

DEVELOPMENT OF CHINESE UNIVERSITY EFL LEARNERS' SPEAKING  
SKILLS THROUGH LANGUAGE INPUT OPTIMIZATION



A Thesis Submitted in Partial Fulfillment of the Requirements for the  
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การพัฒนาทักษะการพูดภาษาอังกฤษของนักศึกษามหาวิทยาลัยจีน  
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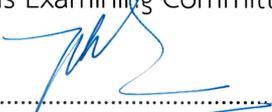


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# DEVELOPMENT OF CHINESE UNIVERSITY EFL LEARNERS' SPEAKING SKILLS THROUGH LANGUAGE INPUT OPTIMIZATION

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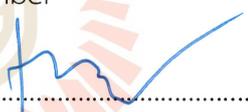
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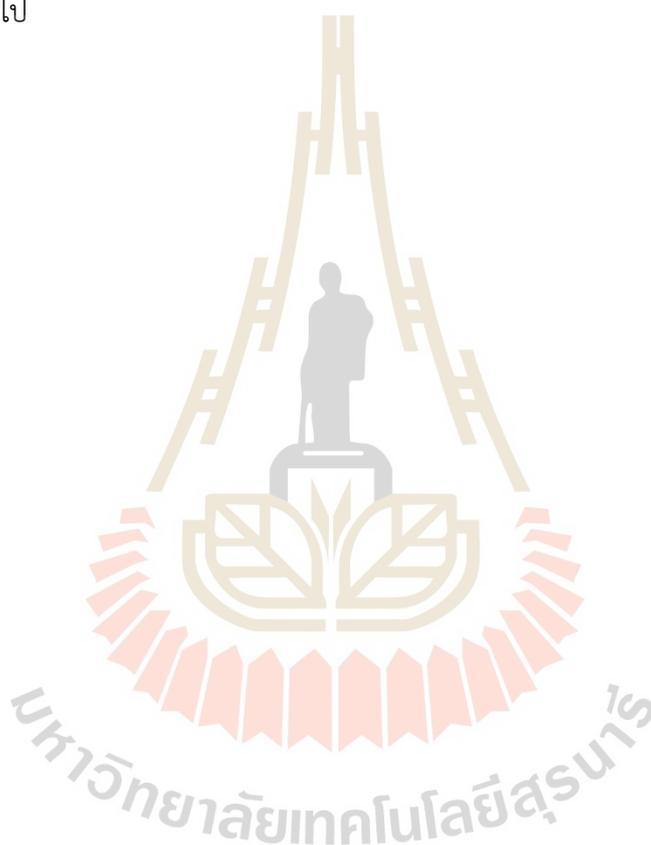
คำสำคัญ: ทักษะการพูด/ ทฤษฎีเวอร์เบอร์โทนอนอล/ หลักการตามนีโอเวอร์เบอร์โทนอนอล/ การเพิ่มประสิทธิภาพ

การศึกษานี้มีวัตถุประสงค์เพื่อตรวจสอบว่าหลักการนีโอเวอร์เบอร์โทนอนอลในการป้อนข้อมูลภาษาสามารถเพิ่มพูนทักษะการพูดของนักศึกษามหาวิทยาลัยจีนในฐานะผู้เรียนภาษาอังกฤษเป็นภาษาต่างประเทศได้หรือไม่ และเพื่อศึกษาเพิ่มเติมว่าความแม่นยำและความคล่องแคล่วในการพูดของผู้เรียนมีการพัฒนาร่วมกันอย่างไร ตลอดจนทัศนคติของผู้เรียนที่มีต่อหลักการนีโอเวอร์เบอร์โทนอนอล (neuro-based input-optimized verbotonal approach, NVT) การบูรณาการตามทฤษฎีเวอร์เบอร์โทนอนอลและการทำงานของสมองด้านข้าง โดยการป้อนข้อมูลเพื่อเพิ่มประสิทธิภาพ เช่น การป้อนข้อมูลแบบไดโซติคอลล (การป้อนข้อมูลแบ่งขั้ว) ไปยังซีกของสมอง โดยสมองซีกขวาได้รับการกรองส่วนสมองซีกซ้ายไม่ได้รับการกรอง วิธีการตามหลักการนีโอเวอร์เบอร์โทนอนอล (NVT) ได้รับการออกแบบมาเพื่อเพิ่มการรับรู้ของผู้เรียนและเพิ่มประสิทธิภาพในการใช้ภาษา

ผู้วิจัยใช้วิธีการวิจัยแบบผสมวิธี (a mixed method design) กลุ่มตัวอย่างในการวิจัยครั้งนี้คือ นักศึกษาระดับปริญญาเอกวิศวกรรมเคมี จำนวน 2 ห้องเรียน โดยผู้วิจัยทำการสุ่มเลือกผู้เรียนเป็นกลุ่มทดลองที่ได้รับการสอนตามหลักการนีโอเวอร์เบอร์โทนอนอล (NVT) จำนวน 32 คน และกลุ่มควบคุมที่ได้รับการสอนแบบดั้งเดิมจำนวน 32 คน เครื่องมือที่ใช้ในการเก็บรวบรวมข้อมูล ได้แก่ แบบทดสอบก่อนและหลังเรียน แบบสอบถาม การสัมภาษณ์แบบกึ่งโครงสร้าง และบันทึกประจำวันที่ทำอย่างเป็นระบบ มีการสุ่มตรวจประเมิน ประมวลผลและนำมาวิเคราะห์

การศึกษาเผยให้เห็นถึงความสอดคล้องของผลการให้คะแนนทั้งคะแนนรวมและคะแนนย่อยในการทดสอบทักษะการพูดก่อนและหลังการเรียน ผลการศึกษาพบว่าผู้เข้าร่วมวิจัยในกลุ่มทดลองมีทักษะการพูดที่มีประสิทธิภาพดีกว่ากลุ่มควบคุมในทุกด้าน ซึ่งบ่งชี้ถึงประสิทธิภาพของการสอนตามหลักการนีโอเวอร์เบอร์โทนอนอล (NVT) เพิ่มเสริมทักษะการพูดของผู้เรียน ในส่วนของการพัฒนาทั้งด้านความแม่นยำและความคล่องแคล่วในการพูด ผลการวิจัยพบว่าผู้เข้าร่วมวิจัยในกลุ่มทดลองมีการพัฒนามากกว่าผู้เข้าร่วมวิจัยในกลุ่มควบคุม อย่างไรก็ตาม เป็นการค้นพบที่น่าสนใจว่าภายใต้การนำหลักการเวอร์เบอร์โทนอนอล (NVT) มาใช้สามารถเพิ่มพูนความแม่นยำและความคล่องแคล่วในการพูดอย่างมีประสิทธิภาพ แม้จะมีรูปแบบการพัฒนาที่แตกต่างกันก็ตาม ซึ่งอาจแสดงเป็นนัยว่าปัญหาที่ยุ่งยากทางการพูดอาจหายไปหากมีการจัดระเบียบการเรียนรู้ได้อย่างมีประสิทธิภาพ นอกจากนี้แล้วผู้เข้าร่วมวิจัยในกลุ่มทดลองส่วนใหญ่มีทัศนคติเชิงบวกต่อการนำหลักการเวอร์เบอร์โทนอนอล (NVT) มาประยุกต์ใช้ในการเรียนรู้การพูดภาษาอังกฤษ เพื่อเพิ่มประสิทธิภาพและประสิทธิผลด้านทักษะการพูดเพิ่มสมาธิ สร้างความมั่นใจในตนเอง และแก้ไขข้อผิดพลาด รวมถึงนิสัยการเรียนรู้ภาษาอีกด้วย

ผลของการศึกษาค้นคว้าครั้งนี้เป็นประโยชน์ทางเชิงทฤษฎีและทางปฏิบัติสำหรับการเรียนรู้ที่จะพูดภาษาอังกฤษเป็นภาษาต่างประเทศ ในแง่หนึ่ง เป็นเรื่องน่ายินดีที่พบว่ากระบวนการตามทฤษฎีเวอร์เบอร์โทนอล และการทำงานของสมองด้านข้างมีความสำคัญต่อการเรียนรู้ภาษา และการป้อนข้อมูลที่เหมาะสมอาจเป็นผลบวกต่อการใช้ภาษาเมื่อมีการปรับเปลี่ยนอย่างเหมาะสมทางกายภาพ ในทางกลับกัน การพัฒนาความแม่นยำและความคล่องแคล่วร่วมกันอาจบ่งชี้ว่าการเรียนรู้ที่มีการวางแผนดำเนินการอย่างดีอาจเป็นประโยชน์ต่อการเพิ่มประสิทธิภาพทั้งสองอย่างพร้อมกันและสามารถแก้ปัญหาที่ยุ่งยากได้ สิ่งที่ได้ค้นพบในการวิจัยครั้งนี้อาจมีนัยสำคัญทางด้านทฤษฎีเวอร์เบอร์โทนอล ภาษาศาสตร์ประสาทวิทยา และการเรียนรู้และการสอนภาษาในบริบทของคนจีน หรือบริบทอื่น ๆ ที่แตกต่างกันออกไป



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SHAOBING ZHANG: DEVELOPMENT OF CHINESE UNIVERSITY EFL LEARNERS'  
SPEAKING SKILLS THROUGH LANGUAGE INPUT OPTIMIZATION.

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Keyword: Speaking Skills/ Verbotonal Theory/ Neo Verbotonal Approach/Optimization

The present study was conducted to investigate whether a neuro-based verbotonal approach (NVT) could enhance the speaking skills of the Chinese university EFL learners, and to further explore how their speaking accuracy and fluency co-developed with each other. The learners' attitudes toward the NVT approach were also explored. With the integration of the verbotonal theory and the brain laterality and supported by the techniques of dichotic listening and low pass filtering, the NVT approach was designed to raise the learners' perception and to ultimately enhance their language production by making the input optimized, i.e., to feed the optimal stimuli dichotically to the optimal side of the brain, filtered to the right hemisphere and unfiltered to the left hemisphere.

A mixed method design was employed. Two intact classes of the same major, 32 students each, in Guangdong University of Petrochemical Technology (GDUPT) were selected as the participants. One class was assigned randomly as the experimental group that received the NVT treatment, and the other the control group used the traditional diotic method. The data collected by the instruments, including pre/post-tests, questionnaires, semi-structured interviews, and diaries were well-documented, blindly rated, calculated, and analyzed.

With the consistency in the rating results of both the total scores and the sub scores in the pretest and posttest, it showed that the experimental group outperformed the control group in an all-round way, which indicated the effectiveness of the NVT approach in enhancing learners' speaking skills. As for its influence on the development and co-development of accuracy and fluency, the results revealed that both aspects were enhanced more than that in the control group. However, it was interesting to find that, for both groups, there was a largely simultaneous enhancement in both of accuracy and fluency despite their different developmental patterns, which may mean the A&F dilemma might disappear if the learning tasks were well-organized. Moreover, most of the participants in the experimental group showed a positive attitude toward the application of NVT approach for learning to speak English for its effectiveness and efficiency in elevating their skills, raising their concentration, enhancing their self-confidence, and changing their false language learning habitus.

The findings in the present study have both theoretical and practical implications for learning to speak English as a foreign language. On the one hand, it is encouraging to find that the integration of verbotonal theory and brain laterality is significant for language learning and altering the physical signals optimally could be positive for language production. On the other hand, the co-development of accuracy and fluency in both groups indicate that well-organized learning tasks might be beneficial for enhancing both of them simultaneously and resolve the A&F dilemma. These findings may also be of significance for the verbotonal theory, neurolinguistics, and language learning and teaching in general or in the Chinese context.



School of Foreign Languages  
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## LIST OF ABBREVIATIONS

CAF	Complexity, Accuracy, Fluency
CALL	Computer-Assisted Language Learning
CET	College English Test
CG	Control Group
EEG	Electroencephalography
EFL	English As A Foreign Language
EG	Experimental Group
fMRI	Functional Magnetic Resonance Imaging
ICT	Information And Communication Technology
IELTS	International English Language Testing System
LEA	Left Ear Advantage
MEG	Magnetoencephalography
MOOC	Massive Open Online Course
NIS	Near-Infrared Spectroscopy
NVT	Neo Verbotonal Approach
REA	Right Ear Advantage

# CHAPTER 1

## INTRODUCTION

The present study aims at enhancing the speaking skills of Chinese university students that learning English as a foreign language (EFL) using a Neo Verbotonal approach (NVT). This chapter is an introduction to the thesis, and it provides a background at the same time a context for the present study. It also includes sections covering a statement of the problem, significance of the study, purposes, research questions, together with definitions of key terms, and the scope of the study.

### 1.1 Background of the study

The past few decades have witnessed the fact that “English has enjoyed great favor and fervor in China since the execution of Open Policy in 1978” (Li, 2016, p.77). On the one hand, English is treated as the global language, or a lingua franca, for the contemporary world. In China, the superior role of English upon other foreign languages has been even strengthened due to the gradually closer business relationship with other countries ever since China became a member of the World Trade Organization and the second biggest economy of the world. On the other hand, for the individuals, being aware the necessity to “use English for upward social mobility, with English tests unanimously required for access to and exit from universities, for job-hunting and career promotion, and for the chance to go abroad” (Liu, 2015, p.77), they are constantly motivated by their teachers and parents to learn English well ever since the period of Junior Middle School, all the way to their college time (Long et al, 2013; Li et al, 2015; Jin, 2014). Thus, there is unquestionably a shared concept that the role of English in education gets strengthened much more than ever and both institutions and individuals need to find out the right way for learning English, and “great efforts and resources have been invested in English language education, both personally and officially” (Li, 2016, p.77).

With the ultimate purpose of effective communication, the Chinese EFL learners are then motivated to acquire the ability to read, write, and speak English fluently and accurately, as well as to correctly understand the materials they listen to. In the past decades, various of English language teaching and learning methods have been

introduced into China, including the Audiolingual method, the Grammar-Translation Approach, the Communicative Approach, as well as the Task-based Approach. However, among the four skills of English learning, there has been more attention paid to reading and writing than listening and speaking. Especially, speaking seems to be the most challenging one since it is more demanding in communication (Pawlak, Waniek-Klimczak, & Majer, 2011).

The speaking proficiency of the Chinese learners is still underdeveloped, and sometimes, their English is called “deaf and dumb” English (Wei et al., 2018). Taking Wei and Su’s (2012, p.12) national survey report as an example, it is estimated that almost 79% English learners are in possession of a spoken competence in English which could not allow them to sustain a conversation beyond initial greetings. Various similar evaluations are made by different institutions, such as the IELTS’ white paper (2017), the data from China Labor-Force Dynamics Survey (CLDS), and other nationally representative surveys (Wang et. al., 2017). Thus, the issue of improving students’ speaking skills is still open for more investigations, especially when the contemporary methods of English teaching in China have been widely criticized as test-oriented and inefficient (Han & Yin, 2016).

With the examination of second language pedagogy, it is found that methods for teaching a foreign language that are predicated on the notions of inhibiting L1 activation (Kroll & Sunderman, 2003) or by-passing the mother tongue “phonological sieve” (Trubetzkoy, 1939) or “filter” (Guberina, 1989). “In order to speak a foreign language well, we must be able to tune into the sounds of that language.” (Philipp Botes, 2015, p.81). However, in the traditional classroom teaching models of “Focus on form” and “Focus on forms” (Long, 1988, 1991), the physical aspects, such as the sounds of a foreign language, are of less concern.

The prevailing concepts of “Focus on form” and “Focus on forms” divide classroom instruction into two types, within which the former’s “overriding focus is on meaning” (Long 1991, p. 45–6) with “an occasional shift of attention to linguistic code features” (Long & Robinson, 1998, p.23) while the latter’s focus is on “formal aspects” (Carter & Nunan, 2001) or the “formal elements of language” (Doughty & Williams, 1998). The two terms have triggered plenty of discussion concerning their application and comparison. However, compared to the mutually accepted term of “Focus on form”, “Focus on forms” loaded heated debates concerning the references of “forms” since the “forms” of a language may not be that easy to reach an agreement even though many researchers referred it directly to grammar, segmental linguistic units, specific structure, or the decontextualized rules for their

combination (e.g. Skehan, 2003; Norris and Ortega, 2000; Vinogradov 2010; Bigelow 2010; Bigelow and Vinogradov, 2011). The content of “forms” was also under constant expansion, e.g., Ellis posits that “phonological, lexical, grammatical, and pragmalinguistic aspects of language” (Ellis, 2001, p.2) should also be the forms to be instructed. Along this continuum, it is naturally to find that the understanding of form should not be limited to these kinds of items, and it can be viewed more broadly (William, 2005, p.673).

Objectively and physically, speech sound is the basic form that language exists. All the information, whether it is acoustic, phonological, syntactic, or semantic, could be compressed in the limited length and fluidity of sound flowing. Thus, sound is first and foremost significant for each language, and the distinctive sounds in each language make speaking that language a sound-specific articulating issue and learning to speak that language as the second or foreign language a process of exotic experience of sound perception and production. Thus, the key to learning another language is to make the foreign sound be well perceived and produced by the learners. Previous studies in verbotonalism have shown that linguistic production is closely related to the linguistic perception, and the improvement in linguistic production could be the result of the improvement in linguistic perception (Lian, 1980; Alazard, 2013; He, 2014; Yang, 2016; Wen, 2019).

The Verbotonal theory, proposed by Petar Guberina, regards language as an inseparable living part of human individual that originates from his/her perception and is reflected in his/her expression (Lešić, 2012), and initiates to facilitate linguistic production by reorganizing auditory perception (Renard & van Vlasselaer, 1976). With this belief in mind, the Verbotonalists treat the individual speaker as both a producer and a perceiver, and endeavor to achieve an optimal correction in language by creating an optimal condition for raising the learners’ awareness and changing their perceptions (Ursache, 2017, p.52). The Verbotonal theory, from a constructivist perspective, respects individual differences in information perception and makes optimality as its core theoretical principle. The principle of optimality makes it possible to search for optimal conditions, optimal stimuli, and optimal ways for creating proper sensitization and awareness raising.

The application of Verbotonal theory is called the Verbotonal approach (VT) which has two main implementations in the practical field: speech and hearing rehabilitation as well as foreign language learning (Guberina & Asp, 2013). For the hearing handicapped rehabilitation, the residual hearing ability is emphasized as a primary vehicle for speech and language development when it is carefully

developed (Craig et al., 1974, p.38). For foreign language learning, the Verbotonal approach is an auditory approach that focuses more on synthesizing both vestibular system and auditory system, and it has shown its effectiveness in improving learners' speech, especially in phonetic correction and pronunciation, through prosodic feeling and binaural listening (He, 2014; Yang, 2016; Wen, 2019).

In the past decades since its birth, the Verbotonal approach has spread from Europe to Asia, from Croatia to France and then to Japan and China. In the field of EFL learning in China, previous research (He, 2014; Yang, 2016) has confirmed the significant value of the Verbotonal approach in enhancing Chinese learners' language proficiency in a comprehensive way, covering both aspects of speaking accuracy and fluency.

In this thesis, along with the continuum, a Neo Verbotonal Approach (NVT) is proposed and constructed as an endeavor both in the neurolinguistic field and EFL pedagogical area. The NVT derives from the interconnected principles of two areas, Verbotonal theory and the laterality of the brain. The extending of the optimality principle of Verbotonal theory makes it as a natural step to take brain into the account for achieving optimality. Verbotonalists do emphasize "the structural functioning of brain and its optimal responses" (Roberge, 2019, p.130) and signify that the best way to improve one's perception is to "stimulate the brain" (García, 2018, p.260). As the physiological foundation, the brain is strongly related to the internalization and production of the target language.

From both the biological and cognitive perspectives, linguists admit the asymmetry of the human brain, the lateralized functional advantages of each hemisphere, and the distinct types of attention allocated to the target from each side. Both hemispheres function in tandem and in parallel, which means they compete with each other on some occasions while they would cooperate at other times. The Brain provides the biological foundation where learning resides, as it is repeatedly explained by McGilchrist, "the learning of new information or new skills engages right hemisphere attention more than left, even if the information is verbal in nature. However, once the skills have become familiar through practice, they shift to being the concern of the left hemisphere." (McGilchrist, 2010, p.510; 2019, p.56) Thus, neurologically, learning is a process that takes place in respect to the characteristics of the two hemispheres of the brain, and it is meaningful to take the functional lateralization into account in language learning. The fact that each side of the brain has its own favors in perceiving and processing language provides a chance for constructing a condition with the guidance of the principle of optimality.

Hence, with the combination of the beliefs from both the functional laterality of the brain and the Verbotonal theory, theoretically, a whole new “optimal assumption” emerges if it could be technically realized: *to feed optimal stimuli to the optimal hemisphere is necessary so as to obtain the optimal values for learning alternative languages*. In other words, with respect to each hemisphere’s distinctive functional advantages, to send the optimal stimuli to both hemispheres in tandem may enhance learners’ language perception and production at the same time.

Coincidentally, there are the low pass filtering technique and the dichotic listening technique. Low pass filtering is a technique used to make the prosodic factors, intonation and rhythm, more salient by preserving the low frequency and removing the other part in the auditory signal, which would make the signal more likely be in the favor of the right hemisphere (Blumstein & Cooper, 1974). Meanwhile, dichotic listening is “a well-established method to non-invasively assess hemispheric specialization for processing of speech and other auditory stimuli” (Westerhausen, 2019, p.740). The core of dichotic listening is dichotic presentation: “a pair of auditory stimuli is presented simultaneously using headphones, with one of the two stimuli presented to the left ear, and the other one presented to the right ear” (ibid). Due to the contralateral neural connection, stimuli sent to the left ear would activate the right hemisphere (the filtered), and parallelly, stimuli to the right ear would activate the left hemisphere (the unfiltered). The technique of dichotic listening makes the “optimal assumption” technically realized as the Neo Verbotonal Approach.

The Neo Verbotonal Approach, as the contextualization of the principles from both the brain laterality and Verbotonal theory, provides a potential brain-compatible way of language learning. On the one hand, similar to the former Verbotonal approach, this newly developed brain supported Verbotonal approach is neither accuracy-oriented nor fluency-oriented. On the other hand, different from the former Verbotonal approach, the Neo Verbotonal approach focuses more on the optimized signals and the physiological stimulation of the structural brain system and auditory system. With the signals being altered and properly sent to the sensitive side, a gradually comprehensive improvement in EFL learners’ speaking proficiency may potentially be achieved.

To develop the EFL learners’ speaking proficiency has been the most challenging task, especially when the development and co-development of its two componential facets, accuracy and fluency, are examined. Researchers have been arguing about the interrelationship between the two aspects ever since Brumfit

(1984) proposed the paired items. On the one hand, it is easy to find that they may exclude each other along with the development of speaking proficiency. Lennon claims that a learner may be either 'fluent but grammatically inaccurate' or to 'speak correctly but not very fluently', or 'fluent but lacks a wide and varied vocabulary'" (Lennon, 1990, p.390). Ellis (1993) also admits that an increase in fluency in L2 acquisition may occur at the expense of development of accuracy. Housen, et al. (2012) suggest that accuracy and fluency should be acquired sequentially, rather than in a simultaneous or balanced way. There seems to be a paradox in developing both aspects simultaneously, which in this thesis, may be called the Accuracy - Fluency dilemma (Cabaroglu, 2014), or "A&F dilemma". The dilemma is further strengthened with the classroom activities being categorized into accuracy-oriented or fluency-oriented tasks. On the other hand, scholars also call for more studies to bridge the gap and to achieve a balanced development in both facets. Brown postulates that "it is now very clear that fluency and accuracy are both important goals to pursue." (Brown, 2001, p.268) because "we must want our students to be successful language users; able to communicate in any situation; with full comprehension; confident and effective in their adopted language. This requires that they be both fluent in their communication and accurate in their language choice. It's not an either-or situation; it's both." (Hemmens, 2011, para.8)

Thus, to sum up, the present study is to handle the issue of speaking proficiency in Chinese university EFL learners and to examine the "A&F dilemma" alternatively from the view of the Neo Verbotonal Approach. The newly developed Verbotonal Approach is assumed to improve individual perception in the way of altering the signal physically and stimulating the brain by sending optimal auditory signals dichotically, and to ultimately promote individual linguistic performance. The most distinctive characteristics of the Neo Verbotonal Approach in the present study is taking hemispheric advantage of the brain into consideration and the construction of a learning environment supported by the techniques of low pass filtering and dichotic listening.

## 1.2 Statement of the problem

According to the British Council's inaugural white paper on China mainland test takers' IELTS performance in 2017, the Chinese test takers' total score from the IELTS test are below the world average, with the largest gap in speaking proficiency, ranging at number 33 among the 40 countries that provide the most test-takers (cited in Yu & Dai, 2019:100). Thus, it is acknowledged that the speaking skills of Chinese

university students are statistically and comparably underdeveloped. In addition, “EFL learners find it very hard to have both fluent and accurate oral English” (Wang, 2014, p.115), which means that the issue of “A&F dilemma” has also obsessed the Chinese learners for long under the current imbalanced teaching priorities.

Even though studies have been repeatedly conducted in search of methods for balanced enhancement and simultaneous promotion in both accuracy and fluency, there can be found more qualitative suggestions than quantitative evidence in them, which makes them less convincing in handling the issue of “A&F dilemma”. More empirical investigations should be conducted for searching valid evidence.

The apt goal for learning English is to make the learners “so proficient, so accurate, so fluent, so automatic, so implicit, that there is rarely recourse to explicit, conscious thought about the medium of the message” (Nick Ellis, 1993, p.315). As Ellis further noted, “The endpoint of L2 acquisition – if the learners, their motivation, tutors and conversation partners, environment, and instrumental factors, etc., are all optimal – is to be as proficient in L2 as in L1” (ibid), it is obvious that an optimal environment is critical in achieving the ultimate goal. Subsequently, if the optimal provision in EFL learning is the foundation for achieving well developed speech, to construct a learning condition that can optimally facilitate the language learning would be adaptable.

According to previous studies (Zhang, 2022; Zheng, 2022; Wang, 2018; Wu & Gu, 2012; Wang, & Shi, 2015; Cao, 2017), the problems that the Chinese university EFL learners may encounter include: 1. Because of the test-oriented pedagogy, speaking proficiency may be partly neglected in the classroom instruction; 2. Because of the separated class activities that pre-designed under the demarcation of accuracy-oriented and fluency-oriented beliefs, the speaking proficiency may be developed unfairly; 3. Because of the dominance of explicit instruction of the linguistic forms such as grammatical, lexical, structural rules, the English speaking sound may not be seriously focused; 4. Because of the large number of students in a single class for the non-English majors, few chance was allocated to each student for an individualized and optimized instruction. In sum, the English-speaking proficiency of the Chinese university students may have potentially enough room for improvement.

In the present study, concerning the issue of enhancing the speaking proficiency of the Chinese university EFL learners, and based on the Verbotonal optimality principle and the functionally lateralized brain structure, supported with the dichotic listening technique and low pass filtering technique, a neuro optimal conditioning is conceived for language learning.

### 1.3 Significance of the study

The construction and application of the Neo Verbotonal approach in the present study demonstrates a technology-enhanced method for developing the speaking proficiency of the Chinese university EFL students, which may have multiple significance for both EFL research and EFL learning:

Firstly, this research makes valuable contribution in constructing a newly developed method for language learning by taking the structured brain into the scope of learning environment. The Neo Verbotonal approach respects the characteristics of the split cerebral hemispheres and makes use of their advantages for facilitating language learning. It is of great significance in the sense of exploring the way to optimally situate and stimulate brain in a learning context and isolating the role of the two hemispheres in learning English since “they (hemispheres) are themselves part of the foundations of the world in which we try to understand them” (McGilchrist, 2019, p.44).

Secondly, the foremost significance of this research, both theoretically and practically, is to highlight the physically altered speech sound’s role as a new type of “input” (Krashen, 1985, 1992). Krashen’s “input” is conceptually abstract, which is, to a certain sense, unmanageable and diversified in understanding and practice. While in this research, instead of the abstract idea of input, the importance of physical input is focused, and the physically touchable auditory signal is applied in language learning. The connotation of “input” is then expanded beyond what Krashen originally argued. Moreover, the positive effects entailed by the altered inputs may of significant value in exploring more tailored language learning conditions for any language learner.

