differential treatment effects are not due to the different pedagogical gestures. In other words, based on the results, it cannot be argued that the metaphoric gesture is more effective than the deictic gesture.

The pretest scores show that the learners' prior knowledge (including both explicit and implicit knowledge) of the past progressive was obviously worse than that of the simple past. Therefore, there was larger room for improvement in the acquisition of the past progressive, and this can be a main reason for the larger improvement therein. In other words, the differential treatment effects can be mainly due to the different target structures. The learners' prior acquisition of the past progressive was worse than that of the simple past, which allowed larger improvement in the acquisition of the past progressive.

To conclude this section (Section 5.1.1.1 "A Further Examination of the Limited Effects of the Pedagogical Gestures"), first of all, as reported in Chapter 4, the two pedagogical gestures produced non-significant facilitating effects on the acquisition of the two target structures. As further examined in this section, the non-significant facilitating effects apply to both the acquisition of explicit knowledge[23] and the acquisition of implicit knowledge. Moreover, there was larger improvement in the acquisition of the past progressive than in the acquisition of the simple past. This is not because the metaphoric gesture was more effective than the deictic gesture. Instead, this is because there was larger room for improvement in the acquisition of the past progressive than in the acquisition of the simple past. From these findings, pedagogical implications can be generated. Section 5.2.1.1 "Learners' Weaker Areas: The Implicit L2 Knowledge and the Progressive Aspect" below presents the corresponding pedagogical implications.

5.1.1.2 The Effects of Pedagogical Gestures: Previous Studies vs. the Present Study

The section above (Section 5.1.1.1 "A Further Examination of the Limited Effects of the Pedagogical Gestures") examines and confirms the limited facilitating effects of the pedagogical gestures on the acquisition of the target structures. The limited effects apply to learning both the explicit and implicit knowledge. Furthermore, the metaphoric

[23] Admittedly, regarding explicit knowledge, there can be potential ceiling effects at posttests, which limited the facilitating effects of the pedagogical gestures.

gesture is not more effective than the deictic gesture. After confirming the limited effects, this section compares the findings with those of previous studies.

As mentioned in Chapter 3 "Methodology", L2 knowledge should be distinguished as explicit and implicit knowledge (Ellis, 2005). Following the explicit-implicit dichotomy[24], the present study and some previous studies (e.g., Ellis et al., 2006; Fu & Li, 2019, 2022; Nakatsukasa, 2013, 2016, 2021; Qu, 2019; Yang, 2008; Yang & Lyster 2010) examined L2 grammar acquisition by separately measuring learners' explicit and implicit knowledge. On the other hand, some other previous studies which examined L2 vocabulary or pronunciation acquisition, as reviewed in Section 2.2.1.2 "Quantitative Measurements of the Effects", did not follow the explicit-implicit dichotomy and separately measure learners' explicit and implicit knowledge. Instead, they generally assessed learners' acquisition of the L2 target structures in terms of perception and production. As mentioned in Section 2.3.3.2 "Language Influences Gesture: 'Language Architecture'", in the present study, as well as in the previous studies that followed the explicit-implicit dichotomy, explicit knowledge was operationalized as perception of the L2 grammatical target structures, and implicit knowledge was operationalized as production of the target structures. Therefore, the explicit-implicit dichotomy can fit in with the perception-production dichotomy. Accordingly, the results of previous studies and the present study are summarized[25] and compared, with the perception-production dichotomy as the framework. Table 5.9 below presents the summary.

[24] As mentioned in Chapter 3, explicit and implicit knowledge are not mutually exclusive (Ellis, 2023). Meanwhile, the two broad types need to be separately discussed, so "dichotomy" is used here.

[25] The results of previous studies are summarized from the detailed review in Section 2.2.1.2 "Quantitative Measurements of the Effects".

Table 5.9 The Effects of Pedagogical Gestures: Previous Studies and the Present Study

Type of L2 target structure	L2 Target structure	Type of gesture	Effect of gesture on perception of target structure	Effect of gesture on production of target structure	Study
Vocabulary	Mandarin vocabulary	Iconic	Gestures helped recognizing vocabulary	n/a	Huang et al. (2018)
	English vocabulary	Iconic	Observing and performing gestures enhanced understanding and memorizing vocabulary	Observing and performing gestures enhanced production of vocabulary	Tellier (2008)
	Vocabulary of an artificial language	Iconic	Observing and performing gestures facilitated understanding and memorizing vocabulary	Observing and performing gestures enhanced production of vocabulary	García-Gámez et al. (2021)
Pronunciation	Mandarin lexical tones	Iconic[26]	Gestures enhanced tone identification and meaning understanding	n/a	Morett & Chang (2015)

[26] In Morett & Chang (2015), the gestures that produced significant facilitating effects were termed as "pitch gestures" (i.e., "gestures conveying tone pitch contours" [Morett & Chang, 2015, p. 347]). Since "pitch gestures" depict the pronunciation contours, they can be classified into "iconics".

	Japanese segmentals	Metaphoric and beat[27]	Observing and performing gestures improved perception of segmentals	Observing and performing gestures did NOT significantly improve production of segmentals	Iizuka et al. (2020)
	Japanese vowel-length contrasts	Iconic[28]	Observing and performing gestures did NOT significantly improve perception of segmentals	Observing and performing gestures improved production of segmentals	Li et al. (2020)
Grammar	English locative prepositions	Iconic	Gestures did NOT significantly improve explicit knowledge	Both instruction only and instruction + gesture groups significantly outperformed the control group at the immediate posttest of oral production test (NO significant difference between the two experimental groups), but only instruction + gesture group maintained the development at delayed posttest	Nakatsukasa (2013, 2016)

[27] Iizuka et al. (2020) adopted handclapping as the pedagogical gesture. "Under McNeill's (1992) classification of gestures, handclapping may be considered both a metaphoric gesture and a beat gesture: It visually presents the underlying number of moras in the target word (metaphoric) but also expresses the rhythm of speech in Japanese (beat)" (Iizuka et al., 2020, p. 1060).

[28] In Li et al. (2020), the gestures that produced significant facilitating effects were termed as "durational hand gestures", which are "horizontal hand-sweep gestures encoding durational features" (Li et al., 2020, p. 1015). The duration of such a gesture illustrates the length of a vowel, i.e., "the longer the vowel, the longer the spatial movement" (Li et al., 2020, p. 1022). Therefore, like the "pitch gestures" in Morett & Chang (2015), the "durational hand gestures" also depict the pronunciation contours and can be classified into "iconics".

English past tense	Deictic	Gestures did NOT significantly improve explicit knowledge	Both experimental groups significantly improved from pretest to posttest (NO significant difference between the two experimental groups)	Nakatsukasa (2013, 2021)
English past tense	Deictic	Gestures did NOT significantly improve explicit knowledge	Gestures did NOT significantly improve implicit knowledge	The present study
English progressive aspect	Metaphoric	Gestures did NOT significantly improve explicit knowledge	Gestures did NOT significantly improve implicit knowledge	The present study

Note. In the columns for "Effect of gesture on perception of target structure" and "Effect of gesture on production of target structure", the parts describing the effects of gestures are underlined, and the non-significant effects are marked with grey background.
For Huang et al. (2018) and Morett & Chang (2015), in the cells of the column for "Effect of gesture on production of target structure", "n/a" means "not applicable" (i.e., the studies did not mention the effect of gesture on production of target structure).

From Table 5.9, it can be seen that for L2 target structures of vocabulary and pronunciation, the corresponding pedagogical gestures significantly facilitated perception of the target structures (Huang et al., 2018; Iizuka et al., 2020; Morett & Chang, 2015), or production of the target structures (Li et al., 2020), or both perception and production (García-Gámez et al., 2021; Tellier, 2008). By contrast, for L2 target structures of grammar, only the pedagogical gestures for locative prepositions showed a significant facilitating effect on production (i.e., maintained the improved oral production of the locative prepositions at delayed posttest) (Nakatsukasa, 2013, 2016), and none of the other pedagogical gestures (the other pedagogical gestures are for tense and aspect) showed any significant facilitating effect on perception or production (Nakatsukasa, 2013, 2021; the present study). To account for the differential effects, the results for Research Questions 1 and 2 need to be integrated. See Section 5.1.3 "Integrating the Findings for the Two Research Questions" below for the integration and discussion.

5.1.2 Research Question 2

Research Question 2 is about learners' perceptions of pedagogical gestures. To discover learners' perceptions, interviews were conducted. In previous studies, two of the major themes which emerged from the interview and survey data are learners' perceived functions of and attitudes to pedagogical gestures (as reviewed in Section 2.2.2 "Focus 2: Learners' Perceptions of Pedagogical Gestures"). As mentioned in Section 2.2.2.3 "Interview Questions in Previous Studies and the Present Study", following previous studies, the interview questions in the present study cover the two themes (see Section 3.3.2 "Semi-structured Interviews" for the specific interview questions and the design of the interview questions).

In the present study, the interview questions for the theme of "functions" touch upon both general pedagogical gestures (i.e., Question 9) and the specific pedagogical temporal gestures for teaching L2 English tense and aspect (i.e., Questions 4 and 5), and the interview questions for the theme of "attitudes" focus on the specific

pedagogical temporal gestures (i.e., Questions 6, 7, and 8).

Previous and present findings regarding learners' perceived functions of general pedagogical gestures are compared in Section 5.1.2.1, and the present findings regarding learners' perceived functions of and attitudes to the specific pedagogical temporal gestures are discussed in Section 5.1.2.2.