Thirdly, another significance of the present study is that it may enlarge the concept of “form(s)” (Long, 1998, 2000) in language instruction. With Long’s conceptualization of “Focus on form” and “Focus on forms”, “form(s)” comes to be the core concept in the demarcation. However, no matter which part it refers to, meaning or linguistic features (grammar, lexicon, syntax, etc.), there has been few discussions to relate “form” to the non-linguistic aspects that could be technically edited, deformed, and reformed in terms of reshaping the signal and perceptual effect.

Fourthly, the term “frequency” (Nick Ellis, 2002, 2009, 2012), it is traditionally referring to the repetition and redundancy of linguistic cues (Nick Ellis, 2002). In this research, frequency is strongly associated with vibration, one of the most

fundamental physical aspects of any language and signals. The physical aspects of the audio linguistic features may be worth of more attention.

Fifthly, the present study is significant in that it could provide empirical evidence in finding a proper way for developing the speaking proficiency in a whole round way, and both accuracy and fluency could be developed simultaneously. Furthermore, it could also enlighten a re-examination of the co-developmental relationship between accuracy and fluency.

Sixthly, in this study, the target subjects for the newly refined Verbotonal approach are the Chinese university students, whose mother tongue is a tonal language. Due to the strong relationship between language and brain, it is valuable to seek an optimal method for the students with a tonal language background learning a non-tonal English language, and vice versa. The present study would contribute empirical data in exploring how to facilitate language learning for learners with differing linguistic background.

Finally, in addition to the significant findings, the way for designing the study would help highlight the theories behind it, such as the Verbotonal theory, the brain laterality, and the application of the techniques of low pass filtering and dichotic listening. Human brain is indispensable in language learning and its hemispheres could work both independently and collaboratively in the same task, which is meaningful for potential learning condition construction. The Verbotonal theory also has the potential to be implemented innovatively when it is properly involved in other fields.

To summarize, the present study is of multiple significance. As it is mentioned in the previous parts, it may be valuable to find out that the “form” of “input” signal is possibly at an edited “frequency”, which may provide optimal perception in the brain of the learners with different linguistic background to facilitate their language learning and linguistic production.

#### **1.4 Purposes of the study**

The present study stems from the concern over Chinese EFL learners’ difficulties in developing their English speech. Then, to make it clear, this research aims at developing the speaking proficiency in Chinese university EFL students’ speech with the application of a Neo Verbotonal Approach. The study attempts to achieve the following purposes:

1) To investigate whether the application of NVT can help to develop Chinese university English learners' speaking skills, and to find out to what extent learners' speaking skills can be developed, especially in the aspects of accuracy and fluency.

2) To further examine the effect of the NVT on the co-development of learners' speaking accuracy and fluency.

3) To explore the attitudes of the learners towards the application of NVT.

## 1.5 Research questions

To fulfil the abovementioned purposes, the following research questions are proposed:

1) Is NVT effective in developing Chinese university EFL learners' speaking skills? If yes, what is the effectiveness of NVT on the development of accuracy and fluency?

2) What is the interrelationship between accuracy and fluency under the application of NVT?

3) What are the attitudes the learners' hold toward NVT?

## 1.6 Definition of key terms

Terms that are most frequently used in the present study are worthy of a list of explanatory notes:

1) The Verbotonal theory, proposed by Petar Guberina, a Croatian Linguist, is the theoretical principles generalized from his experience in the complex hearing and speech rehabilitation of the hearing handicapped. The Verbotonal theory regards individual as both a perceiver and a producer of language, and the condition of hearing impairment can be thought of not so much as a physical deficit but as a different way of organizing audition (Renard & van Vlasselaer, 1976). To change one's language production, it needs to make use of the residual capability in hearing to maximize individual listening skill for developing intelligible speech. The core concept in Verbotonal theory is optimality (Guberina, 1989), which means to optimally stimulate one's residual capability with optimal stimuli to achieve optimal correction in language perception and production.

2) Verbotonal approach: the application of the Verbotonal theory in the context of hearing and speech pathologies, and foreign language learning is called the Verbotonal approach. The Verbotonal approach was initially used for the rehabilitation of people with severe communication problems and then introduced into the sphere of foreign language learning such as phonetic correction and pronunciation enhancement. In practice, multiple treatment strategies are used and proved to be effective in the Verbotonal approach, especially the vestibular and

auditory-based strategies such as binaural listening, low pass-filtered auditory signal, vocalization with whole-body movements, etc.

3) Neo Verbotonal approach: By synthesizing the Verbotonal theory with the neurologically divided brain concepts, and supported with the technique of dichotic listening, this study constructs an optimized dichotic listening model expecting that the optimal input to the optimal brain hemisphere would benefit optimal perception and bring enhanced language production. This new model in language learning is named the Neo Verbotonal Approach. Compared with the former Verbotonal studies, the Neo Verbotonal Approach focuses more on the auditory system in stimulating the brain for a perception of the optimal input rather than the vestibular system that needs more body movement. Moreover, the former Verbotonal Approach focuses more on feeding both ears with the same filtered signal without considering the hemispheric lateralization in the brain, while the Neo Verbotonal Approach turns to the dichotic listening for making the input more optimal.

4) Optimization: Based on the optimality principle, the verbotonal theory initiates to best stimulate the brain of the foreign language learners in order to make their perceptual mechanisms function to their best so as to facilitate language-learning (Guberina & Asp, 1981; Lian & Sussex, 2018). In the present study, the techniques of low pass filtering and dichotic listening were used in making the signals optimized. With the optimization of the audio features, it is expected to make the linguistic learning facilitated.

5) Dichotic listening: Dichotic listening method was firstly invented by Broadbent (1956) and refined by Kimura (1961), and it is to present simultaneously two auditory stimuli to both ears for exploring the hemispheric lateralization in the intact normal human brain, which is noninvasive and does not require surgically splitting the brain.

6) Low pass filtering: it is a technique used to preserve the low frequency by removing the other part in the auditory signal with the support of audio editing software or devices. In Verbotonal Approach, it is believed that rhythm and intonation transmit meaning, while the low frequencies transmit the rhythm and intonation. Thus, the low frequency is essential in language perception. The low frequency normally refers to the frequency range below 500 Hz. However, in practice, low pass filtering is conducted by removing the part above 320Hz through electronic filtering for achieving low pass filtered audio signals in which individual sound is unrecognizable. Low pass filtered sentences are used to make learners aware of the sentence's prosodic patterns (Guberina & ASP, 1981). Low pass filtering of sentences removes the interference of vowels and consonants and focus on the

fluid traits of the sentence, or the flowing of the spoken stream, which could decrease the pressure for analytical understanding of every piece in the sentence and make the prosodic factors, intonation and rhythm, more salient.

7) Speaking proficiency, in this study, is regarded as the language proficiency embodied in one modality of the four skills, the speaking skill. Speaking proficiency, speaking ability, and oral proficiency are interchangeably used with the same meaning. However, speaking, speaking skill, and speaking performance are the ways or actions for realizing speaker's language proficiency. Language proficiency, in the present study, specifically refers to the extent of effectiveness in using English as a second language in communicative situation.

8) Accuracy: it is traditionally understood as the ability to produce error-free speech or avoid error in performance (Housen & Kuiken, 2009; Ellis, 2008) and regarded as one aspect of the speaking proficiency focusing more on the correctness or deviance of linguistic units or patterns at the specific level of delicacy. In this study, it relies more on close analysis of detailed aspects of linguistic features, such as the correct use of phonological, lexical and grammatical knowledge.

9) Fluency: contrary to accuracy, it is regarded as a broad scaled judgement on the holistic smoothness and coherence in linguistic production, and a multi-componential construct supported with subdimensions. In the present study, it is for the ability that produces holistically coherent, smooth, and flowing expressions in terms of aspects like prosody, coherence, and delivery.

10) Lateralization: The human brain, anatomically and medically, can be separated by a longitudinal fissure into two distinct cerebral hemispheres connected by the corpus callosum, the left cerebral hemisphere (LH), and the right cerebral hemisphere (RH). The two sides are distinct from each other in physical shape, size, weight, as well as in neural functions since evolution has made each side increasingly specialized, a process which is called the "functional lateralization of brain" (Warren, 1977; Dean, 1984). The functional lateralization influences language perception on a large scale (McGilchrist, 2019).

## 1.7 Scope and limitations

1) The population for this study is the university English students with pre-intermediate level of English proficiency in China. The participants were chosen based on convenience sampling and they were grouped randomly into an experimental group and a control group based on lots drawn randomly. The limitation of this study may reside in the different numbers of male and female

students. Additionally, the participants of this study were the first-year undergraduate university English students, which did not include English majors and other levels. Regarding these limitations, it should be cautious to treat the findings from this study in making generalization about EFL instructions.

2) The speaking accuracy and fluency to be focused on in this study are regarded as the language proficiency in different aspects of linguistic features, say, accuracy in the correct use of phonological, lexical and grammatical knowledge, fluency in prosody, coherence, and delivery.

3) The concepts of speaking skill and speaking proficiency were not strictly distinguished in the present study, and the two concepts were interchangeably used in describing the EFL learners' speaking ability.

## 1.8 Summary

This chapter presents an overall description of the present study, including the background and the problems of the Chinese university EFL students in learning to speak, the significance of the study, the purposes of the study, the research questions, definitions of the key terms, and the scope and limitations of the study. The next chapter is to make a review of the relevant literature concerning theoretical background of NVT.



## CHAPTER 2

### LITERATURE REVIEWS

This part is to make a detailed explanation of the derivation of the Neo Verbotonal Approach (NVT). The first and foremost is to make a brief review of the arise of the Verbotonal theory, its application, and its spreading and new development. Then, it is to introduce the brain lateralization and the distinct roles of each hemisphere in language learning. Furthermore, with the integration between the brain lateralization and vertobonal principles, the Neo Verbotonal Approach (NVT) comes into being. Then, by relating the NVT with the speaking proficiency, the theoretical framework is then proposed based on the abovementioned review. The last part is the summary of the present chapter.

#### 2.1 Verbotonal theory and its application

Verbotonal theory has a long history, and its source can be traced back to Croatian Professor Guberina. The theory has got a worldwide spreading so far, especially in the EFL field of east and southeast Asia.

##### 2.1.1 The Verbotonal theory and its principles

Between the 1930s and 1950s, Petar Guberina, a Croatian specialist in speech pathologies, developed a clinical treatment to help hearing-impaired children. Guberina carried out his research in collaboration with other specialists and concluded that the best way to improve a patient's hearing capacity is to stimulate the brain optimally. "The brain would function best if it were to receive the auditory stimuli for which the ear is most sensitive; these optimal stimuli would enrich it; and with time and training, it would be prepared to respond to more difficult, less favorable stimuli." (Guberina & Asp, 1981) Optimality is the core concern of the Verbotonal theory, as Guberina admits that:

*"The basic idea in my theory is the idea of optimality. In the broadest meaning of this word, it is a matter of accepting man who is in front of us as he is, without trying to inculcate in him stimuli from outside that he does not accept, but to look among his residual potential capacities, even if they are extremely limited, in order to construct a way that will lead us to the scope*

*we are aiming at, ...the learning of foreign languages and the reeducation of the hearing and speaking handicapped". (Guberina, 1989, p.8)*

By examining the qualities of the spoken language and how vocal-pitch change (intonation) adds meaning to conversational speech, he discovered that only a part of the elements that constitute the acoustic signal were linguistically relevant, which made it possible for the identification and integration of the whole message with a limited number of frequencies. Thus, Guberina argued that if it were possible to delimit and to isolate the really important elements of the acoustic signal (perceptive optimality), and to train the damaged ear in the identification of these elements or use alternatives if the damage was too severe, people with a hearing impairment would take an important step (Asp, 2006).

According to Guberina, the qualities of the spoken language witness the presence of the human individual. "To what extent we master space (in the particular situation), is to what extent we develop our senses, our speech and our personality." (Guberina, 1985, p.37) That is why in his acceptance speech on being inducted as "Officer of the (French) Legion of Honor" as the originator of the Verbotonal Method, Guberina re-emphasizes that "to the human speech, not language, for the problem is to deal with a living being in his real situation where speech is the result of his own being" (Guberina, 1989, p.8). Verbotonal theory shows that "teaching and the rehabilitation of speech and hearing includes working on hearing and speech activity ... involving the human being as a whole" (Lešić, 2012, p.60). In this regard, the Verbotonal theory sees the individual as both a perceiver and a producer of speech, and "If his perception changes, his speech will also change; if we have corrected his speech, we have corrected his perception" (Guberina & Asp, 1981, p1).

Since individual perception habitus (in Bourdieu's notion) is similar to a Sieve (in Trubetzkoy's notion) or a filter (in Guberina's metaphor), all information will be instantaneously filtered and biasedly selected based on his or her (unconscious) preferences. The individual's habitus is in charge of the result of perception as well as the way of perception, since one's speech is deeply rooted in one's operational history for categorizing and making sense of the world (Lian, 2014). The operational history, just as Guberina's metaphor of filter and Bourdieu's habitus, constructs the meaning-making system as well as the way of meaning-making based on one's previous meaning-making histories and experiences, or the history of being oneself. The preparative and selective nature of operational history makes learning to be a

process of continuous “confronting, contrasting, and contesting” (Lian, 2014) in which a constant self-adjustment and meaning making will take place.

With the application of Verbotonal theory and its principles, the Verbotonal Approach came into being. According to Guberina & Asp (1981, p.1), the main goal of Verbotonal approach is to maximize the listening skills of learners who are “deaf or hard of hearing”, while simultaneously develop good spoken language through stimulation. The condition of “deafness” can be thought of not so much as a physical deficit but as a different way of organizing audition. “To find the right way in any specialized field allows us to obtain sound results, and sometimes excellent results, among handicapped subjects considered as real cases, and even as serious ones.” (Guberina, 1989) In order to defeat one’s operational history and to nurture an optimal, profound, and lasting conditioning of audition, the way of perceiving language needs a change.

The residual potentiality, the capability that is not completely removed by a handicap, or by certain kind of deafness, provides the potential for more improvement under an optimal condition that the learner is most sensitive and could be best sensitized. Guberina’s idea of optimality is composed of two parts: one is “the optimal of age” (Guberina, 1989, p.12), the other is “through the procedures that are involved in the optimal of sounds and in the optimal of communication” (ibid). Man uses his mother tongue as a natural filter when he is perceiving sounds of another language. With the puberty of the brain and the myelination of the two hemispheres, the adult’s “mother tongue”, as a filter, interferes and masks the listening of the “ear” for a second language. In this case, the optimal age, or the Critical Period (Lenneberg, 1967) is no longer possible for the adults.

Then it should turn to the procedures that are involved in the optimal of sounds and communication: rhythm and intonation, and the whole body, among them rhythm and intonation are regarded as “the foundation of both listening and speaking skills” (Guberina & Asp, 1981, p.3), and “the whole body, not only speech organs and ears, takes part in the production and perception of speech” (Guberina, 1989, p.8). For Guberina, rhythm and intonation, as the critical elements of the target language that is better learned before the age of twelve, come to be the key issue for adults in learning a second language. Then the residual potentiality in adults provides them with the ability to feel, with limited effort, rhythm and intonation and the meaning being transmitted. For both rehabilitation of hearing and the learning of foreign languages, Guberina suggested a technique of low pass filtering which could

make rhythm and intonation more salient for auditory perception. Compared with the meaning transmitted by the non-filtered sentences, filtered sentences transmit only limited meaning.

It is worth mentioning the technique of low pass filtering and the low pass filtered audio signals that this technique brings. In the Verbotonal Approach, it is believed that rhythm and intonation transmit meaning, while the low frequencies transmit the rhythm and intonation. The reason for this is because the perceived pitch or tonality in language physically locates in the lower frequency region. Low frequency refers to the frequency range below 500 Hz, and in practice, for achieving low pass filtered audio signals, low pass filtering is conducted by removing the part above 320Hz through electronic filtering. In the Verbotonal Approach, lowpass filtering of sentences is used to make learners aware of the sentence's prosodic patterns (Guberina & ASP, 1981).

Low pass filtering of sentences could remove the interference of vowels and consonants and focus on the structural traits of the sentence, or the rhythm of the flowing spoken stream, which could decrease the pressure for analytical understanding of every piece in the sentence and make the prosodic factors, intonation and rhythm, more obvious. In such case, the efforts for understanding isolated word-level linguistic segments decrease, and the confrontation from the mother tongue habitus decreases. As it progresses, more frequency ranges could be employed, and more details could also be added. As the process goes on, learners can gradually produce more sentences in a more proper way.

As the perceiver and producer of speech, learners are encouraged to take advantage of the body's conduction capacity and muscular tensions to facilitate perception. Body movements, especially for infants, are the way to synthesize tempo and intonation in speech. Both the body (vestibular system) and the ear (auditory system) provide sensory information to the child's brain for processing and verbalizing speech, so both are an important part of the Verbotonal Approach (Guberina & ASP, 1981, p.13). No matter which system is involved, with optimals being provided, if one can perceive properly, one can produce properly.

To summarize, the principle of optimality in Verbotonal theory initiates the necessity for using optimals, the low pass filtered signals, to promote learner's language perception and production with respect to the residual potentialities in language learners. The low pass filtered signals can reduce the confrontation from the existing cognitive masks and facilitate perception, which provides the foundation for further development in learning the target language. To contextualize the

optimality principle into classroom language teaching, verbotonalists have achieved a great deal in their long journey.

### 2.1.2 The application and spreading of Verbotonal theory

In 1950s, Professor Guberina applied his auditory-based strategy for teaching foreign languages to improve the auditory perception of adults by providing low pass filtered audio signals and got significant success. Ever since the inception of the Verbotonal theory, it has been applied into the practice of learning foreign languages such as French and English. Lešić highly evaluated by putting that “Bearing in mind the complex dynamic structuration of language and speech, Guberina’s linguistic theory, within the elaborated procedures of the Verbotonal approach, permanently opens new types of practical application in teaching foreign languages, in the diagnostics and rehabilitation of hearing and speech, as well as in fundamental research in language and speech.” (Lešić, 2012, p.44)

Although the Verbotonal theory is revolutionary in language learning, it is not that influential ever since its birth, and there is a long-time hibernation until it is transplanted from Europe to Asia in recent years. In the Europe of the 1980s, Verbotonal theory was applied mainly in the correction of French pronunciation, with Andrew Lian’s research as representative of that activity.

In his book *Intonation Patterns of French (Teacher’s Book) (1980)*, Lian introduced Verbotonalism and performed it in the teaching of French pronunciation. He devised a pattern for the aim of sensitization and reinforcement of the students’ perception, and in doing so optimal situations were constructed to reinforce students’ perceptual and articulatory abilities. The sensitization session is primarily composed of 11 steps from “relaxation phase”, “audition of filtered sentences”, “repetition on a background of filtered patterns”, to “humming the patterns”, and “Repetition exercises”, etc. While the reinforcement session consists of 2 steps only, the “self-testing” and “sensitization and intensive practice” (Lian, 1980, p.3). The implementation of this pedagogical procedure under Verbotonal theory placed students in the optimal condition for acquiring the prosodic features of French by removing the interference of vowels and consonants and enhancing the correct auditory and articulatory habits.

By applying Verbotonal theory in a longitudinal study, Alazard, et al. (2010) investigated the positive influence of oral skills’ training on reading abilities for learners of French as a foreign language. Comparing with the control group where reading comprehension was focused, both acoustic and perception data indicate an improvement in reading fluency, especially for the beginner students within the

Experimental Group only, where phonetic correction and prosodic abilities were emphasized in using the Verbotonal Approach.

With the spreading of the Verbotonal theory, more studies and research have been carried out in East Asia since the beginning of the new millennium. In Japan, Hu & Uno (2005) developed a teaching method based on Verbotonalism to teach Japanese beginners learning the voice tones of Chinese. Results showed that this approach was useful for distinguishing and learning to pronounce voice tones, and students' performance on almost all tasks was significantly improved. Klein (2010) claims the Verbotonal Approach is a "comprehensive and effective Phonetic correction method in class" (p55) after his application of Verbotonal method in phonetic correction. In his article, Klein listed three ways to correct the pronunciation with principles of Verbotonal theory as guidance, namely the Prosodic correction (correction of rhythm and intonation), the Nuanced pronunciation (correction of phonemes), the Facilitating surroundings (correction of vowels). Klein expanded and applied the techniques in both French and English classes targeting the correction of individual phonemes' like /y/ in French and /ph/, /th/, /dh/in English.

Chinese scholars also contributed a great deal to research in the Verbotonal Approach. Hang (2012) implemented the verbotonal system in the teaching of Japanese to Chinese learners. Echoing previous studies, her findings again supported the effectiveness and usefulness of the Verbotonal Approach. More detailed research was undertaken by He Bi (2014) and Yang Yan (2016) in China.

In her unpublished doctoral dissertation, He Bi (2014) studied the effectiveness of the verbotonal system in the context of pronunciation teaching to Chinese university EFL learners. By combining a CALL-based (Computer-Assisted Language Learning) autonomous structure with the verbotonal system of corrective phonetics, 95 Chinese first-year English major students from two intact classes enrolled in a pronunciation course participated in the study. They were randomly designated as the control group and the experimental group. Both classroom and out-of-classroom activities were designed and carried out as pedagogical intervention. Results showed that the experimental group outperformed the control group in every part of the areas tested: phonemes, word-reading, passage-reading, and oral interview, even in pronunciation, comprehensibility and fluency that was rated by native speakers of English.

Yang Yan (2016) focused on developing the speaking skills and phonological working memory of Grade 3 (eight-year-old) Chinese children who are beginning to learn English. With the in-class sensitization and out-of-class

reinforcement sessions applied in the pedagogical intervention, results showed that in addition to the substantial improvement of phonological working memory, the experimental group advanced significantly in both overall speaking proficiency and individual tests: word-reading, sentence-reading, singing, oral interview as well as the five subskills: vocabulary, grammar, pronunciation, fluency and comprehensibility. What is more astonishing is that the students in the experimental group also “outperformed all the other 400 children in the provincial examinations which covered areas not explicitly taught in the experimental group” (Yang, 2016).

From the abovementioned studies, Verbotonal theory has pedagogically shown its value in foreign language teaching, both for phonetic correction and for speaking accuracy and fluency. However, the application of verbotonal theory could be more optimal if it is to take the neuro characteristics of the brain and the physical traits of the audio sounds into consideration. Additionally, it is also worthwhile to take adult learners like university students as the recipients of the verbotonal theory. Thus, with the inspirations brought by the optimality principle in Verbotonal theory, an alternative approach in the current study is proposed, it is the Neo Verbotonal Approach (NVT). In the next part, the construction of NVT is to be illustrated in detail.

## 2.2 Toward a neo verbotonal approach

It should be noted that one of the suggestions of Verbotonal theory is to stimulate the human brain during language learning, which entails the necessity for optimally integrating the brain into the pedagogical situation. Contrary to the previous verbotonal methods, the NVT approach focuses more on the optimization of the audio signals and the role of the brain in language learning.

The human brain, with the advent of neuroscience, has been examined to find the underlying language-brain relations through various approaches, from primitive split-brain observations to noninvasive brain scanning with the help of multiple high-end techniques, electroencephalography (EEG), magnetoencephalography (MEG), functional magnetic resonance imaging (fMRI), and near-infrared spectroscopy (NIS). Consequently, there is now enough evidence that each side of the brain, the left hemisphere or the right hemisphere, has its own functionality (Friederici, 2017, p.16).

### 2.2.1 Brain laterality

As Eric Lenneberg describes in his seminal work *The Biological Foundations of Language*, the brain is “a biological matrix with specifiable characteristics that determine the outcome of any treatment to which the organism is subjected” (Lenneberg, 1967, p.394), which makes it both as a “hard-wired” and hardly a “hard-

wired” mechanism (ibid). Plainly, the brain can change and adapt itself along with experience by reorganizing new pathways and creating new connections among neurons if it is necessary, which is the phenomenon of Neuroplasticity, an ability that makes the brain reshape its structures by reconnecting the neurons. As long as learning happens, new connections would be built. Thus, it is an ongoing process throughout life, which guarantees the possibility of learning new things at any age. It is safe to admit that the human brain provides the foundation for any learning and for knowledge transmission in generations of human being.

“The human brain is a grayish-pink, jelly-like ball with many ridges and grooves on its surface” (Danesi, 2003, p.22), which is the control center of the whole body, “constantly receiving information from the senses about conditions.”(ibid) On the one hand, the brain could analyze, synthesize, and make response to the information sent to it, while on the other hand, it could store, retrieve, and make connections among the information it has processed. These functions empower the human brain with unfathomable potential in learning, imagination, and creation.

Language is universal in human society, perhaps because of specialized brain organization. Human brain, anatomically and medically, is separated by a longitudinal fissure into two distinct cerebral hemispheres that are connected by the corpus callosum, the left cerebral hemisphere (LH), and the right cerebral hemisphere (RH). In physical size, “the right hemisphere is longer, wider, and generally larger as well as heavier than the left” (McGilchrist, 2018, p.21). However, in function, some neural functions or cognitive processes, with millions of years of evolution and their increased specialization (Odisho, 2014, p.35), are specialized to one side of the brain or the other, which is called the “functional lateralization of the brain” (Warren, 1977; Dean, 1984). The functional lateralization also asymmetrically influences language perception. There has been enough evidence showing that, for the brain, there is a clear asymmetry of function related to language (McGilchrist, 2019).

### **2.2.2 The left hemisphere**

It is widely known that damage that happens to certain parts of the brain would lead to a variety of aphasias, and this is the way the forerunning researchers got to know the language function in the brain, especially for its left hemisphere. As early as the 1860s, French neurologist Paul Broca identified that one’s speech would be disturbed when damages occurred to the frontal lobe in the left hemisphere, but not be disturbed by lesions in the right hemisphere. If one hemisphere comes to be more heavily involved in a particular task, it is said to be dominant (Bear et al., 2020,

p.695). So, the dominant left frontal lobe, a region Broca identified as critical for speech articulation, has come to be called Broca's area. In 1874, a German neurologist, Karl Wernicke, reported another region distinct from Broca's area in the left hemisphere, that lesions would also disrupt normal speech, and this region is now called Wernicke's area. The syndrome that brought by damage to these areas are called Broca's aphasia and Wernicke's aphasia, the former one sees that the patient has difficulty speaking or articulating verbally even though he or she can understand language heard or read, the latter one sees the patient's ability in speech articulation but poor comprehension. In the 1950s, a "supplementary area" (Danesi, 2003, p.28), which is involved in several functions previously thought to be restricted to Broca's and Wernicke's areas was discovered by the Canadian neurologist Wilder Penfield and his associates. With more than 100 years investigation concerning the left half of the brain, a consensus was reached with accumulated evidence that "the left hemisphere controls speech in most people" (Bear et al., 2020, p.708) and "The left hemisphere was chock full of speech and language processes. While the right seemed mute and language impoverished." (Gazzaniga, 2015, p.72)

### **2.2.3 The right hemisphere**

Ever since the identification of Broca's area and Wernicke's area, scholars have to know that "language is usually not handled equally by the two cerebral hemispheres" (Bear et al., 2020, p.706). Compared to the continuous attention focused on the left hemisphere, the silent right hemisphere did not attract the same attention, which does not mean it knows nothing of the language. The dominance of the left hemisphere was not challenged until the 1960s when Sperry and Gazzaniga made their discovery based on the behavior of split-brain patients, the people "who had had their two hemispheres separated by a surgical section of the corpus callosum in order to attenuate the seizures they tended to suffer" (Danesi, 2003, p.35). Functions of individual hemispheres in split-brain patients were examined under a series of studies by Sperry and his associates and they found that the right hemisphere did have the capacity for reacting correctly to simple spelling, printed words, and occasionally written words (Gazzaniga, 2015, p.58) even though they also admitted that complex linguistic functions pertained to the left hemisphere (Sperry, 1969).

Sperry abandoned the widely accepted concept of left hemisphere dominance and managed to balance the two hemispheres that "Each brain half appeared to have its own, largely separate, cognitive domain with its own private

perceptual, learning, and memory experiences, all of which were seemingly oblivious of corresponding events in the other hemisphere.” (Sperry, 1982, p.1224) It is safe to say that each hemisphere has its own advantages in function. In the following decades, balance between the two hemispheres was gradually achieved with more discoveries concerning the right hemisphere's function. Blumstein and Cooper found that “damage to the left hemisphere does not seem to significantly affect the perception of the prosodic features of language” (Blumstein & Cooper, 1974, p.156) and “the right hemisphere is more efficient in processing intonation contours than the linguistically specialized left hemisphere” (ibid). Paradis (2004) also pointed out that the right hemisphere was to process the information holistically and nonverbally and lesions in the right hemisphere would cause difficulties in processing languages with connotative meaning, metaphor, emotion and humor. Gainotti concludes in his study that the right hemisphere plays “an important role in the use of higher-level language functions, such as metaphors, to convey complex, abstract concepts” (Gainotti, 2016, p.72).

A more thorough summary for the function of the right hemisphere is made by Roger Sperry who summarized his points in his 1981 Nobel lecture that the right hemisphere was capable of “reading faces, fitting designs into larger matrices, judging whole circle size from a single arc, discrimination and recall of nondescript shapes, making mental spatial transformations, discriminating musical chords, sorting block sizes and shapes into categories, perceiving wholes from a collection of parts, and the intuitive perception and apprehension of geometrical principles.” (Sperry, 1982, p.1224) To add more for seeing in cerebral asymmetry as neurological basis for a fundamental dichotomy in human thought, Sperry added that “The parallel mental functions of the separated hemispheres are found to differ further in important ways, the most conspicuous being that the disconnected left hemisphere retains the ability to speak its mind, much as before, whereas the right hemisphere, for most practical purposes, is unable to express itself either in speech or in writing.” (Sperry, 1984, p.661)

Historically, there is a focus shift from the left hemisphere to the right hemisphere in which Roger Sperry’s studies concerning split-brain patients play an important role. Sperry demonstrated the right hemisphere was not inferior to the left.

There is indeed a striking asymmetry in hemispheric function. Levy (1969) proposed that left and right hemispheres are characterized by inbuilt, qualitatively different and mutually antagonistic modes of cognitive processing, the left being

basically analytic and sequential, the right spatial and synthetic. Sperry added that “The right-hemisphere specialities were all, of course, nonverbal, nonmathematical, and nonsequential in nature. They were largely spatial and imagistic, of the kind where a single picture or mental image is worth a thousand words.” (Sperry, 1982, p.1225) Much past work has focused on the polarization between the two hemispheres, often resulting in two lists of characteristics showing at each side in one same image.

By referring to McGilchrist’s works like *Ways of Attending: How our Divided Brain Constructs the World* (2020), and *Meaning is not in things but in the betweenness* (2016), the distinctive traits of the two hemispheres can be summarized and illustrated in the Table 2.1 and 2.2.

**Table 2.1 The Left Hemisphere’s View of the World**

The Left Hemisphere’s View of the World	
● Focus on the familiar	The familiar and known are more important than the new. Attention is narrowly focused.
● Focus on precision	Quantification, repetition, categorization, division, fixity and precision are valued. Emphasis on parts, detail and predictability. Knowledge is fixed and certain.
● Focus on the abstract	Things are seen abstracted, isolated, from context. Views progress as linear and values sequential analysis.

From Table 2.1, the left hemisphere tends to have more focused attention and ready to interpret and categorize what it perceives into its abstract internal logical and representational system that built along its own operational history in cognitive experience. It also wants to seek more confidence in isolating divided details whereby more attention would be put on more concrete and precise aspects to achieve more accuracy and fixity. All the information that goes to the left hemisphere would be analytically checked in detail, abstracted into categories, integrated into its own system, and stored for further retrieving.

**Table 2.2 The Right Hemisphere’s View of the World**

The Right Hemisphere’s View of the World	
● Focus on the new	The implicit and hidden are more important. Attention is narrowly focused. Process Knowing is a reciprocal, reverberative, emergent process, not fixed or certain. Sees things as a connected whole, a net of interdependencies, a flowing structure that changes over time.

Table 2.2 The Right Hemisphere's View of the World (Cont.)

The Left Hemisphere's View of the World	
<ul style="list-style-type: none"> <li>● Focus on uncertainty</li> </ul>	Tolerance for ambiguity. Appreciates paradox, self-doubt and uncertainty. Values the ability to change our minds. Embraces 'both/and' thinking.
<ul style="list-style-type: none"> <li>● Focus on the realistic</li> </ul>	Recognizes the primacy of experience and sees everything in context. The way of being in the world is embodied rather than conceptual.

While for the right hemisphere (see Table 2.2), comparatively, it is always open for contextually new and unfamiliar patterns that need a holistic recognition in which the flowing and process is more important. The right hemisphere would tolerant and reduce the information that would interrupt its judgment on a certain uncertain pattern. Based on a series of investigation, Bogen put his well-known conclusion that "...Whereas the left hemisphere was rational, analytic, and logical, the right hemisphere was emotional, holistic, and intuitive." (Cited in Michael Corballis, 2012, p.8)

Parallely speaking, "the left hemisphere reasoned sequentially, excelled at analysis, and handled words. The right hemisphere reasoned holistically, recognized patterns, and interpreted emotions and nonverbal expressions", which are the two different modes that the brain works, called by Sperry and Bogen as the L-Mode (Left Hemisphere Mode) and R-Mode (Right Hemisphere Mode) as it is illustrated in Table 2.3 (cited in Danesi, 2003, p.35).

Table 2.3 The L-Mode and R-Mode

Modes	L-Mode	R-Mode
Hemispheric Specialization	<ul style="list-style-type: none"> <li>• major speech subsystems (pronunciation, grammar, etc.)</li> <li>• literal meaning</li> <li>• sequential relations</li> <li>• verbal memory</li> <li>• logical thinking (deduction, induction, etc.)</li> <li>• abstracting and generalizing</li> <li>• analysis and linear thinking</li> </ul>	<ul style="list-style-type: none"> <li>• intonation and other prosodic subsystems</li> <li>• metaphorical, and emotional meaning</li> <li>• spatial relations</li> <li>• nonverbal memory</li> <li>• intuitive and spatial reasoning</li> <li>• concretizing and associating among things</li> <li>• synthesis and multiple thinking</li> </ul>

Based on the abovementioned two parts, there was a shift in attention that paid to the two hemispheres of the brain, i.e., the left hemisphere got focused initially and then the right hemisphere got the same attention from neurologists. With more focus laid on the hemispheric specialization of each side of the brain, both hemispheres have got full attention.

However, as more scholars joined in and more investigation conducted, the relationship between the two hemispheres also has got renewed, i.e., there are both hemispheric specialization for each side and hemispheric complementation between the two sides, as the forthcoming part illustrates.

#### **2.2.4 Hemispheric specialization and hemispheric complementation**

In terms of the relationship between the two sides, it was formerly speculated that “the two cerebral hemispheres would compete, and on any given trial, one won” (Bear et al., 2020, p.707). However, with more research being conducted, it is clearly shown that the two hemispheres are just different, and in a certain task, either side may dominate due to the functional asymmetry while at the same time cooperate smoothly with the other side. It is more appropriate to regard the brain as a well-organized organ that could function both asymmetrically and cooperatively between its left and right hemispheres.

In his book *Principles of Psychopathology: Two Worlds, Two Minds, Two Hemispheres* (Cutting, 1997), John Cutting, by reviewing the literature on cerebral hemisphere differences, proposes his conclusion that each hemisphere contains sufficient mental functions to allow it to interact independently with the outside world. Neither side is subordinate to the other concerning the things it constructs or represents in the world. The different versions of the world represented by the two parts are valuable, and each side feels authentically in touch with what is real (Cutting, 1997). “It therefore follows that the hemispheres need to co-operate.” (Sinason & Richards, 2014, p.317)

Same as Cutting, McGilchrist, a consultant psychiatrist, in his newly expanded masterpiece: *The master and his emissary: The divided brain and the making of the western world* (McGilchrist, 2019), a book provides “a profound examination” (as Phillip Pullman puts in the Cover of the book) of different traits of each hemisphere, claims that “the world we know is synthesized from the work of the two cerebral hemispheres...Each has its own fundamental sets of values, or priorities, and each needs the other for different purposes” (McGilchrist, 2019, p.12). It should be noted that the distinctions between the left hemisphere and right

hemisphere are not completely clear-cut as they just represent significant tendencies rather than absolute compartmentalization.

Bogen (2000) renewed his idea that normally the two cerebral hemispheres work in parallel, but with crossover influence on each other. Danesi also points out that “both hemispheres, not just a dominant one, were needed in a neurologically-cooperative way to produce complex thinking abilities.” (Danesi, 2003, p.35) It is not the issue of either left OR right but left AND right because there is “no simple segregation of language to the left hemisphere, but a separation of functional components between the hemispheres” (Mitchell & Crow, 2005, p.972). The functionally analytic hemisphere and holistic hemisphere in the brain may contribute to linguistic perception and production in one’s language learning.

Thus, for language learning, as a parallel processor, the two hemispheres of the same brain would naturally work together with respect to each side’s advantage. McGilchrist (2019, p.69) adds that “in almost every case, what is new must first be present in the right hemisphere, before it can come into focus for the left...the learning of new information or new skills also engages right hemisphere attention more than left, even if the information is verbal in nature. However, once the skills have become familiar through practice, they shift to being the concern of the left hemisphere.” Thus, with different favorable tendency for each side, the right hemisphere is more sensitive to new experiencing information and left hemisphere is more sensitive to analytical information, as Danesi posits that “New notions and structures are learned more efficiently when the learner’s brain is allowed to process it in terms of an R-Mode (experiential) to L-Mode (analytical) flow.” (Danesi, 2003, p.50) “RH to LH flow”, named by Danesi as “The Modal Flow Principle” (Danesi, 2003, p.50), is the ultimate tendency of the whole interactional process within the brain in spite of the continuously dynamic exchange and cooperation between the two sides. With this belief in mind, this study seeks to construct a new method that could make use of each hemisphere by considering its functions.

To summarize, the brain, as an organ of highly adaptable and plastic qualities, is critical for language acquisition. Thus, “Teachers should transform the knowledge of brain science into practical teaching methods to activate students’ left and right hemisphere. They should also integrate students’ hearing, vision, memory, emotion and reason to help students acquire a foreign language much easier.” (Gao, 2017, p.246)

It is due to the remarkable difference within the two hemispheres and the inseparable collaboration of them, conditioning each individual hemisphere in an

appropriate way may help enlarge their individual advantages, either focused or broad attention, analytic or holistic perspective, rigidity or flexibility, etc. With respect to the hemispheric characteristics, it is believed that for the same language source, something new, flexible, contextual should be sent to the right hemisphere, while something familiar, fixed, concrete, and highly detailed should be sent to the left hemisphere.

### **2.2.5 Auditory input form and the Brain Laterality**

Language is in fact composed of physical sounds. In this present study, the Neo Verbotonal Approach is trying to make both modified signals and feeding mode optimized for each hemisphere, and the first and foremost attention should be placed on the physical quality of the input signal, or the form of the input. Ideally, proper input may bring expected output.

The mother tongue phonological system allows the speaker intuitively to accept the familiar aspects of the sound system in a new language and reject the others, which is metaphorically described as “phonological sieve” by Trubetzkoy (1939). Philipp Botes (2015, p.81) points out that “In order to speak a foreign language well, we must be able to tune into the sounds of that language.” However, the physical aspects of sound are of less concern in the traditional classroom teaching models of “Focus on form” and “Focus on forms”.

Centering on the degree of attention paid to linguistic elements, Long’s (1988, 1991) proposal divides classroom instruction into two types as “Focus on form” and “Focus on forms”, within which the former’s “overriding focus is on meaning” (Long 1991, p. 45–6) with “an occasional shift of attention to linguistic code features” (Long & Robinson, 1998, p.23) while the latter’s focus is on “formal aspects” (Carter & Nunan, 2001). Ever since the two terms were coined, plenty of discussion has occurred concerning the application and comparison of the two approaches. However, discussion concerning form, or “formal aspects” seems much less than other aspects because it is easy to refer form to what is intensively taught in the traditionally structural class, such as grammar. Ellis expands the contents of form and posits that “The term ‘form’ is intended to include phonological, lexical, grammatical, and pragmalinguistic aspects of language” (Ellis, 2001, p.2). Jessica encourages that the understanding of form should “not be limited to these kinds of items” (William, 2005, p.673) and it can be viewed more broadly based on the fact that “language is treated as an object rather than exclusively as a tool for communication” (Ellis et al., 2001, cited in William, 2005, p.673).

Objectively, language exists in the form of speech signal, or sound form. Only when intended speech signal is perceived, discriminated, and understood can it bridge meaningful communication between interlocutors. With thousands of years of evolution, human language has empowered speakers with the ability to produce a minimum amount of effort to achieve the maximum result, it is to say, infinite stretches of meaning could be generated with finite speech signal, or sound units in phonology. All the information, whether it is acoustic, phonological, syntactic, or semantic, could be compressed in the limited length and fluidity of sound flowing. Thus, sound is first and foremost significant for each language and the distinctive sounds in each language make speaking that language a sound-specific articulating issue and learning to speak that language as second or foreign language a process of exotic experience of sound perception and production.

The sound form in each language differs in a big scale, both phonetically and phonologically. Phonetics, as explained in Collins English Dictionary (2014), is the branch of linguistics that deals with speech sounds and their production, perception, description, and representation from both acoustic and physiological point of view, which technically excludes linguistic considerations. Phonetics “provides a valuable way of opening our ears to facets of language that we tend to understand by reference to their written rather than their actual spoken forms” (Delahunty & Garvey, 2010, p.89). In phonetics, there is a distinction between the physically actual spoken forms, that of observable and measurable physical parameters, and the abstract linguistic forms, a set of representational system in an attempt to describe and explain the observed data (Hirst & Di Cristo, 1998, p.4). This study prefers the former ones, the acoustic forms.

The physically acoustic forms of language, such as fundamental frequency (F0), intensity, duration and spectral characteristics, are cognitively perceived as forms of pitch, loudness, length and timbre, that of prosodic terms in phonology. Phonology, contrary to the study of physical level of speech signal in phonetics, is about differences of meaning signaled by sound (Ken Lodge, 2009) and studies the sound units in a language and the sound patterns they formulate. The meaningful sound patterns can be structured into segmental properties, that of vowels and consonants, and suprasegmental properties (interchangeably used with prosody) including stress, pitch, loudness, rhythm, intonation (Chun, 2002, p.4).

The distinction between phonetics and phonology is not sharply clear in a certain case. However, it is widely accepted that phonetics studies speech sounds as sounds while phonology focuses on the abstract rules of sounds independent of

their physical realization in speech. Both branches are centered on the description of the sound system in human language, physically or abstractly.

The connection between the physical and abstract forms of speech is quite straight. Grice and Baumann (2007, p.2) illustrate how acoustic, perceptive, and even articulatory counterparts correlate to each other in the Table 2.4.

The triangular relationship of “Sound—Perception—Articulation” reflects the interaction among the factors that are related to language learning and speaking, whether it is for L1 or L2. Sound is both the starting point and the ending point in the circle within which it is necessary to perceive the sound before one can produce, and it is essential to perceive the physical acoustic forms before understanding the linguistic meanings in communication.

**Table 2.4 The counterpart of acoustics, perception, and articulation**

Acoustics	Perception	Articulation
fundamental frequency (F0) measure: Hertz (Hz)	pitch perceived scale: high – low	quasi-periodic vibrations of vocal folds
Intensity measure: decibel (db.)	loudness perceived scale: loud – soft	articulatory effort, subglottal air pressure
duration of segments measure: millisecond (ms)	length perceived scale: long – short	duration and phasing of speech gestures
spectral quality measure: formant values in Hz	vowel quality perceived scale: full – reduced	vocal tract configuration, articulatory precision

Each language has a distinct sound system which would bring a kind of deafness to the non-native speaker. Even though the audio spectrum range human being can hear spans broadly from 20 Hz to 20,000 Hz, practical speech usually falls within the 100 and 8000 Hz range. Different languages only make use of selected narrow ranges which make them remarkably distinct from each other in sound frequencies as illustrated by Table 2.5 (Mauleetal 2007, cited in Philipp Botes 2015, p.81).

The ear is normally receptive to a wide range of sound frequencies and can detect a variety of rhythms. During development, however, the ear adjusts to a way of hearing that is conditioned by its mother tongue. For SL/FL learners, because they have got used to the speech frequencies of their mother tongue, it would be difficult to perceive the signal in the new semiotic system. Taking English learners in China as examples, the native speakers of Chinese need to jump from their familiar

frequency range below 1800 Hz to the unfamiliar frequency range above 2200 Hz, which would be quite a challenge both auditorily and articulatorily.

**Table 2.5 Language sound frequencies**

Herz	125	250	500	1000	1500	2000	3000	4000	12000
German									
Italian									
Spanish									
French									
English (GB)									
Chinese									

Basically, the phonological information like rhythm, intonation, and other prosodic features can be found in sound waves, thus the technical treatment happens to sound wave would bring change in the phonological information transferred by it.

Taking low-pass-filtered sentence for example, by removing the part above 320Hz through electronic filtering, the remaining “rumbly” flow of the sentence preserves the intonation and rhythm and eliminates the sounds of vowel and consonant, which makes the global shape of the sound flow (the part of prosody) more salient while the detailed sound features and linguistic meaning more reduced. The filtered sentences could preserve the intonation contours and the speech-like quality, while render the words and most phonetic information unintelligible. Filtering could be regarded as a load-lightening measure, through which only the “relevant frequencies” or part of features of a sound are allowed to remain. The low-pass-filtered sentence could make intonation and rhythm pattern more salient.

Neurolinguistic studies have shown that the suprasegmentals are more favored by the right hemisphere while the segmentals are more favored by the left hemisphere.

As early as in the 1960s, there had been confirmed a right ear advantage (REA) for verbal stimuli such as real words, real or synthetic nonsense syllables (Shankweiler & Studdert-Kennedy, 1967; Kimura and Folb, 1968), and a left ear advantage (LEA) for prosodic aspects such as pitch contours, and emotional tones (Kimura, 1964; Curry, 1967; Spellacy, 1970). The connection between LEA and right hemisphere, or REA and left hemisphere, is explained by Kimura (1961, 1967) as a structural issue of brain organization that “the auditory pathways from sensory organs to processing areas are to a larger extent contralateral than they are

ipsilateral”, which is physiologically a “nerve connection” fact. Thus, the REA and LEA and their preferential factors in language could exhibit the hemispheric preferences in the brain.

In 1974, Blumstein and Cooper had found that the right hemisphere is directly involved in the perception of intonation contours or prosodic features since prosodic information is mainly encoded in the intonational contour. In their study, five tasks were conducted using the technique of dichotic listening. Dichotic listening method was firstly invented by Broadbent (1956) and refined by Kimura (1961), and it is to present simultaneously two auditory stimuli to both ears for exploring the hemispheric lateralization in the intact normal human brain, which is noninvasive and need not to surgically split a brain. From the five dichotic listening tasks, all participants showed a consistent left ear superiority in intonation contour perception. In the study, different intonational sentences, declarative, interrogative, imperative, conditional, are randomly sent to the participants in dichotic mode and only one single stimulus should be reported from them for baseline matching. The consistent LEA in Blumstein and Cooper’s study (1974), on the one hand, challenges the former presumption that anything linguistic is a function of the left hemisphere due to its language dominance, and on the other hand, does provide a possibility that the intonational aspects are not necessarily processed in the same way as other linguistic components in speech signal.

Since the 1970s, more and more evidence could be found in supporting LEA or right hemisphere superiority in dealing with intonational cues. Additional evidence concerning hemispheric preferences comes from studies related to the structure and function of auditory cortex in the brain. Zatorre, Belin, and Penhune’s study (2002) shows that the primary auditory cortices in both hemispheres could respond to speech and tonal pitch, speech sounds and musical tones, but they have their computational preferences that the left primary auditory cortex reacts specifically to speech sound characteristics, the right to characteristics of tonal pitch. They also proposed in their conclusion that “relatively subtle quantitative differences in neural response properties early in the cortical processing stream can lead to qualitatively distinct functional roles.” (Zatorre et al., 2002, p.44) which entails the significance in the hemispheric preferential.

More advanced neuroimaging techniques have also been used in locating the functional regions in the brain. Accumulated evidence has been found that the REA and LEA related cortex in speech perception are asymmetrically distributed in their corresponding brain regions, separately, the REA is associated with the parts on

the left hemisphere, the mid- and posterior-superior temporal gyrus, the superior temporal sulcus, while the LEA is associated with the parts on the right hemisphere, especially the anterior superior temporal sulcus (Liebenthal et al. 2005; Indefrey & Cutler, 2004; Levy et al. 2003; Kriegstein & Giraud, 2004).

Friederici, a specialist in neurolinguistics, has contributed her mountainous efforts since 1990s, as Chomsky praised that “Friederici’s impressive study is indeed comprehensive, covering a rich range of experimental inquiries and theoretical analyses” (2017: IX, Foreword for Friederici’s *Language in our brain: The origins of a uniquely human capacity*). In 2011, Friederici made her thorough review in terms of the cognitive process in the brain activated by input signals under neuroimaging and proposed her “Model of auditory sentence comprehension” (Friederici, 2011, p.1377), as illustrated in Figure 2.1.

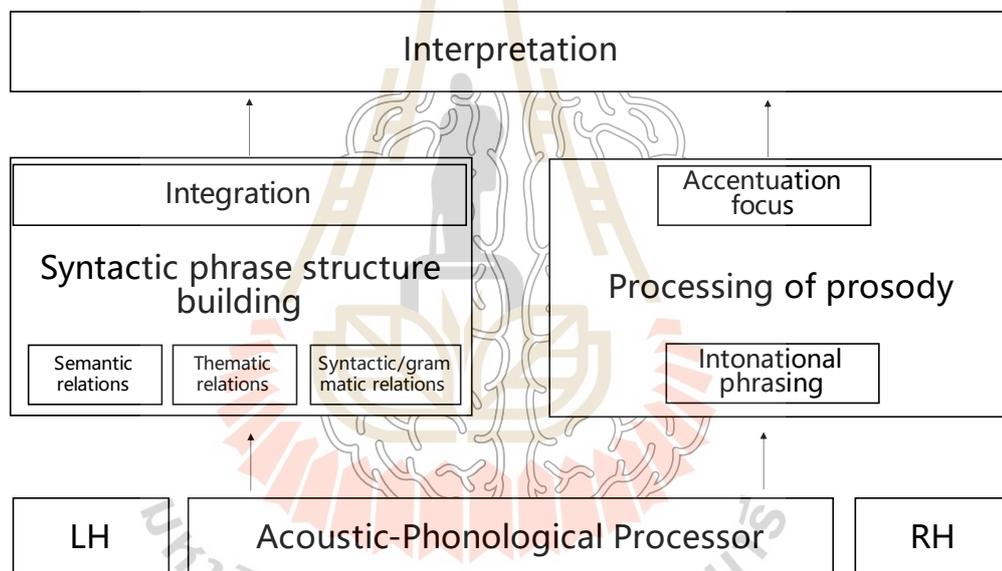


Figure 2.1 Model of auditory sentence comprehension

Friederici later in 2017 explains in detail about the different processing stages from auditory input to interpretation. The Acoustic-Phonological phase is the initial stage of signal input where both hemispheres would participate. “Output of this initial process is then further processed by the left hemisphere and the right hemisphere according to their specifications—segmental sounds in the left hemisphere and suprasegmental parameters in the right hemisphere.” (Friederici 2017, p.16)

The process in the left hemisphere has three sub-processing stages for dealing with semantic and syntactic/grammatical information, and then the processed

information would be integrated and interpreted into the existing knowledge. At the same time, two sub-processing stages are taking place in the right hemisphere to deal with two separate aspects of prosodic information in speech, one is sentence melody and intonation, which can signal the beginning or end of a phrase in a sentence, the other is the processing of accentuation relevant for thematic focus. “During auditory speech comprehension, the different subsystems within one hemisphere (as well as across the two hemispheres) work together to achieve smooth comprehension.” (ibid)

Friederici’s auditory sentence comprehension model shows a full image that both hemispheres would work simultaneously in parallel and in cooperation in auditory perception. Both segmental sounds and suprasegmental parameters would be processed in the favoring hemispheres with respect to their functional specialization. Although Friederici admitted that not all cases could be explained by this model with the considerable heterogeneity among subjects, it is a model based on empirical data and subject to more changes based on new data (Friederici, 2011, p.1385).

### **2.2.6 The Neo Verbotonal Approach**

As the abovementioned studies presented, corresponding to the REA and LEA, the left and right hemispheres of human brain would work preferentially in processing the auditory signals, that is, the suprasegmental prosodic information is processed predominantly in the right hemisphere while segmental and grammatical information in the left hemisphere. Guided by the optimality principle of the verbotonal theory, possible measures may be taken to make the input signals optimized according to the hemispheric advantages or the REA and LEA, which may raise the learners’ perception and hence improve their verbal production. An assumed new model of language input comes into being thanks to the innovation of dichotic listening method and the application of low pass filtering technique.

Dichotic listening method, as mentioned in the previous part, invented by Broadbent (1956) and refined by Kimura (1961), could make it technically practical in feeding each ear the favored signal. In this way, a kind of optimality could be achieved only if the signals carrying prosodic features are sent to the left ear (right hemisphere) while segmental and grammatical signals to the right ear (left hemisphere). Along with this expectation, another optimality could then be achieved with the help of low pass filtering technique, which has been illustrated in previous part (see 2.1.1). Low pass filtering technique, frequently used by verbotonalists,

could preserve the prosodic features by removing the interference of vowels and consonants.

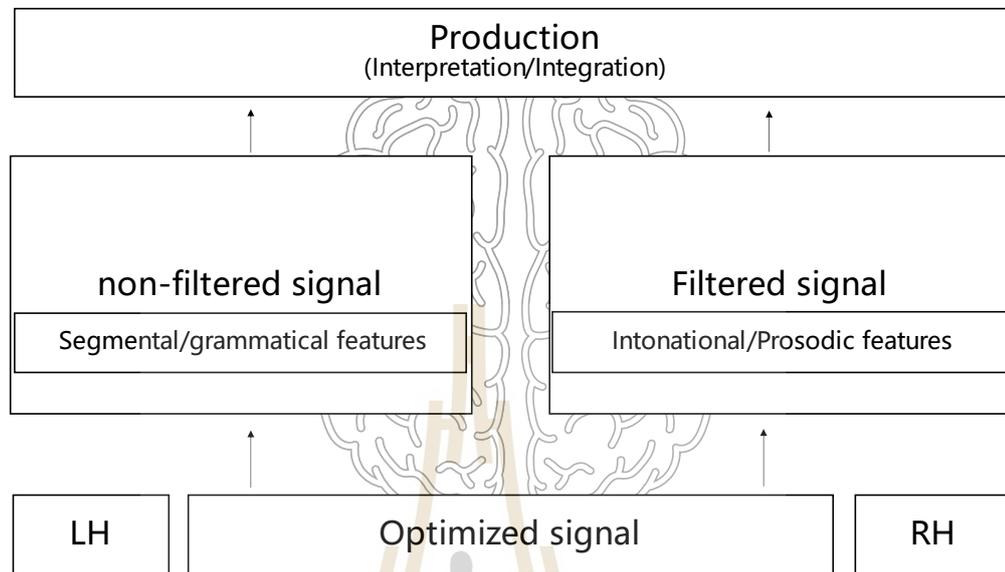


Figure 2.2 An improved model of auditory sentence comprehension

With the application of both techniques, the optimized signal could then be optimally sent to the favored side of the brain, i.e., the filtered signal to the RH while the unfiltered to the LH. The optimality principle could be achieved in the optimized feeding mode, both in terms of the brain lateralization and signal preference, which can be illustrated in Figure 2.2 based on adaptation of Friederici's model.

In combination with Verbotonalism and the neurologically divided brain concepts, this study constructs an optimized dichotic listening model. The new auditory feeding mode provides a possible brain-compatible condition for foreign language learning, and it is expected that the optimal input to the optimal hemisphere of the brain would entail and achieve an optimal perception and production. In this thesis, the application of this new model in EFL learning is called the Neo Verbotonal Approach (NVT), which is ORIGINALLY the brainchild of Prof. Andrew Lian.