5.1.2.1 Learners' Perceived Functions of General Pedagogical Gestures: Previous Studies vs. the Present Study

Regarding learners' perceived functions of general pedagogical gestures, there are some common findings in previous studies and the present study, some findings which are only in previous studies, and some findings which are only in the present study. Table 5.10 present the findings. The findings of previous studies are extracted from the detailed review in Section 2.2.2 "Focus 2: Learners' Perceptions of Pedagogical Gestures", and the findings of the present study (i.e., codes of the interview data) are extracted from the tables in Section 3.6.2 "Analyses in Relation to Research Question 2" and Section 4.2 "Results for Research Question 2".

Table 5.10 Learners' Perceived Functions of General Pedagogical Gestures: Previous Studies vs. the Present Study

	Previous studies	**The present study**
Common findings	1. "Cognitive functions", including enhancing comprehension and facilitating processes of learning (Sime, 2006, 2008)	1. Code 9b.3 Facilitated understanding for Question 9 (extracted from Tables 3.7 and 4.14)
	2. "Emotional/affective functions" (i.e., emotional involvement of learners) (Sime, 2006, 2008), such as "positive influence on liveliness", "positive engagement", and "positive influence on…motivation in learning" (Kusanagi, 2015, p. 298)	2. Codes for Question 9: 9b.7 Enlivened class, 9b.4 Attracted attention, 9b.8 Engaged students, and 9b.6 Interesting (extracted from Tables 3.7 and 4.14)
Findings only in previous studies	1. The "cognitive function" of providing feedback (Sime, 2006, 2008)	
	2. "Organizational functions" (i.e., classroom organization) (Sime, 2006, 2008)	
	3. "Positive influence on…intimacy, rapport, trustworthiness…the learning environment" (Kusanagi, 2015, p. 298)	
Findings only in the present study		Codes for Question 9 (extracted from Tables 3.7 and 4.14): 9b.1 Facilitated memorizing 9b.2 Concretized abstract concepts 9b.5 Facilitated inferring 9b.9 More engaging and convenient than other means

Note. The key words of the findings are underlined.

Regarding the interview codes in the right column, see Table 3.7 for corresponding example responses from participants.

The common findings can, to some extent, represent universal learners' perceived functions of general pedagogical gestures, which are similar across different cultures: pedagogical gestures can generally facilitate understanding and learning, enliven class, attract learners' attention, engage learners, and motivate/interest them.

On the other hand, some findings in previous studies are absent in the present study, and some findings in the present study are absent in previous studies, perhaps because the circumstances of previous studies and the present study are different. Sime (2006, 2008) and Kusanagi (2015) studied naturalistic classroom interactions, and they found more types of functions (i.e., providing feedback, classroom organization, and positive influence on the relationship between the teacher and students). By contrast, the present study conducted experimental lessons and focused on teaching L2 English tense and aspect, which may have led the learners to think more about the cognitive functions (i.e., facilitating memorizing, concretizing abstract concepts, facilitating inferring, and being more engaging and convenient than other means). The new findings further specify the "cognitive functions" identified by Sime (2006, 2008).

5.1.2.2 Learners' Perceptions of Pedagogical Temporal Gestures

The section above (Section 5.1.2.1) discusses learners' perceived functions of general pedagogical gestures. This section discusses learners' perceptions (including perceived functions and attitudes) of the specific pedagogical temporal gestures. The learners' perceptions of the pedagogical temporal gestures (i.e., the qualitative findings for Research Question 2) are expected to explain or complement the effects of the pedagogical temporal gestures (i.e., the quantitative findings for Research Question 1).

Perceived Functions

Among the interview questions, Questions 4 and 5 are about the learners' perceived functions of the pedagogical temporal gestures. Table 5.11 below presents Questions 4 and 5, the corresponding codes, and the results (i.e., frequencies and percentages of the codes), which are extracted from Tables 4.13 and 4.14 in Section 4.2

"Results for Research Question 2".

Table 5.11 Learners' Perceived Functions of Pedagogical Temporal Gestures

Questions	Codes, and the frequencies and percentages
4a. Do you think the teacher's gestures are effective for helping you learn the target English tense and aspect?	4a.1 Effective (27, 90%) 4a.2 Somewhat effective (2, 6.7%) 4a.3 Not very effective (1, 3.3%)
4b. If yes, then how did the gestures help you learn the target English tense and aspect?	4b.1 Concretized the abstract time concepts (27, 90%)[29] 4b.2 Facilitated memorizing tense-aspect (7, 23.3%)[30] 4b.3 Facilitated understanding tense-aspect (5, 16.7%)[31]
5. If you can think of some other functions of the teacher's gestures, then what are the functions?	5.1 Generalization (8, 26.7%)[32] 5.2 Engaged students (3, 10%)[33] 5.3 More convenient than time axis (2, 6.7%)[34]

Note. Regarding the interview codes in the right column, see Table 3.7 for corresponding example responses from participants.

According to the results for Question 4a, the majority of the learners (i.e., 27 out of 30) considered the pedagogical temporal gestures as effective for learning L2 English tense and aspect. Meanwhile, two learners had some reservations, and one learner did not regard the gestures as very effective.

The two learners who had some reservations both acknowledged that the gestures spatialized the temporal concepts, but they also mentioned that they basically did not produce gestures, so the gestures could be "somewhat effective". The learner who did not regard the gestures as very effective said: "It's not very helpful to me, because I learned the two target structures quite clearly." I checked with the learner, and she confirmed that my verbal instruction had explained the target structures clearly, and the

[29] Code 4b.1 coincides with Code 9b.2 "Concretized abstract concepts" for Interview Question 9 in Table 5.10.
[30] Code 4b.2 coincides with Code 9b.1 "Facilitated memorizing" for Interview Question 9 in Table 5.10.
[31] Code 4b.3 coincides with Code 9b.3 "Facilitated understanding" for Interview Question 9 in Table 5.10.
[32] Code 5.1 is similar to Code 9b.5 "Facilitated inferring" for Interview Question 9 in Table 5.10.
[33] Code 5.2 coincides with Code 9b.8 "Engaged students" for Interview Question 9 in Table 5.10.
[34] Code 5.3 is similar to Code 9b.9 "More engaging and convenient than other means" for Interview Question 9 in Table 5.10.

gestures did not further facilitate her learning. In the three learners' comments, there does not seem to be any clue to explain the limited effects of the gestures on learning the two target structures, which does not meet the expectation that the interview findings can explain the experiment findings. On the other hand, the comments indicate that gestures sometimes can play a peripheral role.

When the learners who regarded the gestures as effective were further asked how the gestures helped the learning (Question 4b), they commented that the gestures concretized the abstract time concepts and facilitated understanding and memorizing tense-aspect. Like some of the responses to Question 9, the comments for Question 4b further specify the "cognitive functions" of pedagogical gestures (Sime, 2006, 2008)[35]. The comments also suggest that the pedagogical temporal gestures facilitated the learners' conceptualizations of the temporal concepts (i.e., past and progressiveness), which provides empirical evidence for the "Gesture-for-Conceptualization Hypothesis" by Kita et al. (2017)[36].

The present study aims to explore the effect of the gestures on learners' acquisition of tense-aspect. "Acquisition" is specified as explicit knowledge (or perception) and implicit knowledge (or production). Explicit knowledge is assessed though UGJT, and implicit knowledge is assessed thought EIT. In SLA, "acquisition" usually does not include "conceptualization", and there seems to be no authoritative test to assess a learner's conceptualization. In the present study, the facilitating effect of the gestures on the learners' conceptualizations was not assessed by a test, but reflected by the learners' interview responses. Therefore, the interviews not only discovered the learners' perceptions, but also reflected the effect of the pedagogical gestures on the learners'

[35] Interview Question 4b is about how the pedagogical temporal gestures helped with learning L2 English tense and aspect, and Interview Question 9 is about the learners' perceived functions of general pedagogical gestures used by previous teachers of other subjects (e.g., geography, maths, physics, and chemistry).
The similar codes for the two interview questions represent the universal functions of pedagogical gestures (e.g., concretizing abstract concepts, and facilitating understanding and memorizing) across different subjects.

[36] As mentioned in Section 2.3.2 "Gesture and Thought: 'Gesture-for-Conceptualization Hypothesis'", according to the hypothesis, a speaker's gestures influence a listener's thinking. Therefore, the teacher's pedagogical temporal gestures can help with the learners' conceptualizations of past and progressiveness.

conceptualizations of the target structures (in addition to the effects of the gestures on the learners' perception and production of the target structures, as measured by UGJT and EIT). In this sense, the interview findings complement the experiment findings in terms of the effects of pedagogical gestures, as expected.

On top of these, the learners mentioned some other functions of the pedagogical temporal gestures (Question 5), including generalization (i.e., applying the temporal gestures to other tense-aspect structures), being more convenient to use than time axis (i.e., using one's own body is more convenient than drawing a time axis), and engaging students. Like some of the comments for Questions 9 and 4b, "generalization" and "being more convenient to use than time axis" can also be classified into the "cognitive functions" of pedagogical gestures (Sime, 2006, 2008). Like some other responses to Question 9, "engaging students" is a type of the "emotional/affective functions" of pedagogical gestures (Sime, 2006, 2008).[37]

Attitudes

Among the interview questions, Questions 6, 7, and 8 are about the learners' attitudes to the pedagogical temporal gestures. Table 5.12 below presents the questions and results, which are extracted from Table 4.13 in Section 4.2 "Results for Research Question 2". The results show that the majority of the learners had positive attitudes towards the pedagogical temporal gestures, regarding the gestures as important and interesting. At the same time, there are a few learners who had some reservations. In general, the learners' attitudes are positive, and this can arise from their perceived effectiveness of the gestures on their conceptualizations of the target structures, as revealed by their responses to Interview Question 4b on how the gestures helped them learn.