Compared with the former verbotonal approaches, the Neo Verbotonal Approach focuses more on making use of the auditory system in stimulating the brain than the vestibular system that needs more body movement. The body movements in a classroom may not be that easy to do in a comfortable way if it is too crowded, especially for the populated Chinese classes. Moreover, the former

Verbotonal studies paid more attention on feeding both ears with the same filtered signal without considering the hemispheric lateralization in the brain, and most of the former studies are targeting at one aspect of speaking, especially, pronunciation correction. In this thesis, it is expected to enhance language learner's linguistic production when they are situated in the newly and optimally constructed condition, the Neo Verbotonal Approach.

## 2.3 NVT and Speaking Skill

The ultimate purpose of the present study is to explore the effectiveness of the newly proposed brain-based verbotonal approach in improving the speaking skill of the Chinese university EFL learners. It is necessary to make a brief review of the concept of speaking proficiency and its components.

### 2.3.1 Speaking Skill

Broadly, the concept of language proficiency is interchangeable with language skill in conceptualization in the EFL field and is still open for more specification. Even though arguments still exist, there are commonly accepted four components of language proficiency or language skills, including Listening, Speaking, Reading, and Writing (Hulstijn, 2011). Speaking is usually regarded as the most challenging one among them (Pawlak, Waniek-Klimczak, & Majer, 2011). However, the questions, how to improve EFL learners' speaking skill, what dimensions should be included, and how to assess the improvement of speaking, have long been in arguments.

Firstly, in order to facilitate students in the speaking learning, different approaches, whether old-fashioned or updated, have been proposed and applied.

Along with the evolvement of ideology from the behaviorism, cognitivism, to constructivism, and the application of their distinct principles, there were multiple approaches emerged, to name a few, such as the audiolingual method under the behaviorism, the communicative method under cognitivism, and the computer assisted learning under the social constructivism. "Each of these approaches has made important contributions to second and foreign language teaching and learning" (Matamoros-González et al., 2017, p966). As times change and techniques develop, language learning has now become a practice for any person who wants to communicate cross-culturally at their own will and needs by using whatever tools they can access to, computer or cellphone. Thus, to illustrate the changes, a brief comparison is made here by taking the previously prevailing audiolingual method

and the recently-developed computer assisted language learning (CALL) method as examples.

The audiolingual method was proposed by American linguists in 1950s. It considered language learning simply as form of behavior to be learned through the formation of correct speech habits (Larsen-Freeman, 2000; Thornbury 2000; Dendrinos, 1992) and good habits were formed by giving correct responses rather than by making mistakes (Richards and Rodgers, 2014). In practice, the audiolingual method stressed to imitate native language through dialogues. As Mart (2013) summarized, a general process in a typical audiolingual class is like this: 1) The teacher reads a dialogue by modeling it, 2) Students repeat the dialogue, 3) Some words or phrases are changed or substituted in the dialogue. By modelling the teacher and by repeatedly imitation, in the end, students may be able to memorize the dialogue and use the patterns in a similar setting.

This method has long been criticized as teacher-centered (Djauhar, 2021; Mei, 2018) since teacher dominates the teaching process and hence plays an active and central role. Students need only to passively follow the models according to the teachers' instruction without considering whatever their own ideas are. This mechanical training process is also in favor of structural linguistics rather than other factors that related to the society, culture, and communication. Too much attention to the mechanical training of linguistic elements and ignorance the content and meaning may make students fail in applying what they have learned. Moreover, from the perspective of the students, the audiolingual method was sometimes thought to be boring and frustrating due to the extensive memorization, repetition, and over-learning of patterns (Alemi and Tavakoli, 2016). As the passive learners, students could not control the learning materials as well as the learning process. Thus, the audiolingual method is still arguable in EFL field even though it may have "had a greater impact on second and foreign language teaching than any other method" (Nunan 2000, p.229).

In recent few decades, along with the development of the information and communication technology (ICT), computer assisted language learning has been widely used in EFL field because it is helpful to provide a learner-centered and personalized learning context as well as to promote learner autonomy, engagement, and interaction (Fischer, 2007; Ozawa, 2019; Pennington & Rogerson-Revell, 2019; Perks & Warchulski, 2019). In contrast with the abovementioned audiolingual method, the learners in CALL are able to "control the learning pace and select what must be learned and in what ways they can learn it, which, in turn, causes them feel more

confident in learning” (Vahdat & Eidipour, 2016, p1609). As for speaking, learners can make use of the latest technologies and tools to join in a speaking activity by exchanging text, sound, and video in various formats with its own affordances. The application of CALL has proved to be largely effective in improving speaking. For example, the study conducted by Rizkiani et al. (2023) showed that CALL was capable to improve learners’ speaking skills, promote motivation, activate the learners, and make English learning interesting. Hashemifardnia et al. (2021) examined Massive Open Online Course (MOOC) in enhancing the Iranian EFL learners’ speaking proficiency, and the results showed that the experimental group outflanked the control group in all the three aspects (accuracy, fluency, complexity). However, there were also certain demerits in CALL, such as the inexperienced organization of the materials, the casual instability of the learning software, and the cost in accessing to the online or offline information (Hanafiah et al., 2022). Meanwhile, as James once reminded, CALL was not merely to use computer but to “integrate these technologies within methodologies recognized by the profession as being appropriate to particular pedagogical goals” (James, 1996, p20). Anyway, marked by the interaction between students and materials through internet technology, the existence of programmed teaching, and flexibility in the process, CALL is still one of the focuses in the field of English education and more explorations are needed.

Secondly, accuracy and fluency are the most prominent dimensions in evaluating speaking, and they are commonly regarded as exclusive to each other.

Influential models related to speaking proficiency have evolved for decades, from Adams’s (1980) two layered structure, “overall global proficiency” plus “5 subskills”, to De Jong et al.’s “various linguistic skills” (De Jong et al., 2012, p.10) which contains declarative knowledge (vocabulary and grammar), processing skills (lexical retrieval and phonetic encoding) and pronunciation skills (quality of speech sounds, word stress, and intonation), and to a recent stratified multi-componential model proposed by Ockey and Li (2015), which includes the interactional competence and individual skills of phonology, grammar and vocabulary, and fluency. The inconsistency in understanding entails a number of discrete constructs in speaking proficiency.

In the past three decades, the most influential construct about speaking proficiency is the CAF model: Complexity, Accuracy, and Fluency (Ellis & Barkhuizen, 2005; Norris & Ortega, 2009). The CAF model has long been applied both pedagogically and theoretically as an analyzing structure in exploring the variation in

language learners' L2 skills, speaking or writing, under the interference of certain independent variables.

In the present study, Complexity, due to its written language preference (Miller & Weinert, 2009) and advanced speaker inclination (Skehan, 2009, p.510), is less discussed, and the focus is on accuracy and fluency. The two factors, oral language rather than the written form as the focus, and the pre-intermediate level of the targeted participants, together excluded Complexity from the present study.

### 2.3.2 Defining accuracy and fluency

Accuracy, less arguable than fluency, is in fact not that easy to define. Most notions would take error-free, norm compliance, or rule conformity as the explanation of accuracy. Many researchers would like to interpret accuracy literally into more error-making indicates less accuracy and make their justification in this trend. For example, there are Foster and Skehan's (1996) "freedom from error", Ellis's (2008) "the ability to avoid error in performance", and Housen and Kuiken's (2009) "the ability to produce error-free speech". On the contrary, errorless language means more norm and rule abidance, examples like Hammerly's (1991) "the degree of deviancy from a particular norm", Skehan's (1996) "how well the target language is produced in relation to the rule system of the target language", Nation's (1999) "how closely learners' language resembles accepted standards", Pallotti's (2009) "the degree of conformity to certain norms", Housen et al's (2012) "the extent to which an L2 learner's performance deviates from a norm". Due to the nature of norm or standard is in essence a matter of socially shared subjective judgement, accuracy could be generally understood as the extent of code control (Hammerly, 1991, p.12), or error avoidance (Ellis, 2008) in learner's language production (speaking or writing).

Basically, the concept shared by the scholars is that fluency, contrary to accuracy, is concerned more with the smoothness and coherence of linguistic production in practical communication (Housen et al., 2012), such as words and phrases that realized as stress or intonation at a suprasegmental level (Friederici & Chomsky, 2017, p.15). Thomson further points out that "When deciding on the content of instruction, suprasegmental features should be given priority, since they are likely to impact fluency more than segmental features." (Thomson, 2015, p.223) In this sense, fluency is also closely related to suprasegmental features that are longer in time and larger in scale like prosody and coherence.

In this study, for the above reasons and the purpose of the present study, accuracy is operationalized in terms of the correct use of phonological, lexical and

grammatical knowledge and errors in each type would be calculated to see the accuracy development in the participants. Fluency is to be evaluated based on the prosody, delivery smoothness in expression, coherence in explanation, and topic relatedness. Moreover, as what Derwing et al. (2009), Isaacs and Trofimovich (2012) suggested, rater's perceptual evaluation and judgement can also be used as essential supplement. Thus, for the present study, accuracy and fluency are to be evaluated by the raters with reference to the guidance of the rubrics as well as their own understanding of accuracy and fluence.

### **2.3.3 The accuracy and fluency dilemma**

In a nutshell, accuracy and fluency are always understood as the counterparts to each other. Regarding language learner's linguistic production as an object for observing, accuracy and fluency focus separately on their favoring aspects: the former is to inspect, detect, and examine the correctness of minor features, or the accuracy features, such as the segmental; while the latter concerns more on the smoothness of the broad features, or the fluency features, such as the suprasegmental.

The differentiation between accuracy and fluency is strongly related to the language teaching pedagogy, traditionally, the accuracy-oriented approach and the fluency-oriented approach (Hammerly, 1990). The accuracy-oriented approach focuses more on the explicit instruction of forms in isolation in which the emphasis is on pre-selected linguistic items (Long, 1991), and errors are frequently corrected with instant corrective feedback (Lightbown and Spada, 1993). Long (1991) regards accuracy-oriented approach as Focus on forms, or form-focused in Ellis's proposition (2001). This approach focuses on repetition of newly introduced forms and grammatical structures and synthesizing them into speaking (Willerman, 2011), which is correspondent to Audio-lingual method, the representative method in this trend. The Audio-lingual method teaches language through dialogues that focus on habit formation in students. Through the mechanical modelling of the correct target language, students will achieve expected communicative competence by forming target language habits and defeating the old habits of their native language (Larsen-Freeman, 2000, p.45). The Audio-Lingual method considers language learning simply as to form native language habits in learners teaching via modelling vocabulary and grammatical patterns (Dendrinos, 1992), or form of behavior to be learned through the formation of correct speech habits (Thornbury, 2000, p.21).

The fluency-oriented approach believes "fluency in communication is what counts" (Wills, 1996, p.24), emphasizing to communicate meaning in real time

and prioritizing meaning over form (Ellis, 2003), hence there is the term meaning-focused (Ellis, 2001) or “Focus on form” (Long, 1991; Muranoi, 2000). Contrary to accuracy-oriented instruction, this approach regards errors as tolerable and probable and they are signs of natural language development, in which teachers tend to show more tolerance for students’ grammatical errors than showing lack of accuracy than for learners’ lack of fluency (Finardi & Porcino, 2012). Grammatical or pronunciation errors are insignificant, especially in the early stages, and error-correction can hinder learners’ development in speaking. Successful communication should be prioritized over grammatical accuracy (Hughes, 1989), and it should be considered a success if the messages are communicated, and corrective feedback is not necessary when errors happen (Wills, 1996). In language education, Brown and Nation (1997) value the importance of meaning-focused activities in developing fluency and encourage to provide more meaningful oral communication opportunities for learners. Communicative approach represents this trend.

Accuracy and fluency as speaking proficiency not only differ in conceptualization and pedagogy, but also compete in cognition. Skehan (1998) and Bygate (1999) believes that fluency competes with accuracy, while Ellis (1994) thinks that the increase in fluency may occur at the expense of development of accuracy. The reason for the incompatibility between accuracy and fluency may find its illustration in Skehan’s Trade-off Hypothesis (2009). The Trade-off Hypothesis proposes that due to capacity limitation in working memory, speakers must divide their attentional resources among all the processes a task requires, such as signal selection, effective information processing, and response actions. If the demands of one task exceed the available resources, the ongoing processes and related areas of performance would come into competition with each other. “The control function of attention will prioritize certain performative aspects over others, and only those aspects receiving enough attention will reach optimal performance while processes under limited attention become erroneous” (Skehan, 2009). Based on Skehan’s idea, if learners aim at being fluent, less attention will be available for accurate performance, and vice versa. Multiple studies (e.g., Bygate, 2001; Finardi, 2008; Finardi & Porcino, 2012) evidenced the hypothesis that there were trade-off effects between accuracy and fluency. However, more rigorous empirical findings point to the emergence of trade-off effect depending on the nature of differing tasks. As summarized by Skehan (2001, 2009): personal information exchanging tasks tend to favor both accuracy and fluency simultaneously, while pre-task planning yields greater fluency but with negligible effect on accuracy. Thus, even though “the idea

of trade-off is initially highly intuitive” (Nishimura, 2000), it does explain some competing cases in developing L2 accuracy and fluency.

As early as in 1998, Ebsworth, in his article *Accuracy vs. Fluency: Which Comes First in ESL Instruction?* proposed the questions of which one is more important, and which one should be taught first but displayed no definite answers to them. Brumfit (1979) initiated the fluency-first pedagogy with regarding accuracy-oriented pedagogy such as Grammar-translation method and Audio-lingual method as obsolete ones. And since then, along with the prevailing of communicative approach in EFL field, and the complaints made by teachers about the lack of effectiveness in the long run and the boredom they would endanger among the students (Stern, 1991), fluency has been prioritized against accuracy, and “accuracy activities such as drills and grammar practice were replaced by fluency activities based on interactive small group work” (Richards, 2001, p.35). As research progresses, it seems there is also a kind of time sequence in acquiring accuracy and fluency for learners. Scholars like Hemmens (2011) and Cotter (2013) recommend that accuracy should be introduced first in the beginner level and fluency comes along as the learners get progress. It is really a paradox if accuracy and fluency exclude each other while language learners want to have both, which is undoubtedly a dilemma, the accuracy and fluency dilemma (Cabaroglu, 2014). Hammerly (1991) warns that, in a dilemma like this, a strong focus on fluency may have a consequence of neglecting learners’ linguistic competence which could, in turn and in part, prevent students from moving beyond a certain level of proficiency.

#### **2.3.4 The potential role of NVT**

The interrelationship between accuracy and fluency, seemingly distinct from each other in definition and pedagogy, can be an ambiguous myth or a trap, which has influenced in a big scale both in classroom activity designation, materials planning, model or paradigm choosing, and L2 education mindset (Anderson, 2013). Critics and research have shown that no single method can alone account for the complexity of L2 learning, whether accuracy oriented or fluency oriented.

However, in terms of promoting both accuracy and fluency, most of the previous studies (e.g., Nishimura, 2000; Luchini 2004; Willerman, 2011) are providing qualitative suggestions with their validity being unidentifiable, let alone the effectiveness in pedagogy. It is still open for searching for alternative methods as well as better understanding variables that may be involved in or affect L2 accuracy and fluency learning. Coincidentally, The NVT matches the hemispheric preferential in the brain where the LH is for processing segmental and grammatical aspects and the RH

is for prosodic features. Thus, the application of the Neo Verbotonal Approach is hypothesized to improve speaking accuracy and fluency at the same time. The Neo Verbotonal Approach does not focus with a bias towards accuracy only or fluency only, neither fluency oriented nor accuracy oriented.

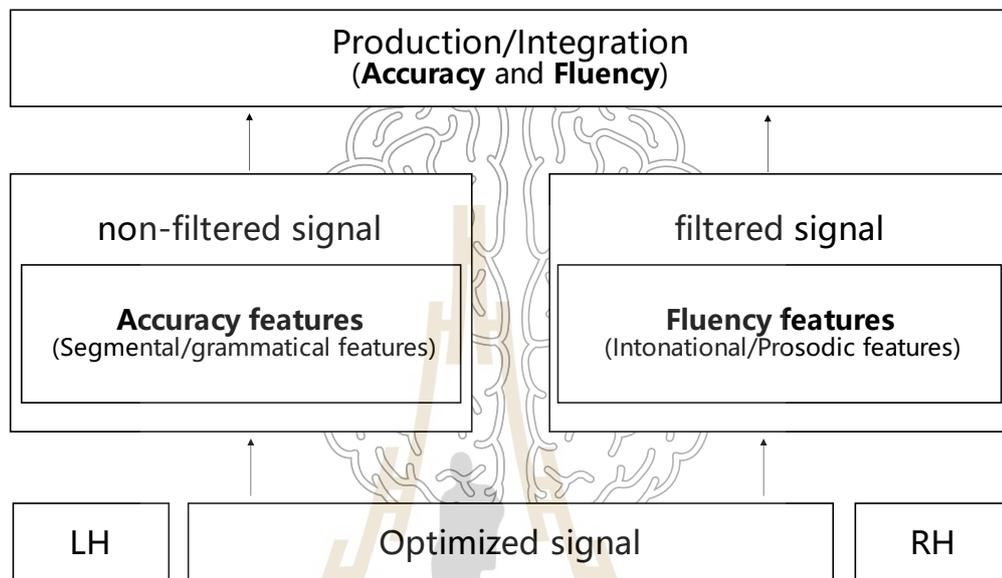


Figure 2.3 Model for Simultaneous Enhancement of Accuracy and Fluency

It is assumed that with the simultaneous input of both accuracy features and fluency features dichotically, a simultaneous processing and synthesizing would happen in the brain until a final integration in speaking, a full circle of perception and production then completes with accuracy and fluency being acquired. Thus, ideally, the Neo Verbotonal Approach would make it an alternative way for a balanced enhancement for accuracy and fluency, which is illustrated in Figure 2.3.

In this study, the Neo Verbotonal Approach is to provide a hypothesized condition in which the speaking proficiency of EFL learners is expected to be promoted. At the same time, due to the fact that the NVT condition makes the accuracy features and fluency features salient for the favored side of the brain, both aspects are also expected to be developed, which provides the chance for an examination of both the development of speaking proficiency, and the co-development of accuracy and fluency under NVT. The effects of the new approach will be examined by a pretest-posttest design to see the development of the overall speaking proficiency and in a diagnostic test for examining the co-development of accuracy and fluency.

## 2.4 Theoretical framework

The Neo Verbotonal Approach, in the present study, is constructed with respecting the functional asymmetry of the brain in processing incoming information. NVT attends to the advantage of each hemisphere by providing favorable linguistic features, synthesizes both the laterality of the brain and Verbotonal theory with the help of dichotic listening method and low pass filtering technique. The new approach involves the interaction between signals, physiological sensory, operational history, and the internal logical and representational systems, and within the process meaning would be created, altered, challenged, and refined internally in the learners.

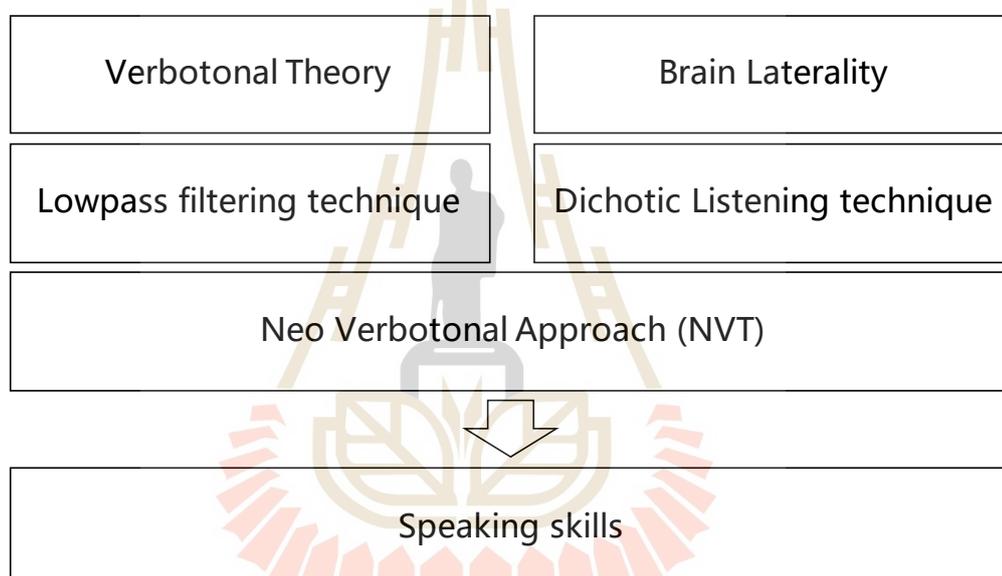
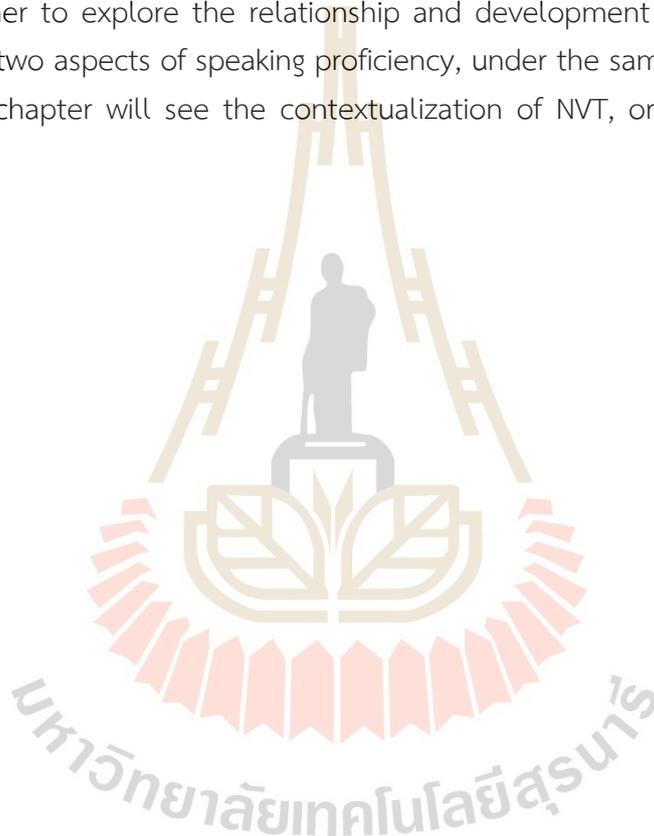


Figure 2.4 The Theoretical Framework for the NVT intervention

The brain is the organ of knowledge and organizer of our abilities, our means of forming thoughts and developing ideas, of instantly understanding words coming rapidly in conversation. The Neo Verbotonal Approach relies on the integration of the optimality principle under the Verbotonal theory and the internal working mechanism in the brain. Furthermore, on the abovementioned basis, it might provide a condition that could stimulate learners' brain in feeling both the accuracy features and fluency features, and which is hopefully expected to make their speaking both improved in accuracy and fluency with a period of education. To put it together, all these abovementioned aspects make up the theoretical framework for the present study (see Figure 2.4).

## 2.5 Summary

In this chapter, concerning the issue of learning English as a foreign language in the Chinese context, a Neo Verbotonal Approach is proposed with its guiding principles mainly deriving from the verbotonal theory and the brain research, including the optimality principle, the brain laterality, and its hemispheric preference in attending to linguistic features. Briefly and technically, the new method may orientate learners to gradually enhance their perception of the optimal input and ultimately enhance their speaking proficiency in general. In addition, the present study is further to explore the relationship and development of speaking accuracy and fluency, two aspects of speaking proficiency, under the same new approach. The forthcoming chapter will see the contextualization of NVT, or the methodology of the study.



## CHAPTER 3

### METHODOLOGY

This chapter presents the methodological aspects of the dissertation. Sequentially, it is going to outline the designation and research approach, sample selection, instrumentation, the research process, the methods of data collection, data analysis, the ethical considerations, and the pilot study as well as subsequent improvements.

#### 3.1 Research design

In the present study, the main purposes were to examine the effectiveness of the newly proposed NVT approach in enhancing EFL learners' overall speaking skills, the development of the accuracy and fluency, the co-development of the two aspects, as well as the attitudes of the participants when using it. In responding to the abovementioned purposes, a mixed method design was chosen due to the need of gathering both qualitative and quantitative data.

Mixed method is an ideal approach if both qualitative and quantitative data were to be accessed to because it could not only help provide fuller and richer information (Schoonenboom & Johnson, 2017) but also more comprehensive understanding of the targeted questions (Riazi & Candlin, 2014; Creswell & Creswell, 2018). Furthermore, the use of mixed methods may allow the researcher "to get rich information that could not be obtained using each method alone" (Almeida, 2018).

##### 3.1.1 Mixed method

As it was shown in Chapter 1, there were a total of three research questions in the current study, and the issue of each question that addressed would require a corresponding data collection method to answer it, either quantitative or qualitative, as shown in Table 3.1

**Table 3.1 The research questions and data collection**

Research questions	Data collection instrument	Data type
1) Is NVT effective in developing Chinese university EFL learners' speaking skills? If yes, what is the effectiveness of NVT on the development of accuracy and fluency?	Pretest and Posttest of overall speaking proficiency Topic Monologue pretest and posttest	Quantitative Quantitative
2) What is the interrelationship between accuracy and fluency under the application of NVT?	Biweekly Topic Monologue	Quantitative
3) What are the attitudes the learners' hold toward NVT?	Questionnaire Student diary Semi-structured Interview	Quantitative Qualitative Qualitative

To answer the first research question that concerning the effectiveness of the NVT approach in developing Chinese university EFL learners' speaking skills and its effects on the development of accuracy and fluency, a quantitative experiment was needed because the question was in fact to explore the effectiveness of the newly proposed approach. The ideal way of understanding how one variable may influence another variable is to use an experimental design. The method is to have two randomly assigned groups and to expose the experimental group to the experimental treatment and administer the same treatment without the independent variable to the control group, which would make sure that any change in the dependent variable can be attributed to the independent variable. Moreover, a pretest-posttest design is preferred to measure the degree of change occurring as a result of treatments or interventions. So, the first research question was answered by using the overall speaking proficiency pretest-posttest, and the Topic Monologue pretest-posttest.

The second research question was to explore the interrelationship between accuracy and fluency along with the experimental intervention. Due to the dynamic nature of language development, their interrelationship might manifest differently over time. In order to investigate how their relationship changed, this study, by using the biweekly topic monologue tasks, attempted to make repeated measurements across time at equally spaced intervals. The scores derived from each time of the biweekly task formulated the time-series quantitative data, which helped understand how the co-development of accuracy and fluency unfolded over time.

The third question was to examine the attitudes of the participants toward the implementation of the newly constructed NVT approach. In answering it and with the purpose of getting a full understanding, the present study adopted both

quantitative and qualitative methods to elicit both types of data. On the one hand, a questionnaire with close ended questions was conducted to collect quantitative data when the intervention ended; on the other hand, a semi-structured interview with open ended questions was also carried out at the end of the experiment. Additionally, the participants were encouraged to write diaries to record their feelings along with the treatment, which may provide extra supplement in illustrating the question to be addressed.

Thus, to sum up, it was due to the research questions that both qualitative and quantitative data should be collected, and which made it reasonable to adopt a mixed method approach (Johnson et al., 2007) that composed of multiple instruments for collecting the different types of data. In practice, the present study used a quasi-experimental pretest-posttest design with the intervention of the NVT approach as the independent variable and the development of learners' overall speaking proficiency, the development and co-development of accuracy and fluency, the students' attitudes as the dependent variables, which would be illustrated in detail in the forthcoming part.

### 3.1.2 Variables

According to the objectives and the research questions of the present study, the independent variable should be the application of NVT, a newly derived language learning approach based on the theories and findings of Verbotonalism and Neurolinguistics. The specific treatment was *“sending the filtered low frequency signal to the left ear and the unfiltered normal signal to the right ear, together with verbal repetition of the input signals”*.

**Table 3.2** The design of the study

Experimental group	$R-O_1-X-O_2-M-D-S-I$
Control group	$R-O_1-C-O_2-M-D$
Notes:	
$R$ —Random assignment	
$X$ —the NVT treatment	
$C$ —the diotic method	
$O_1$ —Pretest $O_2$ —Posttest	
$S$ —Questionnaire	
$M$ —Biweekly topic monologue	
$D$ —Diary	
$I$ —Semi-structured interview	

As for the dependent variables, this research focused on the improvements in the candidates' overall speaking skills, the development and co-development of speaking accuracy and fluency, as well as the respondents' attitudes toward NVT. To make it specific, the dependent variables were:

- a) the development of overall speaking skills,
- b) the development of speaking accuracy and fluency,
- c) the interrelationship between speaking accuracy and fluency,
- d) the students' attitudes toward NVT.

As soon as the research design, a mixed method, was chosen for the current study, the participants were then needed to be finalized with additional measures taken for identifying the handedness and hearing problems among them. As the two intact classes were randomly assigned as the experimental group and control group, it was the time to integrate the multiple instruments together into the whole research process, as shown in Table 3.2.

### 3.2 Participants

The entire population of the present study was consisted of 6 classes of first year Chemical Engineering students in Guangdong University of Petrochemical University (GDUPT). In considering the classroom realities (Hyland & Hyland, 2006), and for the reason of easy recruitment (Johnson & Christensen, 2019), among the 6 classes, two intact classes were selected as the participants since they shared the same College English teacher and had statistical homogeneity of their English scores in both the College Entrance Examination and term examination of the first half year. Having been living and studying together for half a year in the same environment with the same pedagogic pattern, learning materials, requirements and tests, the two classes had got a kind of homogeneity in educational backgrounds. This homogeneous setting could eliminate most external uncertainties and provide a similar background.

Moreover, supplementary measures were also taken to eliminate the unwanted interfering variables, such as the handedness and unknown problems in hearing. There had been a suggestion that relative manual skill may give a better index of lateral asymmetry than preference alone (Annett, 1970, p.319) which meant that individual handedness might be closely related to hemispheric laterality. Meanwhile, individual hearing capabilities may also strongly influence the lateral auditory perception under dichotic settings. To minimize the effect of handedness and hearing problems, all participants were required to go through a diagnosing

procedure concerning their handedness and a self-report about their hearing capability before the main study.

For the hearing capability, students needed to report by themselves through email to the researcher about whether there had any aural problems or whether they were taking any auditory medicine.

For handedness, this research employed the written “Edinburgh Handedness Inventory-Short Form” (Veale, 2014, p.15) (see Appendix A and B) due to its validity and reliability evidenced by repeated studies (e.g., Krüger et al., 2020; Loprinzi et al., 2019). Comparing with the 12-item “Edinburgh Handedness Inventory” (Oldfield, 1971) and the 10-item Annett’s questionnaire (Annett, 1970), the recently polished 4-item “Edinburgh Handedness Inventory-Short Form” showed higher factorial reliability and more accurate factor scores (Veale, 2014). The “Short Form” is composed of four scaled items, “Writing, Throwing, Toothbrush, Spoon”, with each being divided into five scales based on the handedness in daily life, ranging from “Always right”, “Usually right”, “Both equally”, “Usually left”, to “Always left”. The five scales are equivalent to the five leveled scoring, “Always right =100; Usually right = 50; Both equally = 0; Usually left = -50; Always left = -100”. The final Laterality Quotient would be achieved by adding the scores for the four items in the scale and then dividing this total score by four. If the Laterality Quotient is “-100 to -61”, it belongs to the category of “Left handers”; “-60 to 60”, the “Mixed handers”; and “61 to 100”, the “Right handers”.

According to the hearing problem self-reports and the results of the handedness questionnaire, the Left-handed, Mixed-handed, and self-reported hearing-impaired students were then not counted in as the participants of the experiment and the data produced by them was not included when it was to report and analyze. In this way, only the strongly Right-handed and no hearing-impaired students were recruited as the participants of the present study. The potential threats to the internal validity of this research concerning the participants’ handedness and hearing can then be minimized, which could eventually make the final data collected more convincing. With the conduct of the supplementary measures concerning hearing and handedness, the participants of the study were then finalized (see Table 3.3).

Table 3.3 Demographic information of the participants

Groups		EG	CG
Number		32	32
Gender	Male	17 (53.125%)	18 (56.25%)
	Female	15 (46.875%)	14 (43.75%)
Age	<=18	7 (21.875%)	5 (15.625%)
	19	19 (59.375%)	22 (68.75%)
	20	6 (18.75)	4 (12.5%)
	>=21	0 (0%)	1 (3.125%)
Handedness		Strongly right-handed	Strongly right-handed
Hearing problems		No	No

The two intact classes were then allocated randomly as the control group and the experimental group. Before the start of the intervention, both groups were informed with a written consent form of details of the purpose, procedure, risks, confidentiality, etc. of the experiment. They were also offered the right to withdraw at any time and they were guaranteed to be away from any harm in the research.

### 3.2.1 The experimental group

In the experimental group, there were 32 students, speaking Mandarin as their mother tongue and learning English as their foreign language, and they had been learning English for no less than 9 years under the same educational system in China. Since they had not passed the CET4, their English was at a largely pre-intermediate level.

For the experimental group, they were asked to attend an online course named *Listening and Speaking* (see 3.4.1), which was designed by the researcher and served as one of the elective courses that offered by the university. The online course was used only for the current research and open for the participants only. The experimental group attended the online course for a total of 12 weeks and a total of 24 times to complete all the sessions of training, with each week two times and each time lasting for 45 minutes.

It should be noted that the course of *Listening and Speaking* was all the same for both the experimental group and the control group in its contents, training sessions, training times, and length of each session, except for only one aspect, the way of signal input. In the experiment, the experimental group should attend to the NVT approach by which the signals had been optimized using the low pass filtering technique and dichotic listening technique, while the control group should attend to

the non-modified traditional diotic mode. In other words, the experimental group was under the optimized dichotic listening while the control group was under the traditional diotic listening.

Prior to and after the experiment, both groups were asked to finish a pretest and a posttest concerning their overall speaking proficiency. Meanwhile, amid the experiment, both groups were asked to accomplish a topic monologue task every two weeks, a total of 7 tasks with an extra task taken before the experiment. Additionally, the students in both groups were encouraged to make a learning diary to report their feelings after each training session, covering the date, length of time, place, content of training, and their reflections of speaking learning. In order to elicit more insights from the experimental group, there were the questionnaire and a follow-up semi-structured interview that conducted after the whole project.

### 3.2.2 The control group

The 32 students in the control group shared the similar background with that of the experimental group, speaking Mandarin as their first language and English as a foreign language. The students in the control group had the similar English learning experience under the same educational system as the experimental group.

Theoretically, in an experiment, a control group is the group that does not receive any special treatment and is used as a benchmark. In the present research, the students in the control group needed to do the same thing as what the experimental group did, that is, to attend the online course "*Listening and Speaking*". However, they were attending to the diotic listening that no modification or low pass filtering had done to the input signals, which were actually just the same as what they usually did in their English listening classes. The length of the whole treatment, the times of training sessions, and the time for each session were all in accordance with that of the experimental group. The control group also needed to accomplish the pretest, posttest, and topic monologue, and they were also asked to make a learning diary along with the experiment.

Bearing the research questions in mind and for the purpose of collecting both quantitative data and qualitative data, multiple instruments were used in the research, and they are to be introduced in the next part.

## 3.3 Instruments

With the identification of the independent and dependent variables, as well as the random assignment of the experimental group and control group, the research instruments for data collection then became the focus for the next step of the

research. “Research instrument” refers to the crucial tools used to collect, measure, analyze, and activate data related to the research objectives. Normally, research instruments are the tests, surveys, scales, questionnaires, or even checklists.

In the present study, for answering the research questions and exploring the outcomes and attitudes produced and emerged along with the conduction of the experiment, it was to use the tools, including: (1) Overall speaking proficiency pretest and posttest, (2) Questionnaire, (3) Biweekly topic monologue tasks, to collect quantitative data, while at the same time to collect qualitative data with the help of the tools of (4) semi-structured interview and (5) students’ diary, which should be explained in detail as follows.

### 3.3.1 The pretest and posttest

For the current research, in answering research question 1, there were two pretests and two posttests. The first pretest-posttest was held for examining the change happened to the speaking skills, while the second pretest and posttest was held to examine the development of accuracy and fluency.

Firstly, a pretest and a posttest of speaking skills were conducted respectively for a comparison between the control group and the experimental group, as well as a comparison within the experimental group and the control group themselves before and after the treatment. As it was illustrated in Chapter 2, there had no consensus in designation for speaking proficiency test, and it could be in the shape of either a standardized test or a self-constructed test. In convenience, the present study chose to use a verified Overall Speaking Proficiency Test adopted in He’s study (2014) with a slight modification in its contents.

The reasons for using the Overall Speaking Proficiency Test were due to three points. First, it was originally designed and used specifically for the Chinese university EFL learners, which made it duplicable for the participants in the present study; Second, it covered almost all the features involved in English speaking, including both the segmental features (consonants and vowels) and the suprasegmental features (intonation and stress); Third, it had been verified in its credibility and reliability with its application in the previous research.

**Table 3.4 Tasks in pretest and posttest**

Tasks	Contents	Time	Scoring
Part 1 Phoneme reading	20 transcriptions	1 minute	20%
Part 2 Word reading	30 words	1 minute	30%
Part 3 Passage Reading	100word passage	2 minutes	25%
Part 4 Short Question Responding	5 questions	3 minutes	25%

To be specific, the speaking test was composed of four parts (see Table 3.4). The first part was the Phoneme Reading that accounted for 20%, which was composed of the voiced and unvoiced sounds covering almost all consonants and vowels in English. The Word Reading (30%) was made up of 30 words that appeared in their first semester text book. The third part was the Passage Reading (25%), a passage less than 100 words excerpted from their text book as well. The last part is the Short Question Responding (25%), in which there were five questions concerning the topics that close to the respondents. The four tasks covered the aspects ranging from the segmental to suprasegmental, which could make a thorough examination of the effectiveness of the NVT on the speaking skills.

As for the modification happened to it, there were mainly two aspects involved. On the one hand, since the original score for each part was not put in a balanced way, i.e., the scores of the first two tasks were set at 45% in total and the latter two tasks were 55%, the present study re-allocated the scores for the purpose of balance and easy rating, with the first two tasks amount to 50% and the latter two tasks 50% as well. Second, instead of using the Free Talk in the original test, the present study used short questions to elicit their responses, which was due to the avoidance of possible overlap of the monologue tasks with the free talk. The minimal modifications could make the tests better suitable for the present research. Additionally, it should be noted that the pretest and the posttest were all the same in structure and score allocation (see Appendix C and D).

Secondly, a pretest and a posttest of topic monologue were conducted in order to examine the development of speaking accuracy and fluency.

Topic monologue, as a tool in eliciting spontaneous verbal production (Swerts & Geluykens, 1993), was widely used to detect the changes happened to the speaking skills (Karpovich et al., 2021; Ahmadi & Sadeghi, 2016). With reference to the oral tests of IELTS and CET 4, the topics were selected and pre-designed. Moreover, five experts were asked to make sure of the appropriateness in terms of difficulty and familiarity. The original number of the topics was 15, and only 7 of them were randomly used for the biweekly test (see Appendix L).

Among the 7 monologue tasks, the first task was regarded as the pretest because it was held just before the intervention began and the 7<sup>th</sup> task was regarded as the posttest due to its conduct was after the ending of the experiment. Based on the rating scores of the topic monologue pretest and posttest, the development of accuracy and fluency under NVT could be closely examined. The two times of

monologue tasks were only a part of the total 7 biweekly tasks, which are to be introduced in the next part.

### **3.3.2 Biweekly topic monologue**

Initially, in order to answer the research questions 2, a biweekly diagnostic task was used for the purpose of detailed examination of the co-development of students' speaking accuracy and fluency because there might be "critical moments or episodes or opportunities where developmental increments are likely to occur rather than merely broad-scope changes at underspecified points in the learning process" (Norris & Manchon, 2012, p.241). Detailed inspection of the process could help display a full vision of the "developmental increments".

Every two weeks, students in both groups were asked to produce a monologue on a given topic for a length of one to three minutes and hand in the recordings immediately under the language laboratory management system. There was one monologue task conducted prior to the experiment and six more monologues conducted every two weeks successively. As the whole intervention ended, the collected recordings concerning each topic were then renumbered and blindly rated by three experienced English teachers (among which there was one native English teacher) based on their general understanding of accuracy and fluency in referring to the rubric (see Appendix N). The full score for accuracy is 30, and fluency is also 30. The raters should evaluate accuracy based on the errors in grammar, pronunciation, and meaning explanation, and evaluate fluency based on smoothness in expression, clearance and naturalness in explanation, topic relatedness.

The collected time-series data, i.e., the scores of those 7 monologues, was then ready for both between-group and within-group examination. It was expected that these tasks altogether could make a detailed analysis of the developmental process in participants' speaking accuracy and fluency.

### **3.3.3 Questionnaire**

The Questionnaire, a research instrument, is a written interview composed of a series of questions for the purpose of gathering information from respondents. It is a relatively cheap, quick, and efficient method for obtaining large amounts of information from a large sample of people. Questionnaires are also quick and convenient in gathering information related to the behavior, attitudes, preferences, opinions, intentions, and other internal concepts or information that cannot be directly observed or physically checked. Questionnaires provide an efficient tool for statistical analysis of the responses from the respondents because the information

provided can be easily converted into quantitative data based on the standardized questions.

For answering the research question 3, this research designed the “Questionnaire on Students’ Attitudes for Learning to Speak Using the Neo Verbotonal Approach” (see Appendix E the English version, and Appendix F the Chinese version) by referring to the previous research in questionnaire designation (Lohr, 2021; Oppenheim, 2000; Fowler & Fowler, 1995). The Questionnaire was structurally composed of three parts, including Instructions, Demographic information, and Closed questions.

The Instruction part provided a basic introduction to the aims of the questionnaire and asked for a consent from the respondent. Following the Instruction, it was the Demographic Information aimed to cover the basic background of respondents such as age, gender, ethnic background, etc. The last part was the main part of the Questionnaire, 12 closed questions. The questions were in a Likert scale for measuring the strength of attitudes. To be specific, it was a 5-point continuous rating scale covering (1) strongly agree / (2) agree / (3) neutral / (4) disagree / (5) strongly disagree. Closed questions would structure the answer by only allowing responses that fit into pre-decided categories. Before the implementation of the questionnaire, the index of item-objective congruence (IOC) of it was checked with the assistance of five experts, and the result showed that a high validity was achieved with a percentage of 96.7% (IOC=11.6, Total=12) (see Appendix G) in consistency. Furthermore, for determining the reliability of the questionnaire, the internal consistency from the trial version ( $\alpha = 0.942$ ) was also checked using Cronbach’s Alpha Coefficient ( $\alpha$ ) (Cronbach, 1951).

If scrutinized in detail, the items in the Questionnaire can be further categorized into three parts, the first part, covering the item 1 to 5, was to explore a general judgement in the respondents concerning their like or dislike the NVT approach; The second part, item 6 to 9, was about whether the students believed there was a relationship between the NVT intervention and the development of their speaking proficiency as well as the two aspects of accuracy and fluency. The last part, including item 10 to 12, was about the feelings resulted from the intervention. The data from the questionnaire could provide a holistic picture showing participants’ experiences and feelings toward the NVT treatment.

### **3.3.4 Semi-structured interview**

Contrary to questionnaire, the method that may fail in eliciting in-depth information from the respondents (Saris & Gallhofer, 2007), a semi-structured

interview could work much better for acquiring more live and in-depth data from the respondents' perspective. As one of the most powerful instruments for gaining an understanding of human beings and exploring topics in depth (Fontana & Frey, 2000), an interview can directly display "the meaning that the participants hold about the problem, not the meaning that the researchers bring to the research or writers express in the literature" (Creswell, 2013, p.47). Thus, interview has an advantage in eliciting qualitative data flexibly and directly from the participants.

In accordance with research question 3 of the present research, and based on the items in the questionnaire, a list of 11 questions was pre-constructed for the conduct of a semi-structured interview (see Appendix H and Appendix I). Prior to the conduct of the interview, its IOC was checked with the assistance of the same five experts as in the questionnaire, and the result showed a high percentage of 94.55% (IOC=10.4, Total=11) (see Appendix J) in consistency.

After the participants finished their posttest and questionnaire, the semi-structured interview was carried out face to face in Chinese with 10 randomly selected participants from the experimental group. The number of interviewees selected for the interview was 10 for the reason of "saturation" (Latham, 2013; Saunders et al., 2018) the possible insights from the participants, and each interview costed them 10 to 15 minutes with recordings being made.

To be noted, the semi-structured interview was conducted at a casual place the respondents chose, either the pavilion near a pool, or a café close to the library, which could make them feel fully free to express their opinions, confusions, and sensitive points. In addition to the pre-designed questions, other impromptu questions were also raised during the interview according to their instant reflections. Moreover, some questions were also asked by the participants.

### 3.3.5 Learning diary

Since modern foreign language education stresses the need for more qualitative information about learners and learning, "the importance of a detailed record of a learner's responses would also surely strike a chord" (Alderson, 2005, p.24). As an important tool for qualitative data collection, the learner's diary is seen as more personal than interview and observation, and it could include both interpretation and description on multiple dimensions from the point of the informants (Coleman & Briggs, 2002).

In this study, in order to answer question 3 and for the purpose of collecting more in-depth data, both the control group and the experimental group were asked to produce a digital diary as a record of each training session. The diary,

on the one hand, contained the descriptive information about each training session, such as the training date, place, contents, etc., and on the other hand, it also included reflective information like comments, feelings, and expectations. A booklet and a diary template were provided for the participants (see Appendix K). Moreover, students enjoyed the freedom to report anything else that occurred to them during the treatment, to share their opinions related to the training, and to discuss their concerns in learning to speak English. For convenience and precision in expression, the informants were allowed to use Chinese in writing their diaries. It was made clear to all the participants that all the diaries were used specifically for the present study and that all the information would be strictly classified.

### **3.3.6 Validity and reliability of instruments**

Reliability and validity are important aspects for instrumentation. All the tools in the current study, including the questionnaire, the pretest, the posttest, the semi-structured interview, as well as the topics for the biweekly monologue tasks, were all carefully selected and refined from similar studies that already held in this field. This is because “using an existing instrument that has substantial evidence of reliability and validity in a variety of populations is more cost-effective than starting from scratch to develop and validate an instrument” (Kimberlin & Winterstein, 2008). However, more measures were also taken to secure their reliability and validity.

First, both English and Chinese were used in writing the questionnaire, semi-structured interview, and handedness tests. The use of two languages could reduce the risk of misunderstanding concerning certain items and ensure a concrete answer.

Second, content validity usually depends on the judgment of experts in the field because “there is no statistical test to determine whether a measure adequately covers a content area or adequately represents a construct” (Kimberlin & Winterstein, 2008). In this case, five experts in English teaching, all competent college teachers, were invited to elaborate the content in the questionnaire, semi-structured interview, and monologue topics, in terms of appropriateness, redundancy, or overlapping, sequential order, coverage for the target question, etc., to make sure all items be well checked and organized. Based on the comments and feedback from the experts, the contents in these tools were further revised and improved.

Third, before the main treatment, both the validity and reliability of the questionnaire and semi-structured interview were pre-checked by using the Index of Item-Objective Congruence (IOC) developed by Rovinelli and Hambleton (1977).

Refinement of the instrument then focused on minimizing measurement error for more precise results.

In a nutshell, the validity and reliability of all the instruments were well guaranteed with taking the abovementioned measures.

### 3.4 Research procedure

As what mentioned in the previous parts, the purpose of the present study was to explore the effectiveness of a newly proposed verbotonalism based approach in enhancing the EFL learners' speaking proficiency as well as their attitudes to it, and then a mixed method design was chosen due to the need of collecting both types of data. After that, participants were also finalized and assigned randomly as the EG and CG, and then it was time to implement the design. To make it clear, the detailed procedure of the research is shown in Figure 3.1.

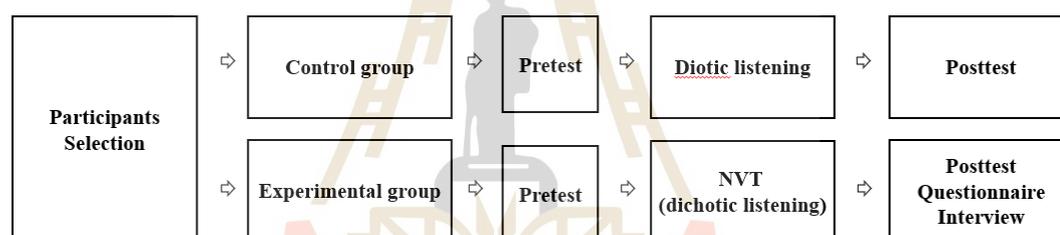


Figure 3.1 The research procedure of the study

While the previous parts had stated the research problems in Chapter 1, the related literature, and the research design, the forthcoming part is to explain how the experiment was conducted, and how the data was collected and analyzed. However, due to the experiment relied heavily on the elective online course, *Listening and Speaking*, which should be introduced first here.

#### 3.4.1 Constructing the online course *Listening and speaking*

In this research, to contextualize the theoretically constructed NVT approach, an elective online course named *Listening and Speaking* (see <https://www.moodlec.com/course/view.php?id=71>) was designed and organized with the support of the Audacity (an audio editing software) and Articulate 360 (an e-learning course-designing software). *Listening and Speaking* was specifically designed and applied in the current research, and only the participants in the present study were authorized to visit.

### Listening Material

For designing *Listening and Speaking*, among the rich materials for English listening, institutionalized testing tasks enjoyed more attention and reputation due to their outstanding influence in evaluating language learners' proficiency for different academic purposes. This research turned to use the excerpts of IELTS listening materials, and the first reason was due to its authenticity in contexts, especially the conversations. The conversations, covering “a whole variety of strategies and tactics” (Golubovskaya & Tikhonova, 2015), may simulate real-life situation and were treated as authentic spoken language in communication. Another reason was because it was convenient to get the listening recordings from IELTS' authorized series of official books and researchers were encouraged to use these materials (Aryadoust, 2013). The recently published trial book IELTS 11 (2016) and IELTS 12 (2017) issued by Cambridge University Press in China (see figure 3.2) were the sources for excerpting the target listening materials.

In IELTS, the listening module has four sections that are composed of different contents, normally with section 1 as “a real-life context conversation”, section 2 as “a monologue in a real-life context”, section 3 as “an academic conversation” and section 4 as “an extract from a lecture”. Among the four sections, with respect to the authenticity in simulating real life and closeness to the students, this research chose to use the “real-life context conversation”.

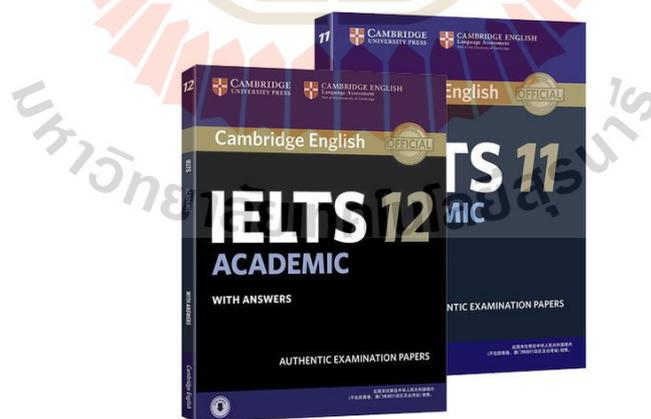


Figure 3.2 IELTS 11 and 12

### Listening Material manipulation

Then the conversations from IELTS 11 and 12 were isolated, divided into short sentences, and finally marked in numbers for the process of dichoticalization, i.e., all the excerpted sentences were transformed into the format of dichotic mode

using the audio editing software Audacity (version 2.3.3): low pass filtered for the left ear and unfiltered for the right ear.

Audacity is a well-developed audio editing software that can help edit the listening materials into dichotic mode and its interface is shown in the picture above when it is ready for conducting Filtering. Taking the sentence “Let me just see” as an example (see Figure 3.3), the spectrograms, both left track and right track of the sentence, were shown clearly in Audacity when the sentence was imported into the interface. Originally, each sentence was in stereo and composed of two tracks, the Left (the upper wave in the picture) and the Right (the lower wave in the picture).

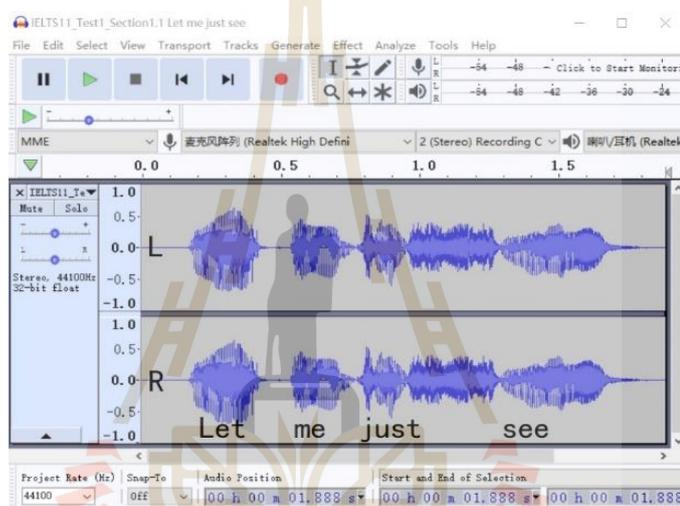


Figure 3.3 The interface of Audacity for Filtering “Let me just see.”

In this research, to make each sentence dichoticalized, the Left track was filtered, and the Right track was left untouched. A three-step process was adopted: Step 1: “Splitting”, Step 2: “Filtering”, and Step 3: “Resynthesizing”. The first step, “Splitting”, meant to separate the stereo into two independent tracks, then the Step 2, “Filtering”, was the core part of the process of dichoticalization, and finally the Step 3, “Resynthesizing”, was to reverse the process in Step 1, i.e., to resynthesize the two tracks together into a single audio. Filtering, as the second step, happened in-between the steps of splitting and resynthesizing, was to preserve the portion below 320 Hz and to remove the frequencies above it, which would make vowels and consonant sounds effectively removed and at the same time the intonation and rhythm patterns salient. Since the low pass filtering happened to the left track only, the process of “Splitting --Filtering-- Resynthesizing” was in fact a process to make the Left track isolated, low pass filtered, and then resynchronized with the untouched Right track again. With the three steps finished, the original sentence was

successfully transformed into the dichotic stereo. The detailed steps in processing the audio files are illustrated in Figure 3.4, 3.5 and 3.6 (using the sentence “Let me just see” as an example).