[37] Interview Question 5 is about other functions of the pedagogical temporal gestures (apart from the functions mentioned for Interview Question 4b), and Interview Question 9 is about functions of general pedagogical gestures.
The codes for the two interview questions are similar, which suggests that the functions indicated by the codes are universal for different teaching targets.

Table 5.12 Learners' Attitudes to Pedagogical Temporal Gestures

Questions	**Codes, and the frequencies and percentages**
6. Do you think the teacher's gestures are important?	6.1 Important (25, 83.3%) 6.2 Somewhat important (5, 16.7%)
7. Do you think the teacher's gestures are interesting?	7.1 Interesting (27, 90%) 7.2 Not very interesting (3, 10%)
8. What is your attitude towards the teacher's gestures? Positive, negative, or neutral?	8.1 Positive (24, 80%) 8.2 Somewhat positive (1, 3.3%) 8.3 Neutral (5, 16.7%)

To sum up the discussion about the results for Research Question 2, as to learners' perceived functions of general pedagogical gestures, the present study corroborates and specifies some previous findings. As to learners' perceptions of the specific pedagogical temporal gestures for teaching L2 English tense and aspect, the participants of the present study overwhelmingly had positive attitudes to the gestures, and described how the gestures effectively helped them learn the target structures. From the findings for Research Question 2, pedagogical implications can be generated. Section 5.2.1.2 "Functions of Pedagogical Gestures" presents the pedagogical implications.

5.1.3 Integrating the Findings for the Two Research Questions

The topic of the present study is pedagogical gesture, and two research questions on pedagogical gesture are proposed. Results for Research Question 1 reveal the limited facilitating effects of the pedagogical gestures on the acquisition of the target structures, and results for Research Question 2 show the participating learners' generally positive perceptions of the pedagogical gestures.

The results for the two research questions may seem contradictory at first glance, but in fact they complement each other, like the two sides of the same coin. On the one hand, the participants' positive perceptions reflect the efficacy of the pedagogical gestures in improving the learners' conceptualizations of tense-aspect (Section 5.1.3.1). On the other hand, the limited effects reveal the inefficacy of the pedagogical gestures

in improving the learners' perception and production of tense-aspect (Section 5.1.3.2).

5.1.3.1 Efficacy in Improving Conceptualizations of Tense-Aspect

As mentioned in Section "Perceived Functions" above, the participants overwhelmingly thought that the pedagogical gestures effectively helped them with learning L2 English tense and aspect. As to how the gestures helped, they mentioned "concretized the abstract time concepts", "facilitated understanding tense-aspect", and "facilitated memorizing tense-aspect". These comments indicate that from the learners' perspectives, the gestures did help with their conceptualizations of tense-aspect (i.e., the gestures helped them understand the abstract temporal concepts in a concrete way). By contrast, the gestures did not significantly facilitate the learners' perception and production of tense-aspect, as shown by the results for Research Question 1.

The pedagogical gestures did produce facilitating effects, but the effects were on the learners' conceptualizations of tense-aspect, rather than on their perception and production of tense-aspect. The perception and production were measured by the acquisition tests (i.e., UGJT and EIT). By contrast, the conceptualizations were not measured and reflected by the tests, but the benefit may not be negligible. Based on this, two questions can be raised.

Question 1. Should "conceptualization" be included as a target of SLA, like explicit and implicit knowledge[38]?

Question 2. If yes, then how to design a valid test to assess learners' "conceptualization"?

The answer to Question 1 can be "yes". Conceptualization can be treated as an important target of SLA, like explicit and implicit knowledge. Conceptualization is crucial for understanding the concepts of L2 target structures, especially when an L2 target structure differs a lot from its L1 counterpart. From learners' perspectives, the interview responses in the present study demonstrate that conceptualization is important

[38] As mentioned in Section 2.3.3.2 "Gesture and Language: 'Language Architecture'" and Section 5.1.1.2 "The Effects of Pedagogical Gestures: Previous Studies vs. the Present Study", explicit-implicit knowledge corresponds to perception-production.

for L2 learning.

Regarding Question 2, a test that can assess learners' "conceptualization" is a narrative test that elicits both speech and gesture. "Conceptualization" belongs to thought. As mentioned in Section 2.3.1 "Gesture, Thought, and Speech: 'Growth Point'", thought is expressed both linguistically through speech and imagistically through gesture. As mentioned in Section 2.3.3 "Gesture, Speech, and Language", gesture complements speech, and some information can only be conveyed through gesture. When it comes to SLA and gesture, Stam (2006) has shown that L2 learners' gestures reveal their L1 thinking for speaking patterns, even though their speech shows high L2 proficiency. When it comes to conceptualization of temporal concepts, Núñez and Sweetser (2006) suggests that conceptualization of time may only be revealed by gesture, and Parrill, Bergen, and Lichtenstein (2013) and R. Wang (2019) have managed to use speaking tasks to elicit gestures which reveal the speakers' conceptualizations of temporal concepts. In the present study, the pedagogical gestures' facilitating effect on the learners' conceptualizations of tense-aspect is reflected by the learners' interview responses. The present study did not include a narrative test to elicit the learners' gestures and confirm or disconfirm the learners' improved conceptualizations of tense-aspect through the elicited gestures. It is worth conducting such a test in the future.

5.1.3.2 Inefficacy in Improving Perception and Production of Tense-Aspect

As reviewed in Section 5.1.1.2 "The Effects of Pedagogical Gestures: Previous Studies vs. the Present Study", pedagogical gestures demonstrate efficacy in facilitating learners' perception and/or production of vocabulary, pronunciation, and locative prepositions. By contrast, in the present study, results for Research Question 1 show the inefficacy of the pedagogical temporal gestures in improving the learners' perception and production of tense and aspect.

To account for the differential effects, I propose that the effectiveness of a pedagogical gesture can to some extent depend on the target structure. If a target structure is concrete in terms of meaning (e.g., vocabulary and locative propositions)

or form (e.g., pronunciation), then the meaning or form can be directly conveyed by the gesture, and the acquisition[39] of the target structure can be significantly enhanced. By contrast, if a target structure is abstract in terms of meaning (e.g., tense and aspect), then the meaning cannot be directly conveyed by the gesture, and the acquisition of the target structure cannot be significantly enhanced.

Kelly's proposition (2017), as reviewed in Section 2.3.3.3 "The Boundaries of Gesture-Speech Integration during Language Comprehension" (i.e., some language components [e.g., concrete semantic, suprasegmental phonetic, and pragmatic] are highly integrated with gesture, whereas some other language components [e.g., abstract semantic, segmental phonetic, and syntactic] are less so), can help explain some of the empirical findings about the effects of pedagogical gestures on language acquisition[40].

Concrete Semantic Target Structures (Vocabulary and Locative Prepositions)

The target structures of vocabulary and locative propositions, as explored in some previous studies (García-Gámez et al., 2021; Huang et al., 2018; Nakatsukasa, 2013, 2016; Tellier, 2008), fall into "concrete semantic" language components (i.e., the target structures have concrete meanings). As summarized in Table 5.9 "The Effects of Pedagogical Gestures: Previous Studies and the Present Study", the corresponding pedagogical gestures for these target structures are iconic gestures, which pictorially represent the concrete meanings.

When the participating learners in these studies received treatment, the pedagogical gestures presented the concrete meanings of the target structures, and meanwhile, the verbal instruction presented the forms of the target structures (e.g., spelling and pronunciation of the vocabulary and locative prepositions). Thus, the

[39] In Section 5.1.3.1 "Efficacy in Improving Conceptualizations of Tense-Aspect", I argue that "conceptualization" should be treated as a target of L2 acquisition. This is only my argument. Following the convention, in the present study, "acquisition" includes perception and production (or explicit knowledge and implicit knowledge) and does not include "conceptualization".

[40] Kelly's proposition (2017) focuses on language comprehension, and the empirical studies focus on language acquisition. Language comprehension plays an important role in language acquisition, and the relationship between gesture and speech during language comprehension (i.e., Kelly's proposition) can also apply to language acquisition.

participating learners' form-meaning mapping was enhanced, and their acquisition of the target structures was improved.

Figure 5.1 below (based on Figure 2.16 "Synthesis: Theoretical framework and the present study") illustrates the process. As analyzed in Section 2.3.5 "Synthesis: Theoretical Framework and the Present Study" and illustrated in Figures 2.16 and 5.1, there can be two approaches for Step ③. One approach is from the teacher's pedagogical gestures directly to the learners' perception and production of the target structures. The other approach originates from the teacher's pedagogical gestures, transits through the concepts of the target structures in the learners' thoughts, and finally reaches the learners' perception and production of the target structures. Given the significant facilitating effects, as shown in the previous empirical studies, the lines for Step ③ in Figure 5.1 are presented as solid lines.