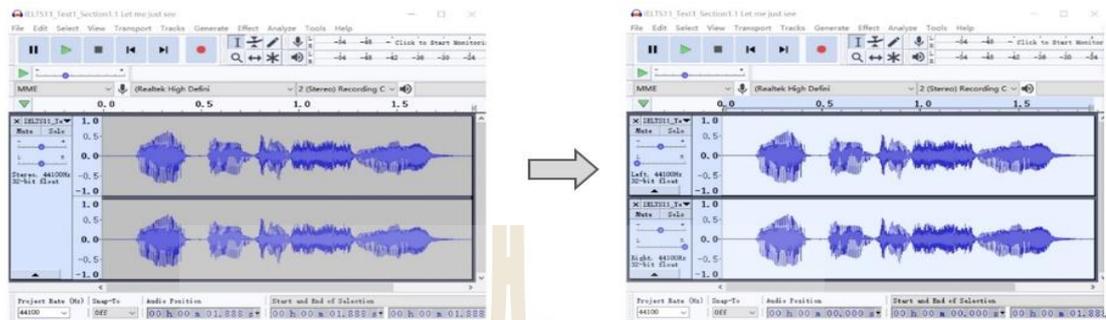


Figure 3.4 Step 1: Splitting

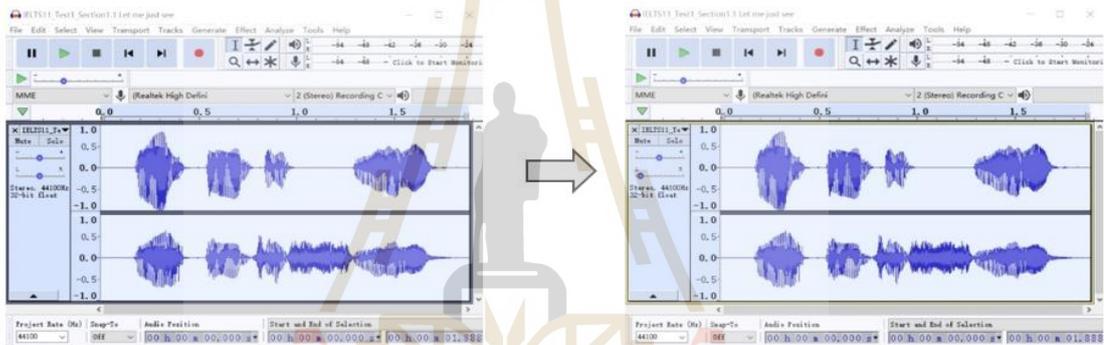


Figure 3.5 Step 2: Filtering

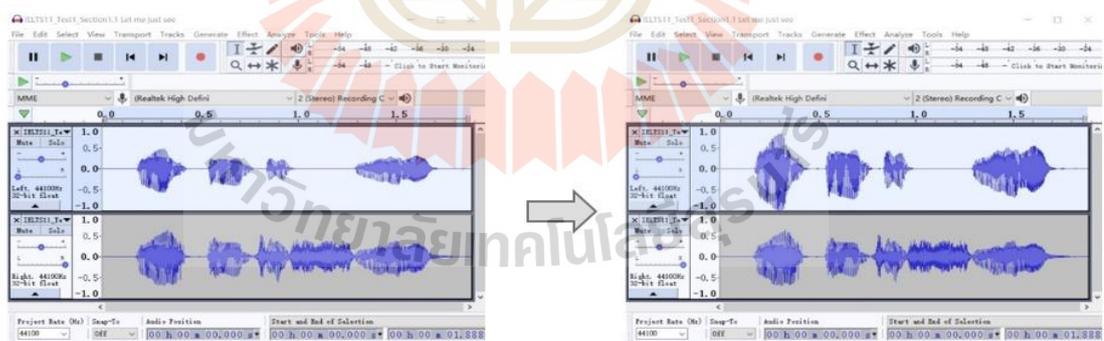


Figure 3.6 Step 3: Resynthesizing

In addition, there were two more techniques that employed as the supplementary during the three steps of processing, i.e., Amplifying and Panning. Amplifying was an automatic process calculated and proposed by Audacity itself for the purpose of increasing the volume of the Left channel to make both channels at the same volume. Additionally, the application of the technique of “80% Left Panning” (Meares & Ratliff, 1976) was to ensure that the azimuth of sound source

(Mironovs & Lee, 2017) was not distorted too left or too right. All the above treatments were accomplished in Audacity.

### **Setting up the online course**

As soon as the materials were split, filtered, resynthesized, and numbered for the main experimental course designation, the online course *Listening and Speaking* was then ready to be set up. With the help of Articulate 360, an e-learning course-design software, the Audacity-processed sentences were organized into different training units. A total of 24 dichotic units were organized for the experimental group, and 24 diotic units for the control group. Given that lots of repetition would take place during each training, and the whole process of each training unit should be no more than 45 minutes, the number of the training sentences in each unit was then settled at 8.

All the packages were then uploaded to an online Moodle platform <https://www.moodle.com/> under the name of *Listening and Speaking* where the participants could register an account for themselves and log in for training as each class began. Moodle (Modular Object-Oriented Developmental Learning Environment) is an open-source software e-learning Course Management System (CMS), and it is free for downloading and installation (Cole and Foster, 2007). “The electronic environment of Moodle is characterized by modularity, special flexibility in managing the learning process, easy publishing of training materials and their support in the format of international standards, management of user groups, the use of Web 2.0 services and the ability to integrate with other web applications.” (Bulaeva et al., 2017, p.406) With the help of Moodle, the whole training process was recorded, such as students’ logging in and out, task accomplishment, and other necessary data related to the experimental activities. Both groups attended the same Moodle-based online course *Listening and Speaking* on the same Moodle platform at the same time. For protecting privacy, only the students from the sampled two classes were authorized to register and access to the contents with their registered accounts.

The online course *Listening and Speaking* had a total number of 24 units with each unit lasting for one credit hour. In each unit, there were 8 excerpted sentences from the IELTS conversations. Students needed to log in the online course and went through the training of each unit. With the help of Moodle’s management function, as soon as the participants logged in, they were automatically getting into the pre-designed distinct contents, i.e., the dichotic and the diotic, which means that the control group could only attend to the diotic sentences that no filtering has

been conducted while the experimental group could only attend to the dichotic sentences that filtering had been manipulated by using Audacity.

In this study, the online course *Listening and Speaking* was specifically designed under the NVT approach for the EFL university students, and it had no fixed textbooks. All contents of the unit were printed out and given to them upon completion of that unit. The students needed to listen to and repeat what they would hear through their headsets. Within the process of the training, the teacher did not interfere except for necessary technical assistance.

The whole process of training took place in the language laboratory where they usually had listening classes using the learning management system. To meet the needs of listening tasks for both groups, a well-equipped language laboratory served as the setting of this study since the language laboratory was a specially contrived, artificial environment where the variables were isolated, controlled and manipulated for achieving objectivity. Zielinski (2012) stressed the overriding significance of providing safe environments for learners to practice because this can help them build confidence and be more willing to speak in their second language. The language laboratories were equipped with multimodal facilities like interconnected computers, headsets, digital projectors, and huge screens. The stereo headsets in the language laboratory had a microphone reaching out from the left, only when they wore correctly could they make recordings and feel comfortable. And to make the laboratory surrounding friendly enough and to guarantee the smoothness of the whole project, all participants by themselves and for themselves can find their seats and adjust the earphones' volume to a loudness that was most comfortable.

Additionally, to make sure both groups have the same setting-time, the training time for both groups was also strictly controlled for each week, to specify, twice a week, and one credit hour for each time.

#### **3.4.2 Pedagogic procedure**

As the participants and the online course got to be ready for the experiment, it was time to follow the training procedure. The present study built up its own training procedure by referring to multiple previous verbotonal studies in which the procedure had been elaborated and evolved into various versions, such as Lian's model, Zhang's model, and Yang's model (see Table 3.5).

**Table 3.5 The previous treatment models**

Previous models	Treatment Sessions
Lian's model (1980)	Sensitization session Reinforcement session
Zhang's model (2006)	Sensitization Session Repetition Exercises
Yang's model (2016)	In-class sensitization session Out-of-class reinforcement session

As a prelude to applying verbotalism into language teaching, Lian (1980) proposed a two-phased “teaching sequence” (1980, p.15) composed of a sensitization session and reinforcement session with sufficient supporting steps such as “relaxation phase”, “audition of filtered sentences”, “humming along”, “mouthing the words”, “repetition on a background of filtered patterns” (1980, p.16-24) in the sensitization session, as well as “self-testing”, “re-sensitization and intensive practice” (1980, p.24-25) in the reinforcement session. The teaching sequence evolved into a two-phased training in Zhang's study (2006, p.150) including the phases of “the Sensitization Session” and “Repetition Exercises”, and the most recent version was in Yang's study (2016, p.88) that consisted of “in-class sensitization” and “out-of-class reinforcement sessions” as the main steps.

**Table 3.6 The NVT treatment process**

Steps		Treatment in each step	1 credit hour (45 minutes)
Step 1	Relaxation	Deep Breath and Light Music	5 min
Step 2	Repetition	Silent Listening 15X Listening Humming or Inner repetition	30 min
		Verbal Repetition 10 X Listening and Shadowing	
Step 3	Reflection	Text and 1X Making Recordings and Comparing with models Communication and Free conversation	10 min

One may have the impression that the previous research put more emphasis on the phases of both sensitization and reinforcement, and encouraged different methods that may contribute to them. However, the only inconvenience was that the training place was switched into different sites in different sessions, such

as, Zhang's study asked for different classrooms, while Yang's study extended to the places out of classroom, which may make the whole process split into distinct and separate spatiotemporal components.

With careful planning and staging, and by referring to the previous verbotonal research, the specific training procedure for the present study was derived by taking the language laboratory setting into consideration, where the students could relax, repeat, and reflect. The concrete steps from Relaxation, Repetition, to Reflection are shown in Table 3.6.

The training sessions were entirely implemented in the language laboratory step by step, which are illustrated in detail in the following parts:

#### Step 1: Relaxation

"Relaxation of the body will bring about a lowering of conscious and unconscious resistance to the learning of a foreign language" (Lian,1980, p.16). Relaxation techniques such as soft music and yoga were effective to "reduce the language shock experienced by many learners especially when they are required to speak in the target language" (Zhang, 2006, p.152). The relaxation step of each session was in fact a part of the preparation, both psychologically and physiologically.

In the present research, there was a period of relaxation at the beginning of each unit. When the students entered the language laboratory, each student was free to find his or her own favorite seat. And as soon as they seated themselves, they needed to put on the earphones correctly by checking the "L" and "R" labels on each side as well as the position of the microphone. From the loudspeaker of the language lab, they could all hear a short period of soft music until everyone had the earphones on their heads correctly and fully relaxed. The soft pure music broadcasted was mutually proposed by the students in advance, i.e., Mo Li Hua (*Jasmine Flower* in English name), a well-known traditional Chinese light music.

This short period of soft music had two purposes: the first was to provide time for shifting the focus of students from the previous activity to the present training unit; the second was to provide time for them to check whether the earphones were in a good condition and to adjust the volumes. Students can adjust the volume by themselves and report any problems with the earphones and find another seat with working earphones. In fact, the regular equipment maintenance for each language laboratory from the school side would reduce the risk in this case, and there were also extra seats available in the language laboratory for the unexpected cases. With all the students seated comfortably, they can, if they like,

take a deep breath for several times or close their eyes for a short period of meditation along with the soft music. The psychological preparation and physiological relaxation are designed to bring the readiness for the upcoming steps. Thus, “Relaxation will therefore be the first step recommended.” (Lian,1980, p.17) This phase may take 5 minutes altogether.



Figure 3.7 The interface of *Listening and Speaking*

#### Step 2: Repetition

As the soft music ended, students were then to log into the “Listening and Speaking” online course (see figure 3.7) where they had been pre-grouped into control group and experimental group through the Moodle system. Each group can only access the specific contents that had been designed for that group. The online course allowed students to click into each unit and started viewing its written contents.

As soon as they got into one unit, they would first encounter the “Important information” notice that contained the “technical details” for guiding them on how to use the materials (see figure 3.8). As they finished reading the “Important information”, there was the core part of the training, the Repetition part.

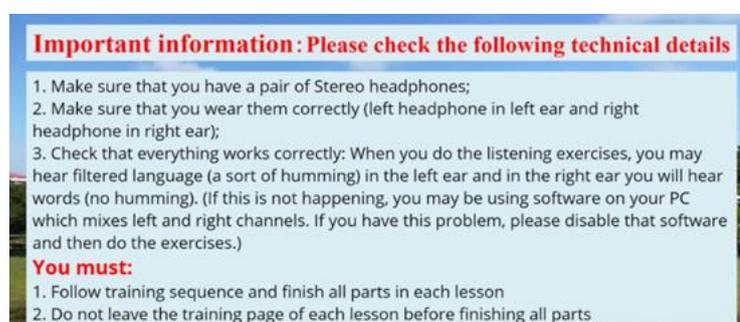


Figure 3.8 The notice of “Important information”

For the contents in the Repetition phase, students in the experimental group were exposed to the dichotic listening materials, the control group to the diotic materials, and all of them should listen and repeat according to the detailed instructions on the screen. The Repetition phase was composed of two sub-phases, the Silent Listening and the Verbal Repetition.

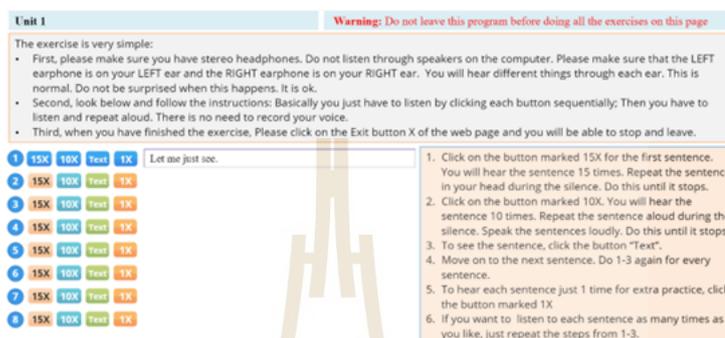


Figure 3.9 The Unit 1 of the “Listening and Speaking”

The Silent Listening part was to tune the students into the sentences of the target language. On the screen (see figure 3.9), students could find buttons in rows of eight. Each row represents one training sentence. There were four buttons in each row that were labeled “15X”, “10X”, “Text” and “1X”. “15X” meant 15 times, similarly, “10X” 10 times, “1X” 1 time. The button “Text” meant to display the written form of the sentence which was hidden until the button was clicked. Students were required to click each button sequentially from “15X”, “10X”, to “Text” and “1X” to unlock the next button. Simultaneously, clicking the buttons sequentially would make the sentence be shown or played the marked number of time(s).

First, students should click “15X” and then listen to the sentence through the stereo earphones. In this case, each sentence was played consecutively for 15 times to soak students’ ears in the target language, which was to make sure students are fully exposed to and awakened in the new linguistic surroundings to defeat and by-pass the mother tongue “phonological sieve” (Trubetzkoy, 1939). Larsen-Freeman (2009) also emphasizes that repetition could drive learning: “When it comes to language learning, revisiting the same, or similar, territory again and again is essential” (p. 584).

Along with the audition, students were encouraged to produce “Humming” or “Inner repetition” for touching and feeling the texture of each sentence. “Humming” was to mimic what they heard with less clear sound, and

“Inner repetition” was to repeat internally what they heard without any sound produced. The voiceless internal repetition or humming was essential for the real articulation since it could raise the intensity of articulatory organs and construct a connection between the meaningful sentence and the related physiological parts, and this kind of articulatory preparation (Levelt, 1999; Emmorey, 2007) which would strongly assist the real production of that sentence.

The internal interpretation of the prosodic structure, the contents, meaning, and sounds of the sentence would be repeatedly intensified as the whole process of repeating 15 times was completed. Then, the next button “10X” was unlocked, which marked the beginning of Verbal Repetition phase where students could model what they heard. Verbal Repetition, or “shadowing” (Cherry, 1953), referring to the technique of “hearing a sentence and then repeating it with a slight delay” (Lambert, 1992), was used here for the vocalization and spoken reconstruction from the students.

Cherry (1953) devised the technique of “shadowing”, and it was originally designed to investigate attention allocation in dichotic listening. Later, based on his experiment, Carey (1971) claimed that shadowing did have a facilitating effect on retention and understanding due to the extra psycholinguistic processes involved in word recognition and semantic recognition. However, Cherry’s original purpose was to figure out how participants repeat one channel aloud while listening dichotically to two stimuli (Lambert, 1992), which means that listeners should pick and model one perceptually more attended signal out of the two differing stimuli. In Cherry’s case, the shadower was focusing on the “attended” task and blocking out the “rejected” task. There was an obvious competition between the two hemispheres in competing for a dominant role in “attending” the input signal.

However, different from Cherry’s distinct input signals sent to the two ears, the present study made the two tracks similar to each other except for the frequency bands permitted. It sought to make use of the advantages of each of the hemispheres to intensify the auditory perception of the input sentences and asked students to articulate them along with their listening process. Thus, from the NVT view, it was to turn the competitive relationship between the two hemispheres into a kind of complementation, compatibilization, and cooperation with both side’s advantages incorporated. In this case, the stimuli sent to the listener were perceptually intensified. The intensified attention might be helpful to monitor, store, and retrieve the linguistic input signals and then to motivate related places of articulation and to transform the message into his/her own verbal output. Within the

process, the shadower's own perceptual system, representational system, and articulatory organs would adjust their habits for producing an imitative output. Furthermore, more concordant pronunciation would emerge with repeated practice and minor self-correction. Thus, this study combined the dichotic listening and shadowing in technique and sought to develop "collaboration" between hemispheric advantages.

The process of shadowing imposed a certain load on the cognitive capacities of the students which could help raise more awareness in parsing the incoming stream of dichotic speech. The students were required to articulate what they think they had heard each time, loudly and carefully. For each sentence, there would be a repetition of 10 times altogether to ensure the quality of shadowing.

When the 10-times repetition concluded, the buttons "Text" and "1X" were unlocked simultaneously. This was designed to provide students with the opportunity to check the reliability of their understanding as well as an extra opportunity for listening and repeating if they wished to do so.

Each sentence would be fully practiced when students have clicked all four buttons. The "15X" button of the next sentence would be unlocked as soon as the "1X" button of the previous sentence had been clicked. Then there was the training for the next sentence for which the Silent Listening and the Verbal Repetition would recycle again until all the eight sentences had been completed. And during the whole process of Audition and Repetition, students only needed to listen to and to repeat the incoming signals without doing anything else like taking notes. This part would last 30 minutes at most.

### Step 3. Reflection

When the students had been cognitively familiarized with the sentences in the Repetition phase, there was the phase of Reflection. Students was then free to produce phonologically, syntactically, and semantically appropriate articulation independently or cooperatively by making use of what they had effectively assimilated through shadowing, as well as to further examine and reproduce the part they were not sure. The purpose was to ask the shadowers to "remember and recall" what they had repeated during the previous phase. Students could either choose to use the recording software in the computer of their seat or to remove the earphones and talk to each other collaboratively. Through imitation and comparison with the model sentences, they might reinforce their perception and production of prosodic structure and articulatory details. This part gave the students a chance to elaborate the appropriateness and accuracy of their utterances as well as the fluidity

and smoothness. With 10 minutes' reflection, their perception and articulation of the target sentences might be intensified and consolidated. The step of Reflection marked the conclusion of each individual training unit. The total training time for each session was about 45 minutes, one standard credit hour in China.

**Unit 1** Warning: Do not leave this program before doing all the exercises on this page.

The exercise is very simple:

- First, please make sure you have stereo headphones. Do not listen through speakers on the computer. Please make sure that the LEFT earphone is on your LEFT ear and the RIGHT earphone is on your RIGHT ear. You will hear different things through each ear. This is normal. Do not be surprised when this happens. It is ok.
- Second, look below and follow the instructions: Basically you just have to listen by clicking each button sequentially; Then you have to listen and repeat aloud. There is no need to record your voice.
- Third, when you have finished the exercise, Please click on the Exit button X of the web page and you will be able to stop and leave.

1	15X	10X	Text	1X	Let me just see.	1. Click on the button marked 15X for the first sentence. You will hear the sentence 15 times. Repeat the sentence in your head during the silence. Do this until it stops.
2	15X	10X	Text	1X	The Charlton room, C-H-A-R-L-I-T-O-N.	2. Click on the button marked 10X. You will hear the sentence 10 times. Repeat the sentence aloud during the silence. Speak the sentences loudly. Do this until it stops.
3	15X	10X	Text	1X	I see, that sounds tricky.	3. To see the sentence, click the button "Text".
4	15X	10X	Text	1X	It's 75 pounds on weekdays.	4. Move on to the next sentence. Do 1-3 again for every sentence.
5	15X	10X	Text	1X	but we do insist that this is paid in cash.	5. To hear each sentence just 1 time for extra practice, click the button marked 1X
6	15X	10X	Text	1X	You have to pay extra for the kitchen if you want to use that.	6. If you want to listen to each sentence as many times as you like, just repeat the steps from 1-3.
7	15X	10X	Text	1X	We have both rooms available that evening.	
8	15X	10X	Text	1X	There are just one or two things you need to think about before the event.	

Figure 3.10 The Training contents of Unit 1

Taking Unit 1 as an example, students should enter into the language laboratory before the scheduled time. They would first listen to a short period of soft music delivered from the broadcaster to make them relaxed, or they could take deep breath along with the music for the same purpose. With the end of the soft music, they started to listen to the 8 sentences (see figure 3.10) by clicking the first button, and then the next button, until the last one. The session of repetition would last 30 minutes. Finally, they would either take off their earphones to exchange ideas with partners using what they had heard or to make recordings and compare it with the models if they wanted, which was the phase for their reflection. The training of Unit 1 ended with their accomplishing all the tasks. Then, it was the turn of the Unit 2, until the last unit, Unit 24. The whole project lasted 12 weeks, and each training unit should begin with Step 1 and end with Step 3.

All the learners should follow the instruction of technical details and finish the whole process sequentially. Meanwhile, in order to facilitate and consolidate the perception and production, all transcripts of each unit were printed and handed out to students after each class for the convenience of their individual checking. Finally, to make sure the equal investment in the present study, students from both groups were neither required nor encouraged to login the online course and do more training out-of-class.

It should be noted again that the experimental group and the control group attended the same online course but listened to the materials in different

aural shapes: optimized dichotic listening sentences versus the diotic unfiltered sentences.

To summarize, this part introduces the preparation of the listening materials and the designation of the Moodle-based online training course, and the steps for conducting each training unit. With the help of the software Audacity and Articulate 360, sentences from each IELTS conversation were transformed into the dichotic mode and composed into different units of the online course. Students in both groups accessed to the online course through the well-equipped internet connection in the language laboratory and finished the tasks step by step as what was designed and required.

### **3.4.3 Data collection**

All along with the conduct of the experiment, both quantitative and qualitative data were collected respectively using the instruments mentioned in the previous part. In this part, a panoramic picture was drawn to show the general pedagogic procedure of the tasks as well as the data collection all through the 12 weeks (see Table 3.7), including the conduction of the pre/posttests, questionnaire, semi-structured interview, biweekly monologue, and the training in each unit.

The tasks for the first week were heavier than that of other weeks because there were the pretest and a Topic Monologue before introducing the students into the online course under a short trial session. The purpose was to make sure the participants fully understand the process of NVT and its requirements, the use of language lab equipment, and the access to the online course. Then there came the first-time treatment, Unit 1. The training procedure went through 3 steps from Relaxation, Repetition, to Reflection, until they finished all the required tasks. With the conduct of Unit 1, students would gradually get used to the new method. In another day of the same week, Unit 2 was conducted in the same training procedure. After each training session, students were asked to produce a learning diary using the provided template. As soon as Unit 3 and 4 were finished, it was time to conduct a biweekly monologue task. In this way, every two weeks, students should finish four units, four diaries, and one topic monologue. The last week witnessed the conduct of the final topic monologue, the posttest, the questionnaire, and the semi-structured interview. As all abovementioned tasks were finished, the whole process of the experiment came to an end.

Table 3.7 The weekly training tasks

Weeks	Tasks		
Week 1	Pretest Topic Monologue 1 Trial session Unit 1	Unit 2	
Week 2	Unit 3	Unit 4	Topic Monologue 2
Week 3	Unit 5	Unit 6	
Week 4	Unit 7	Unit 8	Topic Monologue 3
Week 5	Unit 9	Unit 10	
Week 6	Unit 11	Unit 12	Topic Monologue 4
Week 7	Unit 13	Unit 14	
Week 8	Unit 15	Unit 16	Topic Monologue 5
Week 9	Unit 17	Unit 18	
Week 10	Unit 19	Unit 20	Topic Monologue 6
Week 11	Unit 21	Unit 22	
Week 12	Unit 23	Unit 24	Topic Monologue 7 Posttest Questionnaire Semi-structured interview

For the pretest, it took place prior to the beginning of the treatment in the language laboratory. Participants in both groups were asked to use the microphone on their headset to audio-record while they were reading the listed tasks on the printed papers. The management system of the language laboratory had the function in collecting all the recordings. The posttest was conducted in the same language laboratory immediately after the experiment. The conduct of both pretest and posttest were under the help of two proficient English teachers who were skillful in handling the laboratory management system. A procedure training before the tests was held for them to make sure they could understand all the requirements concerning timing and recording collection.

The topic monologue was held in the language laboratory as well. Each time, the selected topic was shown to the participants, and they were asked to make a short speech related to the topic no less than 1 minute and no more than 3 minutes. The recordings of the impromptu speech were collected within the required time through the management system.

The questionnaire and semi-structured interview were conducted only in the experimental group. As the experimental group finished the posttest, they were asked to stay in the language laboratory for the questionnaire session. It was conducted with the assistance of two volunteers in distributing the questionnaires and collecting the filled copies. Students were fully informed the purposes as well as the way to fill in the questionnaire, and how their information would be protected. Then they should read in detail the introduction, fill out the Demographic Information, and answer the 12 Likert-scaled questions. As soon as they went through all the questions, they could then submit the questionnaire. The results were well preserved for further analysis.

The semi-structured interview was carried out face to face with 10 participants that randomly selected from the experimental group and each interview lasted 10 to 15 minutes. The interview occurred at the site they chose with the purpose of making them feel free to express their views. At the beginning of each interview, they were well informed the purpose, the procedure, and their right to withdraw at any time during the interview. In addition to the pre-designed questions, there were other impromptu questions asked by the interviewer or proposed by the participants. Finally, audio-recordings were made under their agreement and kept confidentially for transcription and further analysis.

Additionally, the diaries produced by the participants in both groups were collected at the end of the experiment. Since there was a template and a blank booklet provided for them in advance, the diaries collected were all well-formatted.

All the measures in collecting the data were smoothly conducted along with the whole process of the treatment, including the pretest, the posttest, the biweekly monologues, questionnaires, and interviews. Then it was the next step, i.e., to analyze what had been collected from the experiment.

#### **3.4.4 Data analysis**

The data produced from the experiment was categorized into the quantitative data and the qualitative data because the way to analyze the two types of data differed from each other (see Table 3.8). For the quantitative data, the current research used the tools of Descriptive statistics, Paired samples t-test, Independent samples t-test, and Moving correlation in analysis, while for the qualitative data, content analysis was the tool in analysis.

Table 3.8 The data analysis method

Types of data	Instruments	Analysis method
Quantitative data	Pretest Posttest Questionnaires Biweekly topic monologues	Descriptive statistics Paired samples t-test Independent samples t-test Moving correlation
Qualitative data	Semi-structured interviews Diaries	Content analysis

### Quantitative data analysis

The quantitative data was composed of students' scores from the pretest and posttest, the results from the Questionnaires, and the rating scores from the biweekly monologues. First, descriptive statistics was used to process the quantitative data with the help of SPSS (Version 20.0) to obtain an overview of the data such as the mean score, standard deviation, and frequency distribution, etc. Then, more detailed inferential statistics were acquired using paired samples t-test, independent-samples t-test, and moving correlation.

First, a paired samples t-test was applied to examine whether there were statistically significant differences between the pretest and posttest for each group. In other words, to determine whether there had been significant progress made within each group. In the present study, the paired samples t-test was used twice, i.e., it was first used to examine the effectiveness of NVT intervention in enhancing the participants' overall speaking proficiency which was designed to answer first part of research question 1, and then it was used to examine the development of accuracy and fluency under NVT, which was meant to answer the second part of research question 1.

Second, an independent samples t-test was used to compare the participants' mean scores on the pretest and posttest which could show whether there was a statistically significant difference between the pretest/posttest scores of the experimental group and the control group. In the present study, it was also used to answer research question 1.

Third, moving correlation is effective in visualizing the dynamic developmental process, the interactions between subsystems, and tracing the changes and degrees of variability in oral L2 production (Yu & Lowie, 2020). In the present study, it was employed to reveal the developmental relationship between speaking accuracy and fluency based on the scores from the biweekly topic monologue tasks, which could reveal how speaking accuracy and fluency co-develop

with each other under the NVT intervention, and ultimately provide answer to the research question 2.

### Qualitative data analysis

Qualitative data normally refer to non-numerical forms of data (Silverman, 2000), and in the present study, the qualitative data was mainly produced from the semi-structured interviews and the students' diaries. As for analyzing the qualitative data, the technique of content analysis was frequently used due to multiple reasons. First, valid inferences from text could be achieved when a set of rigorous procedures are used in content analysis (Weber, 1990). Second, the content-analytic procedures could be replicable on the texts (Krippendorff, 2013). Third, content analysis is unobtrusive for both the sender and receiver of the message (Webb et al, 1981). Finally, the generated results and the texts per se could be preserved for a span of centuries (Namenwirth & Weber, 1987). Thus, the application of content analysis is suitable for the present study when there was a need for “a subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns” (Hsieh & Shannon, 2005, p.1278).