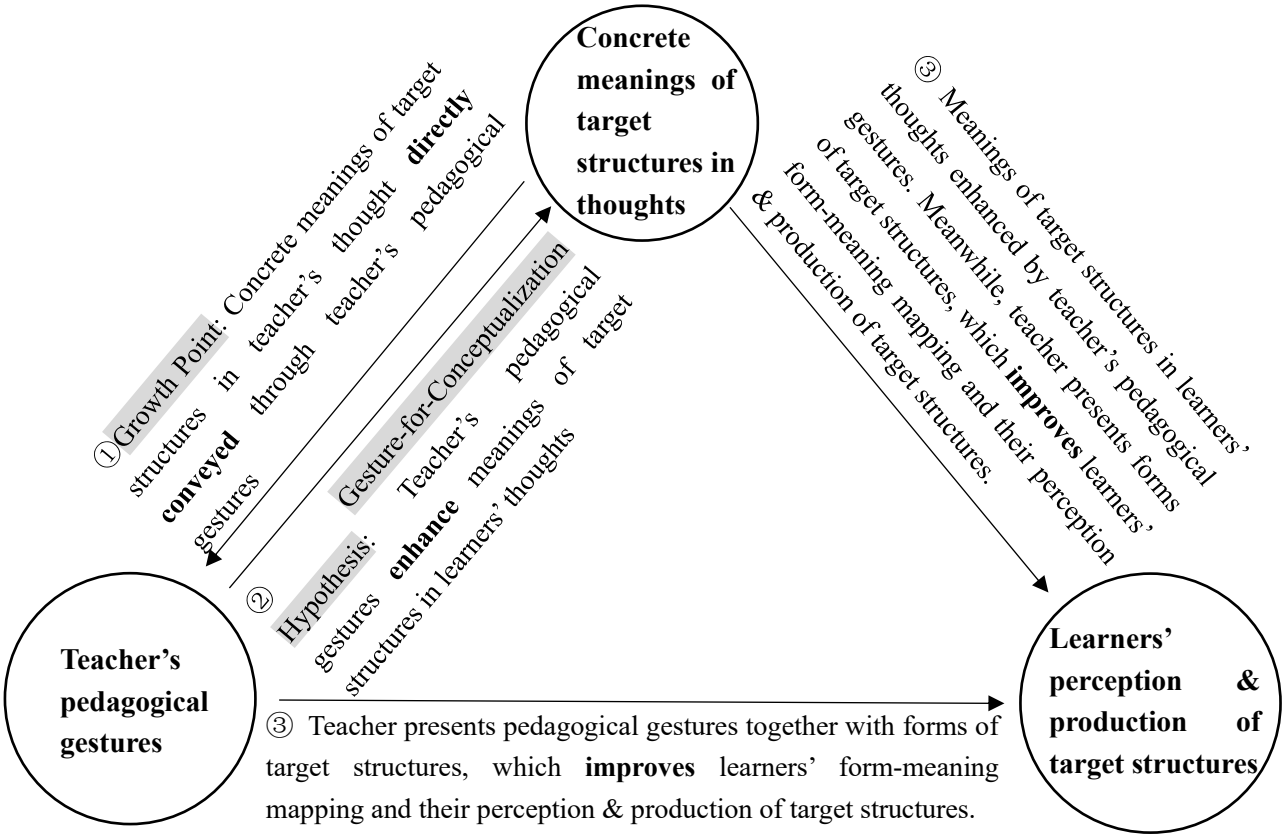


Figure 5.1 Pedagogical gestures can facilitate the acquisition of concrete semantic target structures

In the case of concrete semantic target structures (e.g., vocabulary and locative prepositions), according to Kelly (2017), they are closely integrated with gestures. Given the integration, the two approaches for Step ③ can be regarded as essentially the same approach. Presenting the gesture and the language form can enhance form-meaning mapping. The significant facilitating effects of pedagogical gestures on learning concrete semantic target structures, as discovered in previous studies, provide empirical supporting evidence for Kelly's proposition (2017) in language acquisition.

Abstract Semantic Target Structures (Tense and Aspect)

On the other hand, the target structures of tense and aspect, as investigated in the present study, belong to "abstract semantic" language components (i.e., the target structures have abstract meanings). The deictic gesture concretizes and spatializes the abstract meaning of the past tense, and the metaphoric gesture concretizes and spatializes the abstract meaning of the progressive aspect.

According to the participating learners' interview responses, the process of concretization and spatialization enhanced their conceptualization of the abstract temporal concepts (i.e., past and progressiveness), which confirms the "Gesture-for-Conceptualization Hypothesis" by Kita et al. (2017) (see Figures 2.5 and 2.6 for illustrations). By contrast, according to the participating learners' test results, the gestures did not significantly improve the learners' perception and production of *-ed* and *-ing*. The abstract temporal concepts are the meanings of the target structures, and *-ed* and *-ing* are the forms of the target structures. Accordingly, the gestures only strengthened the meanings in the learners' mind, and did not improve the learners' perception and production of the forms.

I argue that this is because the target structures (i.e., tense and aspect) have abstract meanings, and the gestures' concretization and spatialization can merely enhance the learners' conceptualizations of the meanings, and cannot further enhance the learners' form-meaning mapping. Figure 5.2 below (based on Figure 2.16 "Synthesis: Theoretical Framework and the Present study") illustrates the process. Given the

limited facilitating effects, as shown in the present study, the lines for Step ③ are presented as dashed lines.

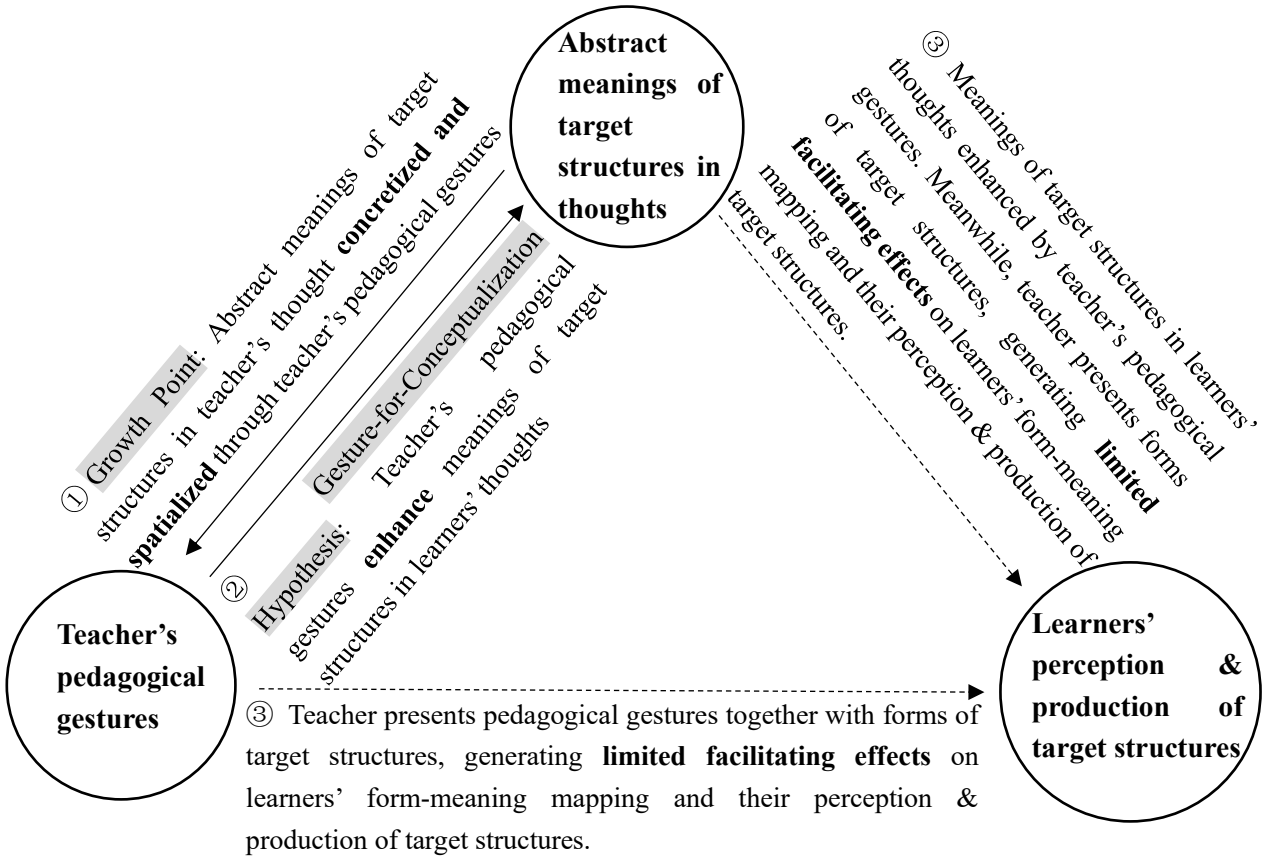


Figure 5.2 Pedagogical gestures cannot facilitate the acquisition of abstract semantic target structures

According to Kelly (2017), there are boundaries between gestures and abstract meanings. Therefore, the two approaches for Step ③ are two different approaches. The gestures can only enhance conceptualizations of abstract concepts, and cannot further enhance form-meaning mapping.

In the cases of vocabulary and locative prepositions, as discussed above, these target structures have concrete meanings in the first place, so the corresponding iconic gestures directly convey the concrete meanings without the process of concretization and spatialization, and the form-meaning mapping can be improved.

Referring back to Kelly (2017), he proposed that during language comprehension, concrete semantic language is closely connected to gesture, while abstract semantic

language is independent of gesture. The aforementioned empirical studies of the effects of pedagogical gestures demonstrate that Kelly's proposition also applies to language acquisition: the effects of gestures on the acquisition of concrete semantic target structures are significant, whereas the effects of gestures on the acquisition of abstract semantic target structures are limited. The pedagogical gestures can directly convey the concrete meanings, so there is no boundary between the gestures and the concrete semantic target structures, and the gestures can significantly improve the acquisition of the concrete semantic target structures. By contrast, the pedagogical gestures cannot directly convey the abstract meanings, but need to concretize and spatialize the abstract meanings (i.e., there is a process of concretization and spatialization), so there is a boundary between the gestures and the abstract semantic target structures, and the gestures cannot significantly improve the acquisition of the abstract semantic target structures.

Phonetic Target Structure (Pronunciation)

Apart from the "concrete semantic" target structures (e.g., vocabulary and locative prepositions) and "abstract semantic" target structures (e.g., tense and aspect) discussed above, empirical studies of the effects of pedagogical gestures cover "phonetic" target structures (e.g., pronunciation). As mentioned above, Kelly (2017) argued that suprasegmentals are deeply connected to gestures, whereas segmentals are less so. By contrast, empirical studies found significant facilitating effects of pedagogical gestures on the acquisition of segmentals (Iizuka et al., 2020; Li et al., 2020; Morett & Chang, 2015). Kelly's argument and the empirical findings seem to be contradictory, but they in fact focused on different types of gestures which produced corresponding differential effects.

Kelly (2017) mainly focused on beat gestures whose main function was to highlight, whereas the empirical studies adopted gestures (including iconics, metaphorics, and beats) which depicted the pronunciation contours. The pronunciation contours are the targets of the acquisition of pronunciation, and they are concrete

language forms which can be visually presented by gestures. The beat gestures in Kelly (2017) only highlighted and did not visually present the pronunciation contours of segmentals, so the beat gestures and the segmentals are not integrated. The gestures in the empirical studies, on the other hand, directly presented the pronunciation contours of segmentals, so these gestures and the segmentals are integrated, and the gestures facilitated the acquisition of the segmentals. Therefore, the target structure of pronunciation is concrete in terms of form (i.e., the pronunciation contours can be directly presented visually), and gestures that directly present the pronunciation contours can significantly facilitate the acquisition of pronunciation. Figure 5.3 below illustrates the process.

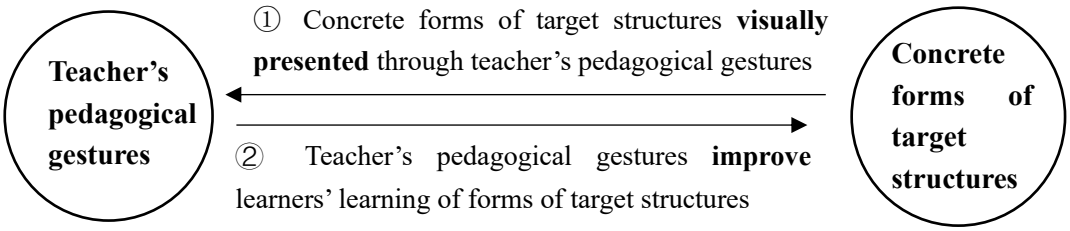


Figure 5.3 Pedagogical gestures can facilitate the acquisition of phonetic target structures

To conclude this section (Section 5.1.3.2 "Inefficacy in Improving Perception and Production of Tense-Aspect"), based on the empirical findings about the effects of pedagogical gestures on the acquisition of different target structures (i.e., vocabulary, locative prepositions, tense-aspect, and pronunciation) as well as Kelly's proposition (2017) about the boundaries of gesture-speech integration during language comprehension, it can be argued that the target structure plays a role in the effect of the corresponding pedagogical gesture. If the target structure has concrete meaning (e.g., vocabulary and locative prepositions) or concrete form (e.g., pronunciation), then the gesture can directly convey the concrete meaning or form and improve learners' acquisition. If the target structure has abstract meaning (e.g., tense-aspect), then the gesture needs to concretize and spatialize the meaning. In this case, only conceptualization of the target structure can be enhanced, and learners' form-meaning mapping of the target structure cannot be enhanced.

5.2 Implications

Based on Section 5.1 "Discussion" above, this section proposes implications from the present study, including pedagogical implications (Section 5.2.1) and theoretical implications (Section 5.2.2).

5.2.1 Pedagogical Implications

5.2.1.1 Learners' Weaker Areas: The Implicit L2 Knowledge and the Progressive Aspect

Section 5.1.1.1 "A Further Examination of the Limited Effects of the Pedagogical Gestures" above confirms the limited facilitating effects of the pedagogical gestures reported in Chapter 4. Apart from the limited facilitating effects, which directly address Research Question 1, some additional discoveries have been made from the results for Research Question 1, as discussed in Section 5.1.1.1. The additional discoveries are not directly relevant to Research Question 1, but they can generate pedagogical implications.

As discussed in Section "UGJT (Explicit Knowledge) and EIT (Implicit Knowledge)" above, the learners' scores of the simple past UGJT and the past progressive UGJT were close to the UGJT full score, whereas their scores of the simple past EIT and the past progressive EIT were less close to the EIT full score. This shows that for both L2 target structures, the learners' explicit knowledge was better than their implicit knowledge. Previous studies also show this pattern (e.g., Nakatsukasa, 2013, 2016, 2021; Qu, 2019). Accordingly, for L2 target structures in general, learners' explicit knowledge can be better than their implicit knowledge. Thus, learners' implicit knowledge of L2 may need more improvement.

Moreover, as discussed in Section "The Deictic Gesture and the Simple Past, vs. the Metaphoric Gesture and the Past Progressive" above, the pretest scores indicate that the learners' prior acquisition of the simple past was better than their prior acquisition of the past progressive. It can be inferred that L2 learners of English generally may also

be better at the past tense than at the progressive aspect. Therefore, teachers may consider devoting more efforts to helping learners learn the progressive aspect.

5.2.1.2 Functions of Pedagogical Gestures

From the discussion about the results for Research Question 2 in Section 5.1.2, pedagogical implications can be generated, regarding the functions of pedagogical gestures. Apart from confirming some functions of pedagogical gestures identified from previous studies, the present study discovers some other functions from the participating learners' perceptions, including facilitating memorizing, concretizing abstract concepts, facilitating inferring and generalizing, and being more engaging and convenient than other means. The newly discovered functions further specify the "cognitive functions" identified by Sime (2006, 2008).

These gesture functions may be particularly helpful for teaching and learning abstract concepts such as tense and aspect. Accordingly, when teachers teach abstract concepts, they may consider using some gestures to concretize the abstract concepts. The gestures can facilitate learners' understanding and memorizing the abstract concepts as well as their inferring and generalizing. Moreover, the gestures, by deploying the body, can engage the learners conveniently.

5.2.1.3 The Acquisition of Which Target Structures Can(not) be Significantly Facilitated by Pedagogical Gestures

As discussed in Section 5.1.1.2 "The Effects of Pedagogical Gestures: Previous Studies vs. the Present Study" and Section 5.1.3 "Integrating the Findings for the Two Research Questions", pedagogical gestures can significantly improve learners' acquisition of target structures with concrete meanings (e.g., vocabulary and locative prepositions) or concrete forms (e.g., pronunciation), but cannot significantly improve learners' acquisition of target structures with abstract meanings (e.g., tense and aspect).

Despite the limited effects, pedagogical gestures can still facilitate learning target structures with abstract meanings, in that the gestures can concretize and spatialize the

abstract concepts, thus enhancing learners' conceptualizations of the concepts. In the present study, the facilitating effect on conceptualization of tense and aspect has been well received by the participating learners. Therefore, it is still desirable for teachers to adopt pedagogical gestures for teaching abstract target structures.

5.2.2 Theoretical Implication

As mentioned in Section 2.3 "Theoretical Framework", the present study involves the relationships among gesture, thought, and SLA. The findings provide empirical evidence for the theoretical propositions regarding the relationships among the triad.

With regard to the relationship between gesture and thought, findings for Research Question 2 (the learners' perceptions of the pedagogical gestures) show that the gestures enhanced the learners' conceptualizations of tense and aspect in their thoughts. This corroborates an argument of "Gesture-for-Conceptualization-Hypothesis" (Kita et al., 2017) that gestures influence listeners' thinking. This also represents gestures' role as "a medium of SLA" (Gullberg, 2006, 2014; Gullberg et al., 2008).

As to the relationship between gesture and SLA, findings for Research Question 1 suggest that the pedagogical gestures had limited facilitating effects on the learners' acquisition of L2 English tense and aspect. Reviewing previous empirical studies of the effects of gestures on SLA, it can be seen that the effect of a pedagogical gesture can to some degree depend on the L2 target structure. If the L2 target structure has concrete meaning (e.g., vocabulary and locative prepositions) or concrete form (e.g., pronunciation), then the facilitating effect of the gesture can be significant. If the L2 target structure has abstract meaning (e.g., tense and aspect), then the facilitating effect of the gesture can be non-significant. The findings for Research Question 1 in the present study echo with the proposition by Kelly (2017) regarding the boundaries of gesture-speech integration during language comprehension (i.e., concrete semantic language components are deeply integrated with gesture, and abstract semantic language components are independent of gesture).