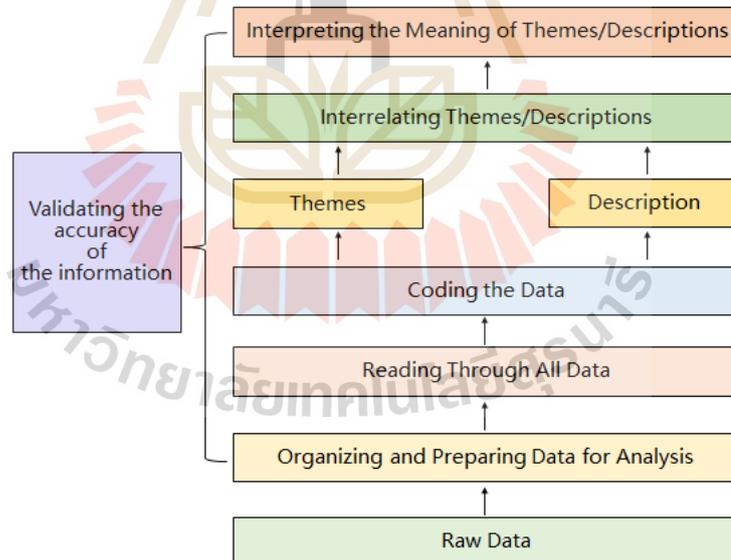


Figure 3.11 General Procedure of Qualitative Data Analysis

In the present study, the collected materials were analyzed with the guidance of a “general procedure” proposed by Creswell, J.W. and Creswell, J.D. (2018, p.269), which is illustrated in Figure 3.11.

Based on the suggested procedure, this study firstly transcribed all the raw data verbatim. Then, the transcriptions were read through for multiple times and

organized with a preliminary understanding of the participants' feelings, ideas, reflections, and suggestions on the intervention of NVT. The coding phase was conducted by segmenting the information into pieces for the purpose of categorizing the participants' responses, and then the derived categories were labelled with different thematic terms. With the integration of the subthemes, and by relating the derived themes to the research questions of the present study, the themes that reflecting the participants' attitudes toward the NVT approach were then interpreted and reported in Chapter 4.

#### **Analysis of accuracy and fluency**

The analysis of accuracy and fluency was in the way of subjective-subjective approach. In fact, the methods used for measuring speaking proficiency vary a lot, either "subjective-subjective approach" or "subjective-objective approach" (De Jong et al., 2012), ranging from qualitative, subjective measurements (e.g., Adams, 1980) to quantitative, objective measurements (e.g., Ahmadian & Tavakoli, 2011; de Jong & Vercellotti, 2016). For assessing the participants' speaking proficiency, different researchers would turn to heterogenous measurements to make the assessment most suitable for their specific understanding and research purposes, which makes it hard to reach an agreement among researchers in measurement because different measurement and analytical methods would bring various research results (Nitta & Nakatsuhara, 2014; Norris & Ortega, 2009).

And in the present study, since the purpose was first to make a general judgement in examining the effectiveness of the newly proposed method, and then to further examine the development of accuracy and fluency, the researcher chose to use a test of overall speaking proficiency for making the judgement of the effectiveness of NVT, and then use the topic monologue tasks to examine the development of accuracy and fluency. In analyzing accuracy and fluency, accuracy is operationalized in terms of the correct use of phonological, lexical and grammatical knowledge and errors in each type would be calculated to see the accuracy development in the participants. Fluency is to be evaluated based on the prosody, delivery smoothness in expression, coherence in explanation, and topic relatedness. Moreover, as what Derwing et al. (2009), Isaacs and Trofimovich (2012) suggested, rater's perceptual evaluation and judgement can also be used as essential supplement. Thus, for the present study, accuracy and fluency are to be evaluated by the raters with reference to the guidance of the rubrics (see Appendix M and N) as well as their own understanding of accuracy and fluence.

To summarize, with the above-mentioned measures in data analysis, the results could not only provide answers to the research questions, but also guarantee a full understanding of the issue of this research.

### 3.4.5 The researcher and the rater

The role of the researcher and rater were different in the study. On the one hand, the researcher in this study served as the teacher for both experimental group and control group, while on the other hand, the raters in the present study were responsible for rating the audio recordings that collected from the experiment.

#### The role of the researcher

In the “perfect” quantitative study, participants act independently of the researcher as if the researcher were not existent (Simon, 2011). The theoretically ideal non-existent role of researcher is treated as a principle in ethical considerations, thus a potential conflict between the ethical requirement and the researcher’s existence becomes apparent in the present contexts. However, the designation and practical conduct of the study could decrease the potential challenge, here are the reasons for it:

On the one hand, the Moodle-based online course, *Listening and Speaking*, was highly self-managed by the participants because there were no interrupts from the teacher all through the training process. The online course was designed under the idea of NVT and for the purpose that the learners could feel free to engage and assimilate information by themselves (Grolnick and Ryan, 1987). The whole training project itself was basically a process of routine training in the language laboratory, and most of the activities were performed by the learners themselves. So, it was obvious that the online course was under the students’ control.

On the other hand, there was limited interaction between the teacher and the students during the training session since the focus of the students was located on the contents of what they hear through headsets and how to make “shadowing”. The teacher only needed to provide necessary technical support or organizational assistance for seat changing or internet connecting. The dominant role of the students reduces the “existence” of the teacher all through the training.

In one word, the training course was largely a self-learning process composed of period of listen-repeat exercises, which would be literally teacher-proof (Wen, Lian, & Sangarun, 2020). In this sense, the role of the teacher was turned to be as only a facilitator or a manager for supporting the training tasks in the language laboratory. The limited influence from the teacher would not bring any abrupt

interference to the treatment. Thus, it was safe for the researcher to function as the teacher for both groups all through the online course training.

#### **The role of the rater**

There were three raters in the study, including two experienced college English teachers (native Chinese) and one native English speaker, and they were invited to rate both the pilot study and the full scaled experiment. In order to make the raters fully understand the requirements as well as to make them get consistent understanding in rating the audio recordings, rubrics (see Appendix M and N) were provided before they started scoring. Moreover, their participation in the pilot study got them ready in rating the recordings produced from the successive experiment. With the audio recordings being renumbered randomly and the producer's information being classified, the rating process was blinded because the raters had no idea of the producer, the time sequence of the recordings. The blind rating could further strengthen the validity and reliability of the research.

#### **3.4.6 Ethics of experiment**

Ethics refers to the moral principles that need to be considered when conducting research. Some of the most critical issues include confidentiality, harm minimization, and the signing of informed consent. The confidentiality principle requires a reliable measure for protecting the participants' individual information from leaking out or being used in other places. Harm minimization implies that the experimental setting, treatment, or any other factor should not bring any severe potential biological or psychological harm to the participants.

For the current research, all the participants were well informed of the treatment measures, information protection, and potential effects in a written consent form. The consent forms were signed by the participants themselves to make sure that they all participated in the experiment voluntarily on the basis of a full understanding of the purpose of the experiment and the possible challenges and risks. Measures for personal information protection and harm minimization like the use of pseudonyms, and equipment safety checking were also undertaken in report writing and conduction of the main study. Additionally, prior to the start of the project, ethical concerns were cleared by the Ethics Committee of GDUPT for their authorized permission and cooperation. Meanwhile, the Suranaree University of Technology Ethics Committee also approved the research.

### 3.5 Pilot study and improvement

The design of the whole research was piloted before it was conducted. Pilot study, also called “feasibility study, small sample size study, pilot randomized controlled trial” (Vogel & Draper-Rodi, 2017, p.2). A pilot study is the first step of the entire research protocol and is often a miniature of the full-scale experiment assisting in planning and modification of the main study. “The primary purpose of a pilot study is not to answer specific research questions but to prevent researchers from launching a large-scale study without adequate knowledge of the methods proposed” (Lowe, 2019, p.117). The purpose for doing a pilot study is to check the appropriateness of research designation, and to make sure the components and procedures are well organized, to be specific, to examine the understandability of terminology, the validation of items, to ensure the smoothness of the procedure, the avoidance of unconscious bias, and to make further adjustment if errors are found. Most importantly, it is to avoid fatal flaw that may be costly in time and money (Polit & Beck, 2008).

Prior to the main study of this research, the pilot study was carried out in two rounds. For the first round, only five volunteered students from GDUPT were recruited with their consent of participating the experiment. All of them were righthanded and had no hearing problem. They were asked to finish studying the online course “Listening and Speaking” within four weeks. Among the five participants, only two students accomplished the full process, including the pretest, posttest, and interview, which were all taken through e-mail and online video conversation due to the outbreak of the COVID-19 pandemic. Based on the results from the only two candidates, the NVT intervention did bring positive effect to their learning to speak, and the novelty of this new approach had more attraction than their previous methods. According to the reflections from the participants, the most annoying barrier was the poor connection to the online course due to the server of the course being located somewhere out of China, which made the logging in time-consuming and exhausting. The unenjoyable experience was the prominent reason that made some of them fail to accomplish the course. Additionally, concerning the course design, they also proposed advice from differing perspectives, such as the necessity to have a guidance brochure if a face-to-face training session was impossible, the repairing of a few functional bugs related to the buttons in some units, and most importantly, they suggested that the server should be much better if it was a domestic one, etc.

Based on the first round, the exposed technical problems were then resolved by repairing the bugs, compiling an instruction, and moving the whole course to a new server located within China which indeed made the access to the online course quick and smooth. With all the preparation settled down, the second round of the pilot study was then conducted.

The second round recruited another group of 13 volunteers from GDUPT with the similar educational backgrounds to the intended samples. All of them were righthanded and normal in hearing. They were randomly grouped into the control group (6 students) and the experimental group (7 students). However, only 5 students from the control group and 5 students from the experimental group eventually accomplished the one-month training.

The second round was completely smooth in the way it was conducted. The smoothness of the process proved the effectiveness of the improvements based on the first round and the feasibility of the pre-designed methodology. Along with the training, related data were then recorded online by the Moodle system, including time of logging in, training duration, progress, etc. Other procedures were also conducted including pretest and posttest, questionnaire. Due to the short time in their training, only a slight improvement was found from the results. However, the results from the questionnaire displayed a positive attitude from them.

During the unexpected COVID-19 period, the whole process of the pilot study was not in a language laboratory and the time length was short. Moreover, there was no chance for other sources of data collection, like student's diary and the biweekly monologue.

It should be noted that 3 raters who had agreed to take part in the project also attended the blind rating session in the pilot study, which at the same time served as a rating trial for the purpose of achieving a consensus in understanding the rubric for evaluation. On the basis of the reflections from both the participants and expert raters, further revisions were made in aspects such as the items of the questionnaire, the contents of the rubric, and few occasional functional bugs of the online course. In general, the pilot study tested and verified the feasibility of the methodology for a full-scale experiment.

### **3.6 Summary**

This chapter covers the research design, selection of participants, instrumentation, data collection and analysis, and the pilot study. The present study chose a mixed-method approach for collecting both qualitative and quantitative data

for a full view of the result. Prior to the full-scaled study, a pilot study was conducted with the purpose of examining the feasibility of the research design. Improvements were made after the pilot study and a solid foundation was then ready for conducting the main study. Finally, along with experiment, both quantitative data and qualitative data was collected with the detailed designation of the research procedure and the application of instruments. The collected quantitative data and qualitative data was then processed and analyzed with the assistance of SPSS and the method of content analysis. The next chapter is to report the findings from the collected data and to explore how the research questions of the present study would be answered.



## CHAPTER 4

### RESULTS

As the conduct of the experiment ended and the blind rating accomplished, the results of the study should be reported by referring to the research questions proposed in Chapter 1. Thus, the current chapter is devoted to report the results of the experiment, and a total of 5 sections are included in this chapter.

The first section is to show the statistic result of the participants' overall speaking performance in the pretest and posttest, as well as the development of their speaking accuracy and fluency, based on the between-group and within-group comparisons in the speaking pretest and posttest, and the topic monologue pretest and posttest. Then, the second section, by examining the monologue tasks using moving correlation, the co-development of accuracy and fluency under NVT is to be reported and to provide answer to research question 2. The third section focuses on the results from the written questionnaire, semi-structured interviews, and students' learning diaries. The findings generated from these sources could exhibit what attitudes the participants might have, which may provide answers to the research question 3. The fourth part is about the data triangulation which would strengthen the validity and reliability of the findings and further explain the answers to the research questions. At last, there is a summary to conclude the current chapter.

#### 4.1 Assessment of speaking proficiency

This section is to report the results from the overall speaking skill pretest and posttest, and the monologue pretest and posttest, which are to answer the research question 1 of the study.

##### 4.1.1 The development of overall speaking skills

To answer first part of the research question 1, the findings from the assessment of overall speaking proficiency tests are reported here directly: the current study found that the students' overall speaking proficiency was improved by the application of the Neo Verbotonal approach, and the new approach was more effective than the diotic method. The forthcoming parts are to report more details of the results.

### Descriptive statistics of the pretest and posttest

On the basis of the quasi-experimental design, a comparison of the students' development in English speaking before and after the treatment was made by using the overall speaking proficiency tests, both pre/post-tests. In the pretest and the posttest, the overall speaking proficiency was assessed according to the students' performance, which would also display the differences between the control and experimental groups and the differences within each group.

The structure of both the pretest and the posttest was the same, which was composed of four parts, including Phoneme reading (20%), Word reading (30%), Passage reading (25%), and Short question responding (25%). Students were required to read the materials or to answer the listed questions, and recordings were made along with the responding process.

Three experienced English teachers (two non-native and one native), guided by the rubrics (see Appendix M), independently and blindly, rated each piece of the audio recordings which were numbered and randomly reordered. The whole rating procedure was blind, and the raters were not able to identify whom the anonymous recordings belonged to or whether they were assessing pretest or posttest. The average of the scores given by the raters provided the final mark.

The inter-rater reliability was firstly calculated using Pearson's correlation coefficient for ensuring the reliability of results. From the data in Table 4.1, there was a significant correlation between the scores the raters gave, either in the pretest or posttest. For the pretest, the correlation between Rater1 (R1) and Rater2 (R2) was reported as .714, and it was .636 between R1 and Rater3 (R3), and .739 between R2 and R3. The posttest was .789 between R1 and R2, .745 between R1 and R3, and .736 between R2 and R3. The above results indicated that there was a high consistency among the raters in their rating and the substantial inter-rater reliability also implied that the measurements in the pretest and posttest was reliable.

**Table 4.1 Inter-rater Correlations in the Pretest and Posttest**

		Inter-rater Correlations		
		R1&R2	R1&R3	R2&R3
Pretest	Pearson Correlation	.714**	.636**	.739**
	Sig. (2-tailed)	.000	.000	.000
Posttest	Pearson Correlation	.789**	.745**	.736**
	Sig. (2-tailed)	.000	.000	.000
	N	64	64	64

\*\* . Correlation is significant at the 0.01 level (2-tailed). R=Rater

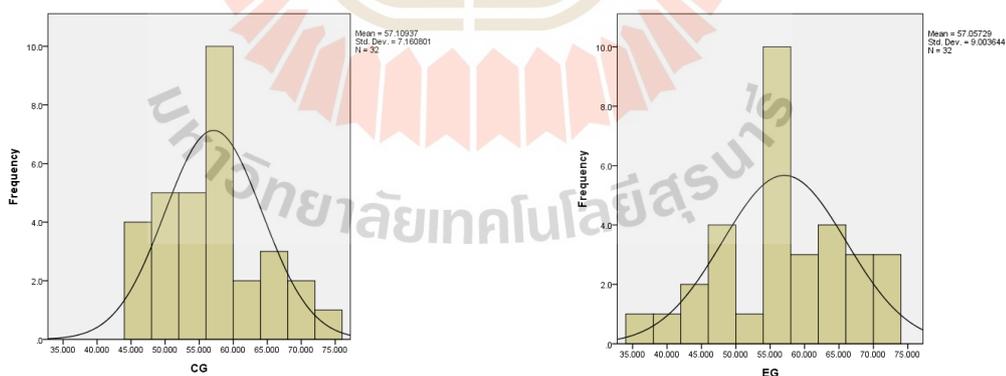
As long as the reliability of the results was calculated and confirmed using the Pearson's correlation coefficient, descriptive statistics are to be presented before conducting the comparisons. The descriptive statistics of the performance of both groups in the pretest and posttest was shown in Table 4.2 covering the aspects of sample number, mean, standard deviation, minimum, and maximum.

**Table 4.2 Descriptive statistics for the students' pretest and post-test scores**

Test	Group	Number	Minimum	Maximum	Mean	SD
Pretest	EG	32	35.67	72.67	57.057	9.004
	CG	32	44.17	72.17	57.109	7.161
Posttest	EG	32	48.33	78.00	63.318	7.912
	CG	32	46.17	73.33	59.328	5.941

Note. EG=Experimental group; CG=Control group

In the pretest (see Table 4.2), it was found that the mean score of EG was 57.057, which was almost the same to the CG, whose mean score was 57.109. Even though the highest scores in both groups seemed satisfactory, 72.67 in EG and 72.17 in CG, the averaged overall performance in the pretest in both groups was unsatisfactory because the means of both groups were below 60% of the total score.



**Figure 4.1 Histograms of the distribution of the total scores in the pretest**

In the posttest, the mean of the EG was higher than 60% (63.318), whereas the mean of the CG was still below 60, reaching 59.328. In terms of the scale of improvement, the EG got an improvement of 6.261 while the CG improved 2.219, which indicated that the EG outperformed the CG in improvement by 282.15%. Based on the descriptive statistics, it seemed that the EG performed better than that

of the CG. Moreover, from Figure 4.1 and 4.2, it is clear that the distribution of the scores in both groups in the pretest and posttest followed normal distribution, which makes it possible to conduct further comparisons between groups.

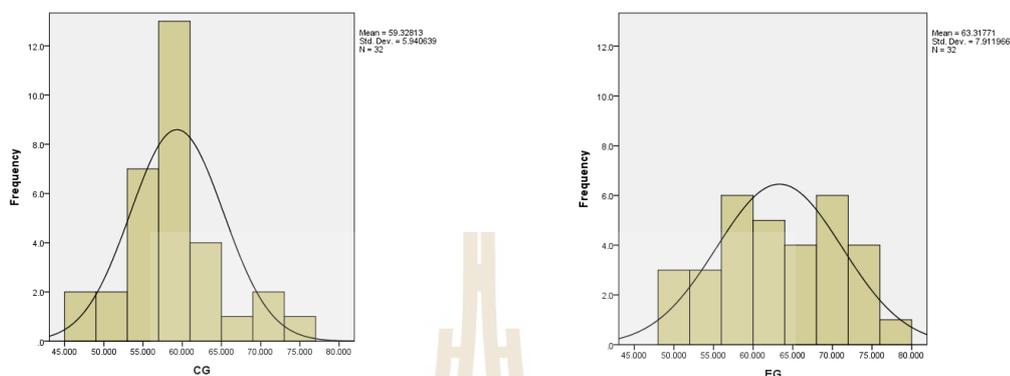


Figure 4.2 Histograms of the distribution of the total scores in the posttest

In order to make it clear, the scores of both experimental group and control group that derived from pretest and posttest were then further compared in two ways, the first was the comparison *between* groups using an independent-samples t-test, and the second was the comparison *within* each group using a paired-samples t-test. Both measures were to examine whether there was any improvement under the proposed treatment of this study.

#### Between-group comparison

In the present study, the significance level set was 0.05, and the confidence interval was set at 95%. Since the size of each group was 32, smaller than 50, the normality of the distribution was then tested using the Shapiro-Wilk test prior to performing an independent-samples t-test. The Shapiro-Wilk test showed that the p values of both groups in both the pretest and posttest were higher than 0.05, with  $p=0.400$  for CG and  $p=0.725$  for EG in the pretest, and  $p=0.247$  for CG,  $p=0.478$  for EG in the posttest, indicating that both groups' scores were normally distributed either in pretest or in posttest. This outcome enabled the use of an independent-samples t-test to compare means in the pretest and posttest.

An independent-samples t-test was used to compare the means of two independent groups for determining whether there was statistical evidence that the associated means were significantly different. Effect sizes were also calculated (Cohen's d). Effect sizes could assess how much difference there is between groups or how strong the relationship is between variables (Durlak, 2009). According to Cohen (1988), an effect size is considered small when a Cohen's d value is of about

0.2, medium when a Cohen's  $d$  value is of about 0.5, and large when the value is of about 0.8 or above.

In the pretest, as shown in table 4.3, a comparison between EG and CG showed that there were no statistically significant differences between the two groups with  $p=0.846>0.05$ . This indicated that, before the intervention, the two groups' performances in the overall speaking proficiency test were at about the same level. In other words, their overall speaking proficiency level was more or less the same before the intervention.

In the posttest, see Table 4.3, the result showed that there were statistically significant differences between the two groups ( $p=0.026<0.05$ ), and the mean score of EG was more than the CG with a difference of 3.990. It was clear that the experimental group performed better than the control group after the NVT intervention. The effect size value was  $d=0.552$ , which was at a medium level as indicated by Cohen (1988).

**Table 4.3 Comparison between EG and CG in the pretest and posttest**

Test	EG (N=32) Mean (SD)	CG (N=32) Mean (SD)	Difference EG-CG	P-value	Cohen's $d$
Pretest	57.057 (9.004)	57.109 (7.161)	-0.052	0.980	0.006
Posttest	63.318 (7.912)	59.328 (5.941)	3.990	0.026	-0.570

Note. EG=Experimental group; CG=Control group

#### Within-group comparison

In order to examine whether there were statistically significant differences within each group between the students' performance in the pretest and posttest, a paired-samples  $t$ -test was conducted. From the result (see Table 4.4), in the experimental group, there were significant differences between the pretest scores and posttest scores, with  $p<0.001<0.05$ , and an effect size of  $d=1.049$  (very large level). For the control group, there were significant differences as well. The means in the posttest were significantly higher than that in the pretest, with  $p=0.034<0.05$ , and an effect size of  $d=0.392$  (low level).

The result indicated that both groups' overall speaking proficiency was significantly improved in the experiment by both approaches used. However, the NVT approach was much more effective than the diotic approach in their performance improvement. As shown in Table 4.4, the EG improved by 6.261 whereas the CG improves by only 2.219, and the EG improved by 282.15% of the CG

score – it generated an improvement almost 3 times greater than the improvement of the CG.

**Table 4.4 Comparison within EG and CG in the pretest and posttest**

Group	Pretest Mean (SD)	Posttest Mean (SD)	Difference Posttest-Pretest	P-value	Cohen's d
EG	57.057 (9.004)	63.318 (7.912)	6.261	<.001	1.049
CG	57.109 (7.161)	59.328 (5.941)	2.219	.034	0.392

Note. EG=Experimental group; CG=Control group

#### Comparison of the subcomponents in overall speaking tests

In order to make a close examination of the effect of the intervention, comparisons both between and within each part of the overall speaking test were also calculated with separate independent samples t-tests and paired samples t-tests.

**Table 4.5 Component Comparison within groups**

Components of test	Groups	Pretest Mean (SD)	Posttest Mean (SD)	Difference Posttest-Pretest	P-value	Cohen's d
Part 1 Phoneme reading	EG	9.323 (3.017)	10.823 (3.158)	1.500	0.012	0.471
	CG	9.292 (3.544)	9.698 (3.525)	0.406	0.469	0.130
Part 2 Word reading	EG	17.802 (4.353)	19.313 (3.859)	1.511	0.061	0.343
	CG	17.271 (2.828)	18.302 (3.120)	1.031	0.076	0.325
Part 3 Passage reading	EG	15.583 (2.110)	16.781 (2.624)	1.198	0.015	0.453
	CG	15.667 (2.954)	15.843 (2.681)	0.176	0.773	0.052
Part 4 Short question responding	EG	14.349 (3.867)	16.401 (3.274)	2.052	0.009	0.495
	CG	14.880 (3.332)	15.484 (3.492)	0.604	0.396	0.152

Note. EG=Experimental group; CG=Control group

Firstly, a paired-samples t-test was conducted individually in terms of the four components of the overall speaking test to see whether there were significant differences within each group. The result is shown in Table 4.5.

For the experimental group, as shown in Table 4.5, the means of all the four components in the posttest were higher than that in the pretest, with P-value as  $p=0.012$  in Phoneme reading,  $p=0.061$  in Word reading,  $p=0.015$  in Passage reading, and  $p=0.009$  in Short question responding. These figures indicate that, for the experimental group, with the exception of part two (Word reading), there were significantly different performances in each test.

For the control group (see Table 4.5), even though the means for each part of the posttest were higher than in the pretest, the results for all the four parts showed no statistically significant improvement, with  $p=0.469$  in Phoneme reading,  $p=0.076$  in Word reading,  $p=0.773$  in Passage reading, and  $p=0.396$  in Short question responding.

**Table 4.6 Component Comparison between groups**

Components of test	Tests	EG (N=32) Mean (SD)	CG (N=32) Mean (SD)	Difference EG-CG	P-value	Cohen's d
Part 1 Phoneme reading	Pretest	9.322 (3.016)	9.292 (3.544)	0.030	0.970	-0.009
	Posttest	10.823 (3.158)	9.698 (3.524)	1.125	0.184	-0.336
Part 2 Word reading	Pretest	17.803 (4.352)	17.271 (2.828)	0.523	0.565	-0.145
	Posttest	19.313 (3.859)	18.302 (3.121)	1.011	0.254	-0.288
Part 3 Passage reading	Pretest	15.583 (2.110)	15.667 (2.954)	-0.084	0.897	0.003
	Posttest	16.781 (2.623)	15.843 (2.682)	0.938	0.162	-0.353
Part 4 Short question responding	Pretest	14.350 (3.867)	14.880 (3.332)	-0.530	0.558	0.147
	Posttest	16.400 (3.273)	15.484 (3.492)	0.916	0.283	-0.271

Note. EG=Experimental group; CG=Control group

By comparing the improvement of performance in each part, it was found that the EG got greater improvement than the CG. Take Part 1 for example, the mean score of EG got improved from 9.323 to 10.823, while the CG improved from 9.292 to 9.698, and the scale of improvement of them were 1.500 and 0.406 respectively. It is obvious that the EG got an improvement of 326.00% than that of the CG in Part 1 in terms of the scale of improvement. For the other three parts, the EG outperformed the CG in a scale of 146.56% in Word reading, 680.68% in Passage reading, 339.74% in Short question responding. Thus, it is indicated that the EG performed better than the CG in all the componential tests.

Secondly, an independent samples t-test was conducted in order to see whether there were significant differences between the two groups in terms of each part of the overall speaking test. Results (see Table 4.6) showed that no significant difference was found between the means of the two groups in each part of the test.

However, statistically non-significant results may be inconclusive since there may be other evidence in the present study, not only the magnitude of the mean difference, could be found if a significant difference had been found in comparing the total scores.

If the progress and regression of both groups in the four components of the overall test were examined in detail (see Table 4.7), we should have more confidence that the EG performed better than the CG in all the tests.