As for the relationship between thought and SLA, integrating the findings of

Research Questions 1 and 2, it shows that the conceptualizations of the past tense and the progressive aspect, which were enhanced by the pedagogical gestures, did not significantly improve the perception and production of *-ed* and *-ing*. Thus, the meanings in the learners' thoughts did not improve the learners' acquisition of the forms of the target structures. The gestures embody the meanings in thoughts, so gesture and thought are closely connected. On the other hand, both gesture and thought are to some extent disconnected to language forms. To improve the acquisition of language forms, form-meaning mapping should be enhanced. Thinking-for-speaking hypothesis (Slobin, 1987, 1991) and Whorf's linguistic relativity hypothesis (Whorf, 1956) highlight the influence of language on thought. "Growth Point" (McNeill, 1992) proposes that thought is expressed linguistically through language. There does not seem to be a theoretical proposition that specifies the influence of thought on language. The empirical findings of the present study provide an example of the disconnected relationship between thought and language forms.

5.3 Conclusion

To conclude the present study, it adopts a mixed methods design (an explanatory sequential design), which consists of a quantitative true experiment and qualitative follow-up interviews. The quantitative true experiment aims to address Research Question 1 (the effects of the pedagogical temporal gestures on the learners' acquisition of L2 English tense and aspect), and the results show that the effects are limited. The qualitative interviews aim to address Research Question 2 (the learners' perceptions of the pedagogical gestures), and the results reflect the learners' generally positive attitudes towards the gestures and their perceived functions of the gestures (including enhancing conceptualizations of tense and aspect). The findings for the two research questions represent the differential effects of the gestures on learning different components of the target structures (i.e., inefficacy in improving perception and production of the language forms, and efficacy in enhancing conceptualization).

The findings of the present study fill the research gaps (i.e., a lack of quantitative

measurements of the effects of pedagogical temporal gestures on the acquisition of L2 tense and aspect, and a lack of corresponding qualitative investigation of learners' perceptions of the pedagogical temporal gestures).

Moreover, the present study generates pedagogical and theoretical implications. Pedagogical implications include: the implicit L2 knowledge and the progressive aspect can be weak areas to L2 learners of English; functions of gestures for teaching abstract targets include facilitating memorizing, concretizing abstract concepts, facilitating inferring and generalizing, and being more engaging and convenient than other means; gestures can significantly improve the acquisition of target structures with concrete meanings or forms, and can also improve conceptualization of abstract concepts. Theoretical implications include: the findings provide empirical evidences for the theoretical propositions regarding the relationships among gesture, thought, and SLA (including "Gesture-for-Conceptualization Hypothesis" [Kita et al., 2017], "gesture as a medium of SLA" [Gullberg, 2006, 2014; Gullberg et al., 2008], and "the boundaries of gesture-speech integration during language comprehension" [Kelly, 2017]), and the findings also provide an example for the disconnected relationship between thought and language forms.

5.4 Limitations and Future Directions

Findings for Research Question 2 (i.e., the learners' perceptions of the pedagogical gestures) reflect that in the learners' opinions, the gestures improved their conceptualizations of tense and aspect. As mentioned in Section 5.1.3.1 "Efficacy in Improving Conceptualizations of Tense-Aspect", a narrative test can elicit gestures through which the learners' conceptualizations of tense and aspect can be examined. It would be desirable to carry out a narrative test to confirm or disconfirm the learners' improved conceptualizations.

Moreover, a function of the pedagogical gestures, as mentioned by some learners in the interviews, is "facilitating memorizing tense-aspect". In the present study, there were two weeks between the immediate posttest and the delayed posttest, which may

not be long enough to show the effect of maintaining memory. Therefore, future studies may adopt a longer delaying period (e.g., one month) to examine the long-term effect.

5.5 Summary of Chapter 5

Following the report of results in Chapter 4, this chapter first discusses and integrates the results for the two research questions. Then, based on the discussion and integration, it generates pedagogical and theoretical implications. Next, it concludes the present study by summarizing the methods, findings, and implications. Lastly, it points out the limitations and proposes the corresponding suggestions for future research.

Appendices

Appendix A: The Untimed Grammaticality Judgment Test

Instructions:

1. Please judge whether the following sentences are grammatically correct or not. If correct, please tick " √ "; if incorrect, please tick "×".

2. If you judge a sentence as incorrect, then please correct the error.

Version 1

10 sentences targeting the simple past:

1. Ten years ago, they study in Sydney.

2. Bobby paints a picture ten minutes ago.

3. Last week, my mother plants tomatoes.

4. The film start an hour ago.

5. Yesterday Mike wait for me in the shop.

6. The trip end last Tuesday.

7. Last month John visited China.

8. Joe needed much help two months ago.

9. The parents shouted at the kid last night.

10. Last winter Sam wanted to travel.

10 sentences targeting the past progressive:

1. Just now the glass fell, but the boy caught it.

2. While I was watching TV, my mother came.

3. Last night a train reached Hong Kong, but the police stopped it.

4. Just now the door closed, but the boy stopped it.

5. Last Saturday Nancy was cleaning her bedroom, and then it was clean.

6. This morning I brushed my teeth. After that, I had breakfast.

7. While I cooked dinner, the door opened.

8. While a boy was climbing the hill, he slipped.

9. The children were singing when their mother was walking into the room.

10. I was listening to the radio when my friend called me.

Version 2

10 sentences targeting the simple past:

1. Tina study in UK three years ago.

2. Tim paint a picture of his mother last month.

3. My friend planted potatoes last week.

4. Yesterday morning the lesson started at 8 am.

5. Last Monday Helen waited for a train.

6. Two hours ago my game ended.

7. Tom visit his grandparents an hour ago.

8. Three months ago the country needs money.

9. Nick shouts to his classmate after school two days ago.

10. Last autumn the family want to go to Beijing.

10 sentences targeting the past progressive:

1. Just now the vase was falling, but I caught it.

2. While the boy watched a game, his father came.

3. Yesterday morning a train was reaching New York, but the police stopped it.

4. Just now the window closed, but I stopped it.

5. Last night I cleaned the kitchen, and then it was tidy.

6. This morning Lucy was brushing her shoes. After that, she went out.

7. While I cooked breakfast, the door opened.

8. My grandmother slipped while she climbed the mountain.

9. I was singing when my mother walked into my room.

10. Tony was listening to the music when his mother was calling him.

Version 3

10 sentences targeting the simple past:

1. Paul study in US six years ago.
2. Last week Jack paint some pictures of his garden.
3. Last month Peter plant vegetables.
4. Eddie start playing ten minutes ago.
5. An hour ago Alice waits for a plane.
6. The film ends at 10 pm yesterday.
7. Three months ago I visited my teacher.
8. The hospital needed medicine last year.
9. My father shouted at me last Thursday.
10. Yesterday afternoon the students wanted to play.

10 sentences targeting the past progressive:

1. Just now the plate fell, but the girl caught it.
2. While Nick was watching a film, Rose came.
3. Yesterday a train reached London, but the police stopped it.
4. Just now the cupboard closed, but the girl stopped it.
5. Last Sunday Roy cleaned the bathroom, and then it was clean.
6. This morning Billy was brushing his hair. After that, he went out.
7. While I was cooking lunch, the door opened.
8. While a girl climbed the hill, she slipped.
9. Ken was singing when Anna was walking into his room.
10. The girl was listening to the song when her teacher called her.

Appendix B: The Elicited Imitation Test

Instructions:

1. Please listen to the sentences one by one.

2. After you listen to a sentence, please judge whether the statement applies to you or not and indicate your judgment on the computer.

3. After your judgment, please orally repeat the sentence in correct English.

Version 1

10 sentences targeting the simple past:

1. I study English last summer.

2. Yesterday my father paints a picture.

3. My classmates plant trees last month.

4. Last night a movie started at 8 pm.

5. My friend waited for me in the park last Saturday.

6. My exam ends last week.

7. I visit New York three years ago.

8. Last winter my family need food.

9. Yesterday morning my mother shouted at me.

10. Last year I wanted a toy as my birthday present.

10 sentences targeting the past progressive:

1. Just now a vase was falling, but my mother caught it.

2. While my sister watched a movie, her friend came.

3. Last night a train reached Nantong, but the police stopped it.

4. Just now the window was closing, but my mother stopped it.

5. Yesterday I was cleaning my room, and then it was tidy.

6. Last week I was brushing the floor. After that, it was clean.

7. While I was cooking breakfast, the door opened.

8. While I climbed the mountain, I slipped.

9. The students were singing when the teacher walked into the classroom.

10. I was listening to the story when my friend was calling me.

Version 2

10 sentences targeting the simple past:

1. Last year my mother studied English.

2. I painted a dog an hour ago.

3. Last week my grandparents plant some flowers.

4. A game start at 10 o'clock last night.

5. Last Friday my classmates wait for me after school.

6. My class ended at noon yesterday.

7. Last weekend I visited my friends.

8. Some countries need medicine last month.

9. Yesterday afternoon our teacher shouts at us.

10. My father wants cake for his breakfast yesterday morning.

10 sentences targeting the past progressive:

1. Just now a plate fell, but my father caught it.

2. While I was watching TV, my teacher came.

3. Yesterday a train reached Shanghai, but the police stopped it.

4. Just now the cupboard closed, but my father stopped it.

5. Last night my mother was cleaning the living room, and then it was clean.

6. This morning my father brushed his teeth. After that, he had breakfast.

7. While I was cooking lunch, the door opened.

8. My grandfather slipped while he climbed the hill.

9. The kids were singing when their father was walking into the room.

10. My sister was listening to the teacher when my father called her.

Version 3

10 sentences targeting the simple past:

1. My grandparents study English last winter.

2. Last week my friends paint some pictures.

3. My parents planted a tree last year.

4. Yesterday morning my breakfast starts at 6 am.

5. I waited for a bus after school last Friday.

6. Last night my friend’s birthday party ends at 9pm.

7. My family visit Canada two years ago.

8. Last spring my school needed money.

9. My classmate shout to me after school yesterday.

10. Last month my grandfather wanted a book as a present.

10 sentences targeting the past progressive:

1. Just now a glass was falling, but my friend caught it.

2. While my brother watched a game, his classmate came.

3. Last night a train reached Beijing, but the police stopped it.

4. Just now the door was closing, but my friend stopped it.

5. Yesterday my classmates were cleaning the classroom, and then it was tidy.

6. This morning my mother brushed her hair. After that, she went out.

7. While I cooked dinner, the door opened.

8. While I was climbing the stairs, I slipped.

9. The daughter was singing when the mother was walking into the room.

10. My brother was listening to the song when his friend was calling him.

Appendix C: The Semi-structured Interview Questions

1. What is your deepest impression of the treatment lessons?

2. What did you learn from the treatment lessons?

3. What gestures did you learn from the treatment lessons?

4. Do you think the teacher's gestures are effective for helping you learn the target English tense and aspect? If yes, then how did the gestures help you learn the target English tense and aspect?

5. If you can think of some other functions of the teacher's gestures, then what are the functions?

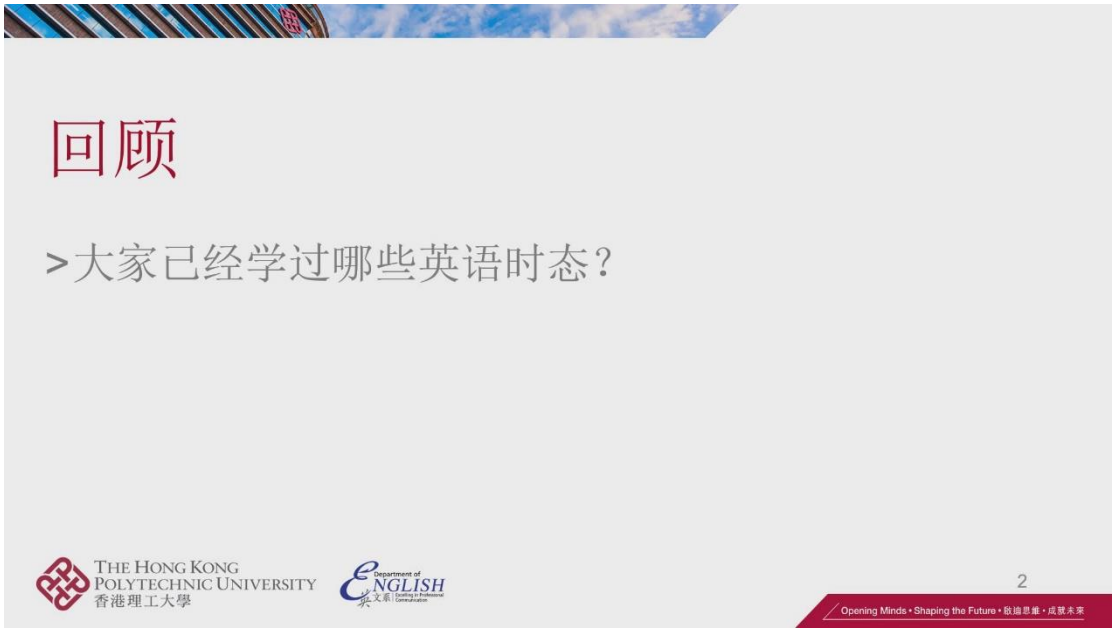
6. Do you think the teacher's gestures are important?

7. Do you think the teacher's gestures are interesting?

8. What is your attitude towards the teacher's gestures? Positive, negative, or neutral?

9. In your previous learning experiences, how frequently did your teachers use gestures during class? If you can recall any gestures teachers used during class, then could you please describe how the gestures were used?

Appendix D: The PPT Slides of the Treatment Lessons for the Instruction + Gesture Group



学习目标

>1.建立英语“时体系统”

>2.掌握2个英语时体

- 一般过去
- 过去进行

纲要

>一、“时体”概念

>二、“时体”形式

>三、“时体”用法

一、“时体”概念

> “时”：谈论的事，在时间上的定位：过去、现在、或将来。

>讲故事

>英语的3个“时”：过去时、现在时、将来时

>时间-空间

- 我们自己的身体所处位置：现在时
- **身体左侧：过去时**
- 身体右侧：将来时

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> “体”：谈论的事本身的状态，如：

- “**一般**现在”“现在**进行**”

>英语的4个“体”：**一般体、进行体、完成体、完成进行体**

- **一般体**：亦“零体”，谈论事情，只谈此事在时间上的定位，不谈此事本身状态。如：一般现在、**一般过去**
- **进行体**：描述某事正在进行、持续、反复、习惯。如：现在进行、**过去进行**
- **完成体**：描述某事已完成。如：现在完成、过去完成
- **完成进行体**：进行体+完成体

>时间-空间

- **进行体：常用手，身体正前方，食指循环旋转**

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>3时：过去、现在、将来
- 手势

>4体：一般、进行、完成、完成进行
- 手势

>英语“时体系统”：
- 3时*4体=12个“时体组合”

4体 \ 3时	过去时	现在时	将来时
一般体	一般过去	一般现在	一般将来
进行体	过去进行	现在进行	将来进行
完成体	过去完成	现在完成	将来完成
完成进行体	过去完成进行	现在完成进行	将来完成进行

>一般过去：手势

- 例句：Tim **painted** a picture of his mother last month.
- My friend **planted** some potatoes last week.

>过去进行：手势

- 例句：Just now the vase **was falling**, but I caught it.
- While the boy **was watching** a game, his father **came**.

二、“时体”形式

>过去时形式：

- 规则动词：-ed
- 不规则动词
- 手势

>填空练习：

- Yesterday morning the lesson **started** (start) at 8 am.
- Last Monday Helen **waited** (wait) for a train to London.
- Tina **studied** (study) in UK three years ago.

>进行体形式：

- be + V-ing
- 现在进行：
- am/is/are + V-ing
- 过去进行：
- was/were + V-ing
- 手势

>填空练习：

- Yesterday morning a train **was reaching** (reach) New York, but the police stopped it.
- Just now the window **was closing** (close), but I stopped it.
- While I **was cooking** (cook) breakfast, the door **opened**.
- My grandmother **slipped** over while she **was climbing** (climb) the mountain.

三、“时体”用法

>目标：一般过去&过去进行，手势

>时态选择，可依据时间状语

- 一般过去的时间状语：
  - 10 minutes ago, an hour ago,
  - yesterday, yesterday morning, yesterday afternoon, last night,
  - last week, last Monday,
  - last month, last year, last summer, 3 years ago

>翻译练习：

- 我的课昨天中午(at noon yesterday)结束(end)了。
- My class **ended** at noon yesterday.
- 上周末(last weekend)我拜访(visit)了我的朋友们。
- Last weekend I **visited** my friends.
- 上个月(last month)一些国家需要(need)更多的医生。
- Some countries **needed** more doctors last month.
- 昨天下午(yesterday afternoon)我们的老师对我们大喊(shout)。
- Yesterday afternoon our teacher **shouted** at us.
- 昨天(yesterday)我爸爸想要(want)蛋糕作为早餐。
- My father **wanted** cake for his breakfast yesterday.

>一般过去vs.过去进行

- 时间状语相似，均为表示过去的时间状语
- 2个意思区别

- 意思区别1：
  - **一般过去**：过去**已经完成**的动作（手势）
  - **过去进行**：在过去的某个时间点，或者时间段，**未完成、正在做、进行中、持续**的动作（手势）。

> 比较：

- I read a book yesterday. （昨天已读完）
- I was reading a book yesterday.（昨天未读完）
- They built a house last winter.
- （去年冬天的时候，已建完）
- They were building a house last winter.
- （去年冬天的时候，未建完）

- 这两组句子，时间状语一样，都是过去的某个时间，
- 但用了不同的时体，就表达出不同的意思。

> 翻译练习：

- 昨天一列火车**正在抵达**（reach）上海，但警察叫停了（stop）它。
- Yesterday a train **was reaching** Shanghai, but the police stopped it.
- 刚刚一扇门**正在关上**（close），但我爸爸把它停住了。
- Just now the door **was closing**, but my father stopped it.
- 昨晚我妈妈**打扫了**（clean）客厅，然后它就干净了。
- Last night my mother **cleaned** the living room, and then it was clean.
- 今早我爸爸**刷了**（brush）牙。然后，他吃早饭。

- 意思区别2：
- 翻译：
- 昨天，当Tom来的时候，Jack正在做饭。
- Yesterday, when Tom **came**, Jack **was cooking**.
- “来come”是短暂动作，用一般过去时；
- “做饭cook”是持续较长的动作，用过去进行时。
- 当一般过去时、过去进行时同时出现，
- 我们一般把**较短的动作**用**一般过去时**，
- **较长的动作**用**过去进行时**

>翻译练习：

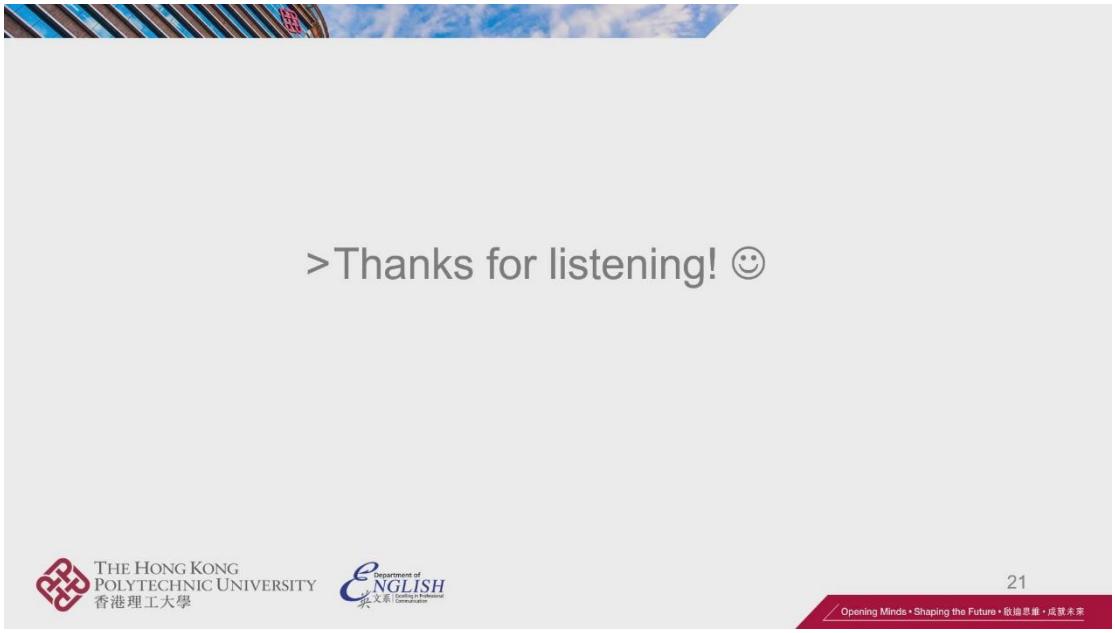
- 当我**正在做饭**（cook）的时候，门开了（open）。
- **While** I **was cooking** lunch, the door **opened**.
- **While + 过去进行（较长动作）：当正在做……的时候**
- 我爷爷滑了一跤(slip)，当他**正在爬**(climb)山的时候。
- My grandfather **slipped** over **while** he **was climbing** the hill.
- 孩子们**正在唱歌**(sing)，**这时突然**他们的爸爸走进了房间。
- The kids **were singing** **when** their father **walked into** the room.
- **When + 一般过去（较短动作）：某事正在发生的时候，突然发生了另一件事**
- 我**正在听故事**，**这时**我朋友**突然**打电话给我。
- I **was listening** to the story **when** my friend **called** me.

用法总结

> 1. 一般过去、过去进行，时间状语相似，都是过去的时间，
> 主要区别在于意思：
> **一般过去**：过去某时，动作**已完成**；
> **过去进行**：过去某时，动作**未完成、进行中、持续中**
> 2. 一般过去、过去进行，同时出现：
> **一般过去：较短动作（when + 一般过去）**
> **过去进行：较长动作（while + 过去进行）**

测试

> Yesterday afternoon, it was raining outside.
> In the house, a dog was sleeping.
> A boy was playing the piano and singing.
> Suddenly a person knocked on the door.
> The dog jumped up.
> The boy stopped playing.
> And he opened the door.


>Thanks for listening! ☺
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21
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Appendix E: Information Sheet

Information Sheet

Gesture and the Acquisition of L2 English Tense and Aspect[41]

Dear Sir or Madam, you are cordially invited to participate in a study conducted by Ms. QU Congyi (Student ID: 1904), who is a PhD student supervised by Prof. HU Guangwei and Dr. Renia LOPEZ at The Department of English, The Hong Kong Polytechnic University. The project has been approved by the Human Subjects Ethics Sub-committee (HSESC) (or its Delegate) of The Hong Kong Polytechnic University (HSESC Reference Number: _____).

The project aims to explore English language teaching and learning. The procedure will follow pretest—treatment—immediate posttest—delayed posttest. Tests will be administered at the three testing times to measure learners' acquisition of English before the treatment, immediately after the treatment, and a period after the treatment. The treatment will consist of two to four lessons. There will be an interview after the delayed posttest. Part of the tests and the treatment lessons will be video recorded, and the interviews will be audio recorded. It may take three to four months to collect research data, during which there will be a one-month interval.

This study will be helpful to your English language learning and will also contribute to English language teaching research and practice. The study should not result in any undue discomfort.

All the information related to you will remain confidential and will be identifiable by codes only known to the researcher. Specifically, all the data collected will be coded by QU Congyi, and any identity-related information therein will be removed. Therefore, the participants in this study will be identifiable only to QU Congyi through the codes. Hard copies of the data will be kept in a locked cabinet that only QU Congyi has access to, and soft copies of the data will be kept in a password protected laptop that only QU Congyi can access. Back-up hard/soft copies of the data will be kept in a separate locked place that only QU Congyi has access to. Thus, all the information related to you will remain strictly confidential. The results of the study may get published but you will not be individually identifiable in these publications.

You have every right to ask questions and to withdraw from the study at any time without penalty of any kind. For questions, you may contact QU Congyi (Email: qcy200818@). In the event you have any complaints about the conduct of this research study, you may contact Secretary, PolyU Institutional Review Board in writing (rohsesc@polyu.edu.hk), stating clearly the responsible person and department of this study as well as the HSESC Reference Number.

Thank you for your interest in participating in this study!

QU Congyi

[41] In the information sheet to be actually presented to the participants (i.e., the Chinese version below), a general title "英语教学研究(English Language Teaching and Learning)" will be adopted. The specific research foci of the study need to be concealed from the participants, so that they will perform naturally rather than paying attention to the research foci.

研究项目介绍

英语教学研究

先生/女士，您好！现诚邀您参与此项研究。此项研究由香港理工大学英文系博士生瞿聪一（学生号：1904　　）开展。瞿聪一由胡光伟教授、Renia LOPEZ 博士指导。此项研究已获香港理工大学 Human Subjects Ethics Sub-committee (HSESC)（或其代表）审批通过（HSESC 参考编号：_____）。

此项研究旨在探索英语教学。研究流程为：前测—实验课—即时后测—延时后测。“前测”旨在测试您实验前对英语的掌握程度。“实验”由 2-4 堂英语课组成。“即时后测”和“延时后测”旨在测试您在实验后对英语的掌握程度。“延时后测”之后有访谈。部分测试、实验课，需要进行录像，访谈需要进行录音。研究资料收集预计共需三四个月，期间有一个月的暂停。

此项研究有助于您的英语学习，也有助于英语教学研究与实践。通常情况下，研究过程不会带来不适。

所有与您相关的信息都会严格保密，且仅研究者知悉相关资料代码。具体而言，收集的所有资料将由瞿聪一进行编码，其中所有与您个人身份相关的信息都将被删除。因此，本研究的参与者仅由瞿聪一通过代码来识别。资料的纸质版将存放在只有瞿聪一可以打开的上了锁的储存柜中。资料的电子版将保存在只有瞿聪一可以打开的受密码保护的电脑中。资料的纸质版、电子版备份，将存放在另外的上了锁的地方，只有瞿聪一可以打开。因此，所有与您相关的信息都会严格保密。此项研究的研究结果可能会被发表，但在这些出版物中您个人将无法被识别出来。

您有权就此项研究的任何部分提出疑问，也有权随时退出此项研究而不受任何惩处。如有问题，您可以联系瞿聪一（邮箱：qcy200818@　　）。意见反馈，请电邮联系香港理工大学 Institutional Review Board 秘书(rohsesc@polyu.edu.hk)。烦请写明香港理工大学研究项目 HSESC 参考编号、研究人员及其所属部门。

谢您参与此项研究！

瞿聪一

Appendix F: Consent Form

Consent Form

Gesture and the Acquisition of L2 English Tense and Aspect[42]

I _____ hereby consent to participate in the captioned research conducted by Ms. QU Congyi (Student ID: 1904).

I understand that the information obtained from this research may be used in future research and published. However, my right to privacy will be retained, i.e., my personal details will not be revealed.

The procedure as set out in the attached information sheet has been fully explained. I understand the benefits and risks involved. My participation in the project is voluntary.

I acknowledge that I have the right to question any part of the procedure and can withdraw at any time without penalty of any kind.

Name of participant _____
Signature of participant _____
Name of researcher _____
Signature of researcher _____
Date _____

[42] In the consent form to be actually presented to the participants (i.e., the Chinese version below), a general title "英语教学研究(English Language Teaching and Learning)" will be adopted. The specific research foci of the study need to be concealed from the participants, so that they will perform naturally rather than paying attention to the research foci.

参与研究同意书

英语教学研究

本人_____同意参与由瞿聪一（学生号：1904　　）开展的上述研究。

本人知悉此研究所得的资料可能被用作日后的研究及发表，但本人的私隐权利将得以保留，即本人的个人资料不会被公开。

研究人员已向本人清楚解释研究程序；本人明了当中涉及的利益及风险；本人自愿参与研究项目。

本人知悉本人有权就此项研究的任何部分提出疑问，并有权随时退出而不受任何惩处。

参与者姓名 _____
参与者签署 _____
研究人员姓名 _____
研究人员签署 _____
日期 _____

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