**Table 4.7 Progress and regression comparison between groups**

Task/Group		Progress ≥20%	Progress <20%	Total Progress	No change	Regression <20%	Regression ≥20%	Total Regression
Part 1	CG	7(21.875%)	7(21.875%)	14(43.75%)	2(6.25%)	12(37.50%)	4(12.50%)	16(50.00%)
	EG	14(43.75%)	3(9.375%)	17(53.125%)	4(12.50%)	7(21.875%)	4(12.50%)	11(34.375%)
Part 2	CG	8(25.00%)	10(31.25%)	18(56.25%)	2(6.25%)	11(34.375%)	1(3.125%)	12(37.50%)
	EG	12(37.50%)	9(28.125%)	21(65.625%)	2(6.25%)	7(21.875%)	2(6.25%)	9(28.125%)
Part 3	CG	7(21.875%)	10(31.25%)	17(53.125%)	0(0%)	10(31.25%)	5(15.625%)	15(46.875%)
	EG	9(28.125%)	10(31.25%)	19(59.375%)	3(9.375%)	9(28.125%)	1(3.125%)	10(31.25%)
Part 4	CG	11(34.375%)	7(21.875%)	18(56.25%)	0(0%)	7(21.875%)	7(21.875%)	14(43.75%)
	EG	14(43.75%)	9(28.125%)	23(71.875%)	0(0%)	6(18.75%)	3(9.375%)	9(28.125%)
Note. EG=Experimental group; CG=Control group; Part 1=Phoneme reading; Part 2=Word reading; Part 3=Passage reading; Part 4=Short question responding								

As shown in Table 4.7, there are different numbers of students in each group got progressed or regressed. However, it should be noted that the total number of students in the EG who made progress was more than the CG, and who regressed was less than the CG. For convenience, the students were categorized into five bands based on the scale in their progress and regression, namely, the students who progressed ≥20%, progressed <20%, had no change (or stayed the same, 0%), regressed <20%, and regressed ≥20%. For Part 1, Phoneme reading, among the 32 participants of the EG, more than half (53.125%) made progress, and a majority of the progressing students (14 students), made progress of more than 20%. This was twice the number of students making progress in the CG (7 students). Part 2, Word reading, also witnessed a large majority, 65.625% (21 students), of the EG making progress, with 37.5% of them (12 students) achieving a progress more than 20%, which was 150% of the CG. The same progress happened in Part 3, Passage reading, 59.375% (19 students) of the EG made progress and almost half of them (9 students) progressed more than 20%, still more than the number in CG (7 students). In Part four, the EG outperformed the CG because a large majority of the participants, 71.875% (23 students), could achieve progress, and 43.75% (14 students) of the EG got a progress more than 20%. Thus, for progress, either for the total number of participants or the large scale of improvement, the EG behaved better than the CG.

Turning to the part of regression, all the four parts witnessed less students regressed in the EG than the CG. In Part 1, Phoneme reading, a total of 16 students (50%) in the CG had lower scores in the posttest than in the pretest, much more than the 11 students in the EG. For Part 2, Word reading, there were 12 students (37.5%) of the CG and 9 (28.125%) in the EG regressed. Moreover, in Part 3 and 4, the difference between CG and EG was even more salient. In Part 3, there were almost half, 46.875% (15 students), of the CG regressed and 5 of them regressed more than 20%, which was much more than the number of student (1 student, 3.125%) in the EG. Similar thing happened to Part 4, a total of 14 students, account to 43.75% of CG, and only 9 students (28.125%) of EG regressed, among which, 7 of the CG and 3 of the EG regressed more than 20%.

Drawing on the diversity of the achievements in each part and the abovementioned comparisons, the EG was in a better componential performance in all the parts of the test than the CG, which indicated that the NVT intervention did have significant impact on the EG's performance, and it was more effective than the diotic method.

To sum up, firstly, the overall result (see Table 4.4) – total of all the subscores - suggests that the EG outperforms the CG: (a) The EG scores significantly better statistically than the CG; (b) The EG improves by 6.261; (c) The CG improves by only 2.219; (d) The EG scores a mean of approximately 4 points greater than the CG (significant); (e) The EG improves by 282.15% of the CG score. The abovementioned facts for the TOTAL scores sufficiently indicate that the EG's improvement is almost 3 times the CG's improvement.

Secondly, for the subskills (see Table 4.7), comparative improvements were also found in the EG. While the differences between the means are not always statistically significant, it is undeniable that the EG's improvement, for every subskill, is larger than the improvement of the CG because, by referring to the progress the participants had achieved, the EG had more students progressed and less regressed than the CG in all the componential tests.

Either for the total score or the subscores, the consistency in outcome using double blind ratings is eloquent in and of itself. There are no instances where the EG scored less than the CG. There are no instances where the EG experienced more regressions than the CG. There are no instances where the proportion of the improvement in the EG was lower than that of the CG. The EG outperformed the CG consistently in all measures. While individual differences in means are not statistically significant using a t-test, that is not the only measure of significance. And, while we are currently discussing

the sub-components of the measurements, we should not forget that the difference in the means between the groups for the TOTAL score WAS in fact significant.

Conclusion can be drawn based on the abovementioned results that the Neo Verbotonal approach could help improve the students' overall speaking proficiency and was more effective than the diotic method, which provides the answer for the first part of research question 1.

#### 4.1.2 The development of speaking accuracy and fluency

For the second part of research question 1, based on the results from the monologue pretest and posttest, it is found that both accuracy and fluency were enhanced under NVT and the traditional diotic mode, but the NVT approach was more effective than the diotic approach.

In the present study, thanks to the biweekly monologue tasks, both the inter-individual data (between groups) and intra-individual data (within a group) were collected to examine the changes happened to the development and co-development of accuracy and fluency. On the one hand, the inter-individual data was in the form of pretest and posttest. Since the first monologue task was held just before the first training session, it was regarded as the benchmark or the pretest of the training in terms of accuracy and fluency. At the same time, the last monologue task was seen as the posttest. Hence, a paired samples t-test and an independent samples t-test was adopted respectively to examine whether there was a significant difference before and after the intervention within and between the groups. On the other hand, in order to examine the intra-individual variation (fluctuation within a group) at different stages across the process of treatment, time series data could be used (Costa et al, 2019), such as the 7 monologues in the present study, to analyze the co-development of accuracy and fluency and their interaction across the stages. With both types of data, a deeper insight into the dynamic development of language learning could be achieved (Molenaar, 2015). It is first to report the results of the inter-individual group comparisons using independent samples t-test and paired-samples t-test.

Firstly, an independent samples t-test was conducted to make a *between* comparison in terms of accuracy and fluency of both groups, and the result is shown in Table 4.8.

In the pretest (see Table 4.8), a comparison between EG and CG showed that there were no statistically significant differences between the two groups either in accuracy ( $p=0.875>0.05$ ) or in fluency ( $p=0.798>0.05$ ), which may indicate that, before the intervention, the two groups' performances in both accuracy and fluency were at about the same level.

Table 4.8 Comparison of A&amp;F between EG and CG in pretest and posttest

Test	Variable	EG (N=32) Mean (SD)	CG (N=32) Mean (SD)	Difference EG-CG	P-value	Cohen's d
Pretest	accuracy	17.417(1.896)	17.401(2.049)	0.016	.875	-0.008
	fluency	16.714(1.821)	16.583(2.205)	0.131	.798	-0.064
Posttest	accuracy	19.234(1.329)	18.125(1.866)	1.109	.008	-0.685
	fluency	18.568(1.837)	17.448(1.572)	1.120	.011	-0.655

Note. EG=Experimental group; CG=Control group

Moreover, the result showed that, in the posttest, there were statistically significant differences between the two groups in both accuracy ( $p=0.008<0.05$ ) and fluency ( $p=0.011<0.05$ ), and the mean scores of EG in both aspects were more than that of the CG with a difference of 1.109 in accuracy and 1.120 in fluency. The effect size value was  $d=0.685$  for accuracy and  $d=0.655$  for fluency, which were both at a medium level as indicated by Cohen (1988).

So, it was clear that the experimental group performed better than the control group after the NVT intervention whether it was for accuracy or fluency.

Secondly, a paired-samples t-test was used to calculate the data from both the experimental group and control group to examine whether there were statistically significant differences in accuracy and fluency within each group between the students' performance in the pretest (monologue task 1) and posttest (monologue task 7) (see Table 4.9).

As shown in Table 4.9, the experimental group sees that the means of accuracy and fluency in the posttest were higher than that in the pretest, with P-value as  $p<0.001$  for both of them. The effect sizes were at a large level, with  $d=0.863$  for accuracy and  $d=0.844$  for fluency. It shows that the NVT approach was highly effective in improving both aspects.

Table 4.9 Comparison of A&amp;F within EG and CG in pretest and posttest

Group	Variable	Pretest	Posttest	Difference	P-value	Cohen's d
		Mean (SD)	Mean (SD)	Posttest-Pretest		
EG	Accuracy	17.417(1.896)	19.234(1.329)	1.817	<.001	0.863
	Fluency	16.714(1.821)	18.568(1.837)	1.854	<.001	0.844
CG	Accuracy	17.401(2.049)	18.125(1.866)	0.724	<.001	0.718
	Fluency	16.583(2.205)	17.448(1.572)	0.865	.004	0.556

Note. EG=Experimental group; CG=Control group

As for the control group (see Table 4.9), significant differences were also found in both aspects, with  $p < 0.001$  for accuracy and  $p = 0.004$  for fluency, which means that both aspects got promoted. The effect sizes (Cohen's  $d$ ) of them were at a medium level with  $d = 0.556$  and  $d = 0.718$ . The diotic method is also effective in promoting both accuracy and fluency.

Taking the scale of improvement into comparison, the NVT group outperformed the control group with a scale of 250.97% in accuracy and 214.34% in fluency (see Table 4.9), which means that the NVT approach was more effective than the diotic method in promoting speaking accuracy and fluency.

To sum up, both accuracy and fluency were found to be promoted under the two approaches, the NVT intervention and the diotic mode. Meanwhile, the NVT approach significantly outperformed the diotic one in both accuracy and fluency. The results may indicate that the newly proposed method, an optimized dichotic listening method, did have a significantly positive effect in English speaking learning. To make a closer examination, in the forthcoming part, more developmental details are to be reported concerning the interrelationship between accuracy and fluency.

## 4.2 The interrelationship between accuracy and fluency

And for research question 2, with the conduction of moving window correlation, it is found that, under the two approaches, there were different developmental patterns of the interrelationship between accuracy and fluency. In the traditional diotic mode, both accuracy and fluency got increased at first and then got decreased latter. The relationship between them changed alternately from supportive to competitive along with the treatment, and among which the A&F dilemma appeared occasionally. Contrarily, the experimental group witnessed a step wise growth in both accuracy and fluency, and there was a relatively strong positive correlation between them which left no traces of A&F dilemma.

### 4.2.1 Developmental patterns

As for the differing details of the development of accuracy and fluency in the control group and experimental group, a full description of them is to be drawn in a visualized way with the assistance of devices of scatter/dot, line graph, and second-degree polynomial.

It is firstly to make a description on the development of accuracy in the control group. Based on the mean scores of the accuracy in each task, Figure 4.3 displays the visualization of its development. By using the technique of Scatter/dot, Figure 4.3 Graph A shows the distribution of the scores in each monologue task. As

the dots were related to each other with lines, the actual fluctuations along with the times of tasks emerged, as shown in Figure 4.3 Graph B. When fitting a trendline to the data using a technique of second-degree polynomial (see Figure 4.3 Graph C), a continuous curve was obtained, which could clearly display the rising and falling trend of accuracy's development. Finally, it is to put all the elements together in Figure 4.3 Graph D to show how they relate to each other.

Based on Figure 4.3, the development of accuracy in the control group went through an unstable uprising phase from the first task to the fourth task. From the fourth to the sixth task, it was at a higher level and lasted for a certain period. The last task witnessed a slow falling phase, but the falling phase ended at a higher level than that of the beginning (see Graph A and Graph B in Figure 4.3).

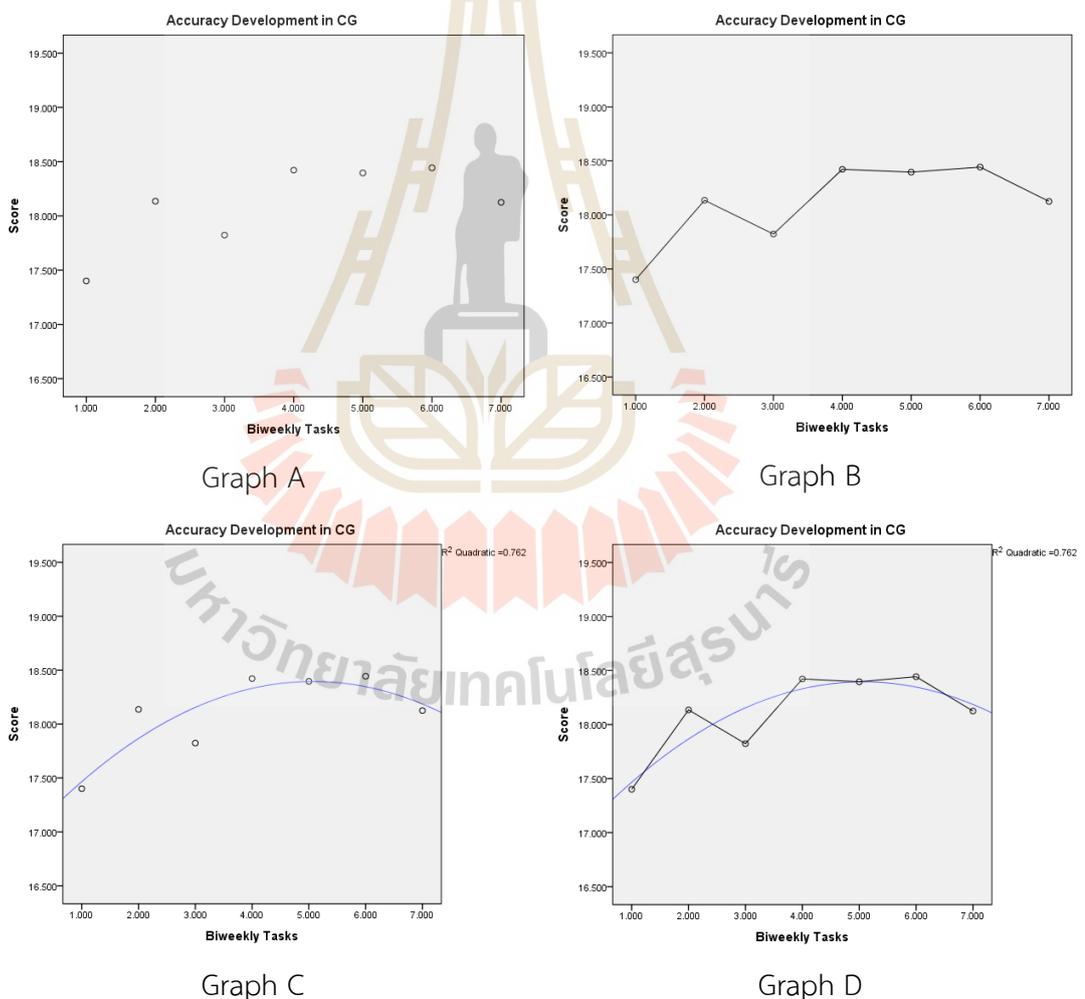
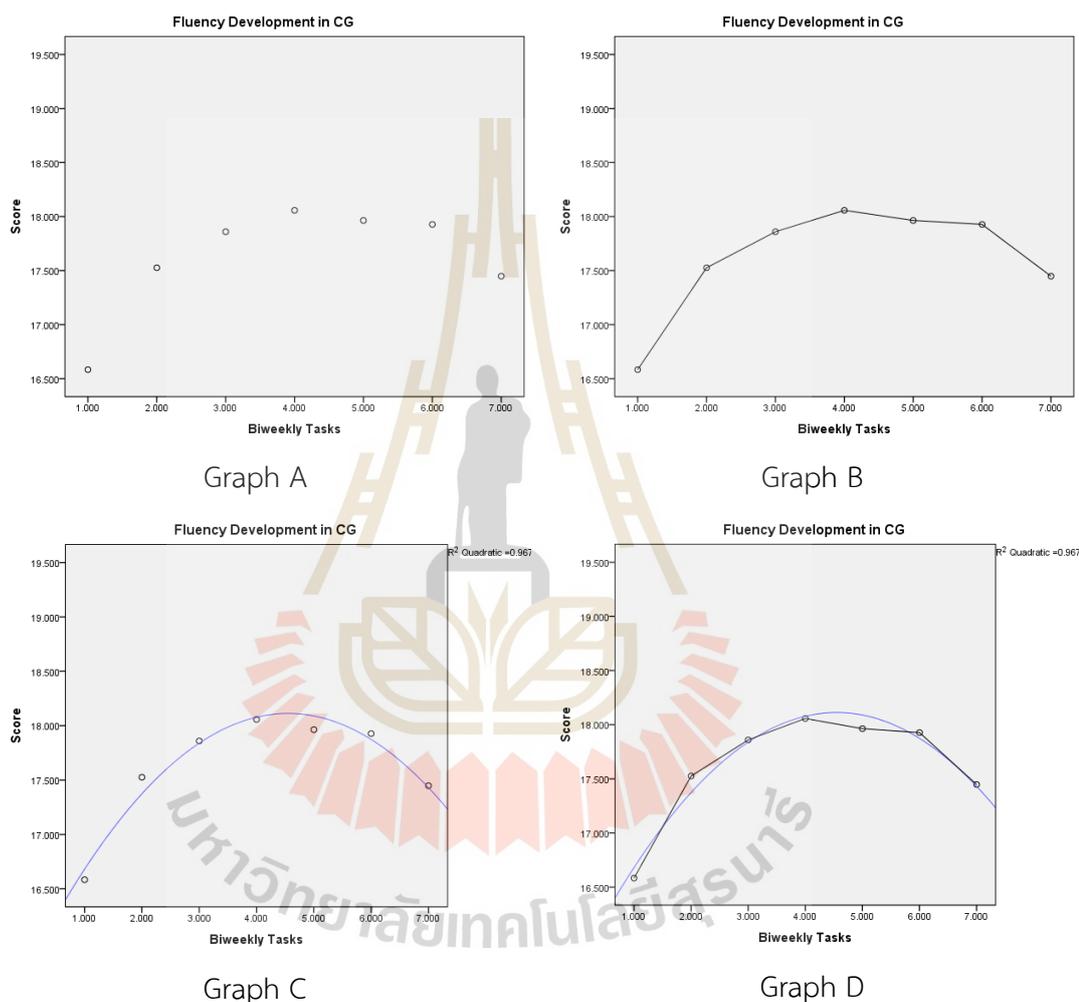


Figure 4.3 Accuracy development in the control group

It is clear that, under the diotic treatment, the control group got promoted in accuracy at the initial period and stayed at a peak for several weeks. However,

from the trendline (see Graph C and D in Figure 4.3), there was an obvious falling phase from the sixth task to the last task as the treatment went on. Although the score of the last task was more than that of the first task, it was much less than the scores of the peak period, even less than the second task score, which may indicate the diotic method became not the same effective as the previous periods.



**Figure 4.4 Fluency development in the control group**

The development of fluency in the control group is presented in Figure 4.4, which is also composed of four parts. Graph A of Figure 4.4 displays the scattered dots of the scores in each task, and Graph B is the line graph that connecting the 7 dots. The trendline is shown in Graph C, and Graph D displays them in combination. Based on Figure 4.4, the fluency in the control group went through a less fluctuated process than that of the accuracy. The first half part witnessed a

steady rising phase and second half saw a slow falling trend (see Graph B and Graph C in Figure 4.4). Its top fell at the fourth task, the same as in accuracy. The score of the ending task was still more than that of the first task.

According to the abovementioned developmental patterns of accuracy and fluency in the control group, there was a certain similarity as well as certain minor difference between them. For similarity, it was found that both aspects experienced a rising phase and a falling phase, and both ended at a higher level at the last task than that of the beginning task. For difference, there was a more fluctuated development in accuracy and a more stable evolution in fluency, and the accuracy had a longer peak period whereas the fluency saw a clear turning point when it reached the top. The different patterns of their development may represent the different effects of the diotic approach.

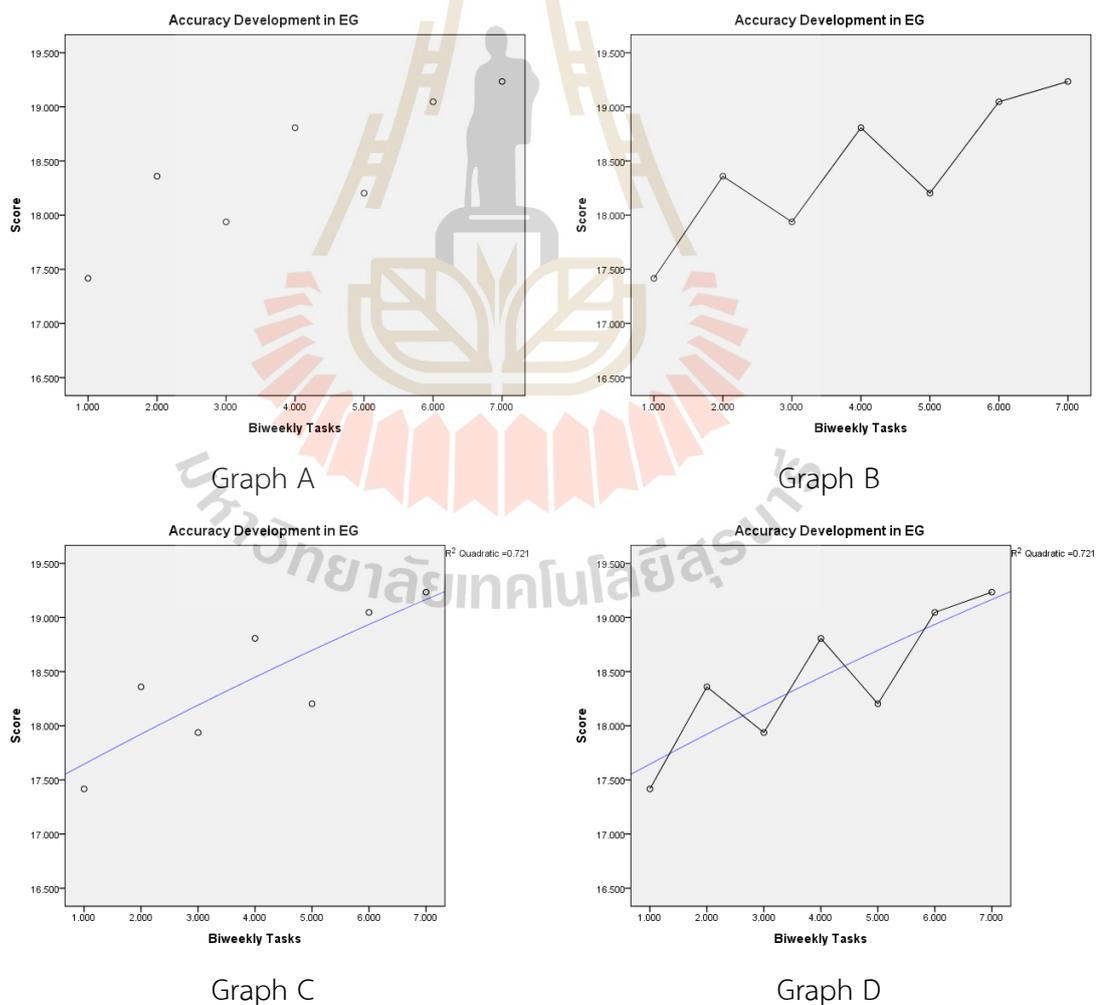


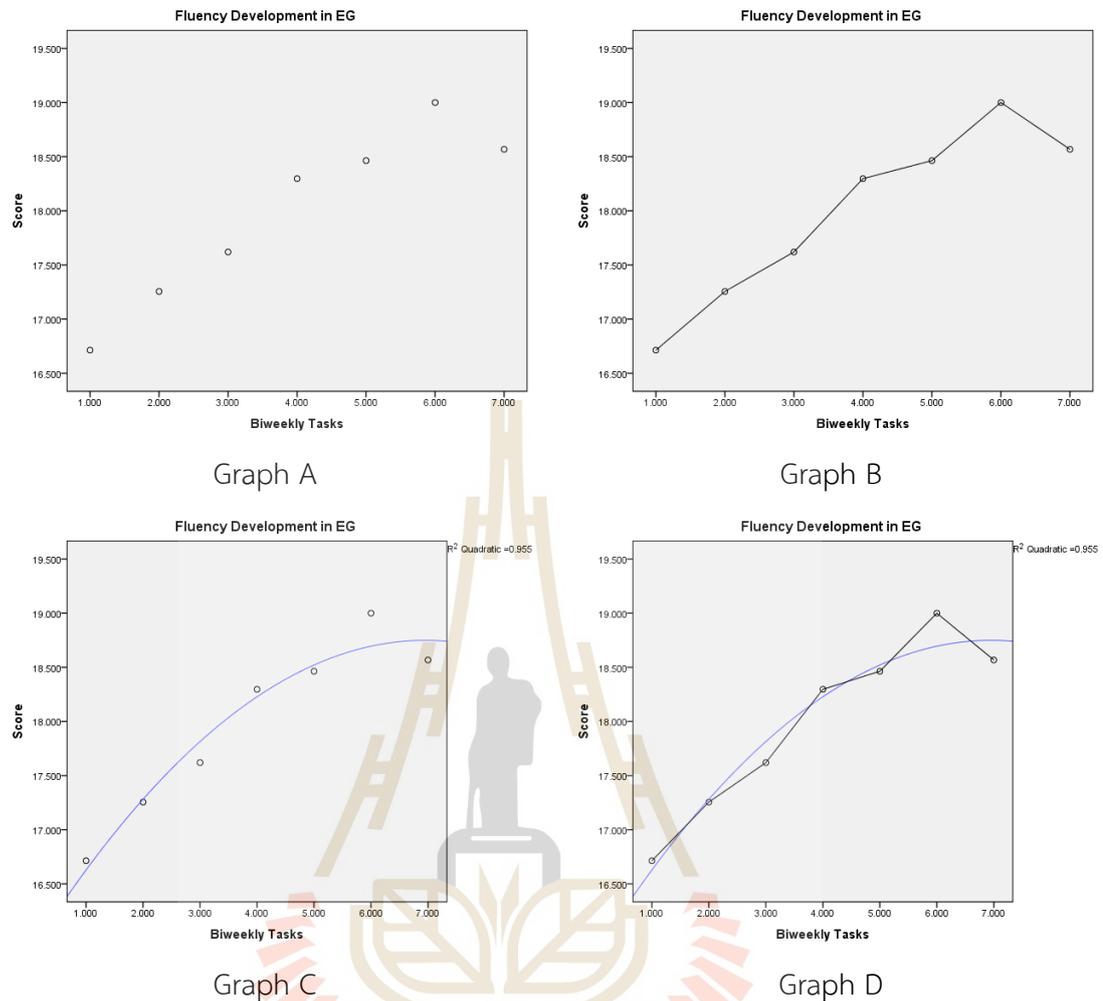
Figure 4.5 Accuracy development in the experimental group

Turning to the experimental group, the development of accuracy is shown in Figure 4.5. Among the four graphs, Graph A shows the distribution of the scattered dots, and Graph B is the line graph when all the dots were related. A trendline was also added and shown in Graph C, and Graph D displays all of them in combination for the purpose of detailed comparison.

Based on Figure 4.5, the accuracy of the experimental group went through a constant fluctuation from the first task to the last one (see Figure 4.5 Graph B). It increased and decreased alternately and reached its peak at the last task. Viewing the trendline in Graph C, it was clear that the accuracy grew steadily in an upward trend and displayed a moderate steepness in changing.

As for fluency in the experimental group, Figure 4.6 illustrates its development, with scattered dots in Graph A, a linked line graph in Graph B, a trendline in Graph C, and a combination of all elements in Graph D. It was found that there was a gradually steady increase of fluency along with the first 6 tasks, and the score of Task 6 was at the top of the plot. The last task encountered a moderate dip in its score, but it was still the second highest score among all the tasks. The trendline demonstrated a constant increase in fluency. And the curving of the trendline came to be more moderate in steepness at the ending part than that of the initial period, which may indicate that the NVT approach could work during the whole process, and its effectiveness was getting less obvious than the beginning period.

Both accuracy and fluency in the experimental group could also be compared from the perspectives of similarity and difference. For similarity, starting from the lowest score of the first task, both aspects had a steadily and constantly increasing trendline until the last task. For difference, the accuracy went through more fluctuations and its trendline appeared to be steeper without too much curving, while the fluency fluctuated less and its trendline was slightly getting curved and not as steep as the initial part. The distinct developmental patterns of both aspects might indicate the different effects of NVT on them.



**Figure 4.6 Fluency development in the experimental group**

To sum up, the description of the development of accuracy and fluency in the abovementioned parts could show that there were different developmental patterns in both groups. Meanwhile, it is interesting to find certain similarities in both groups. On the one hand, the accuracy went through a more fluctuated progress while the fluency was comparatively more stable in changing; on the other hand, both aspects of accuracy and fluency had a quick increase at the initial period and a gradual slowdown at the ending of their trendlines. However, it could also be found that the experimental group witnessed a more long-lasting promotion than that in the control group in both aspects, which may indicate the different effects of the intervention.

### 4.2.1 Interrelationship

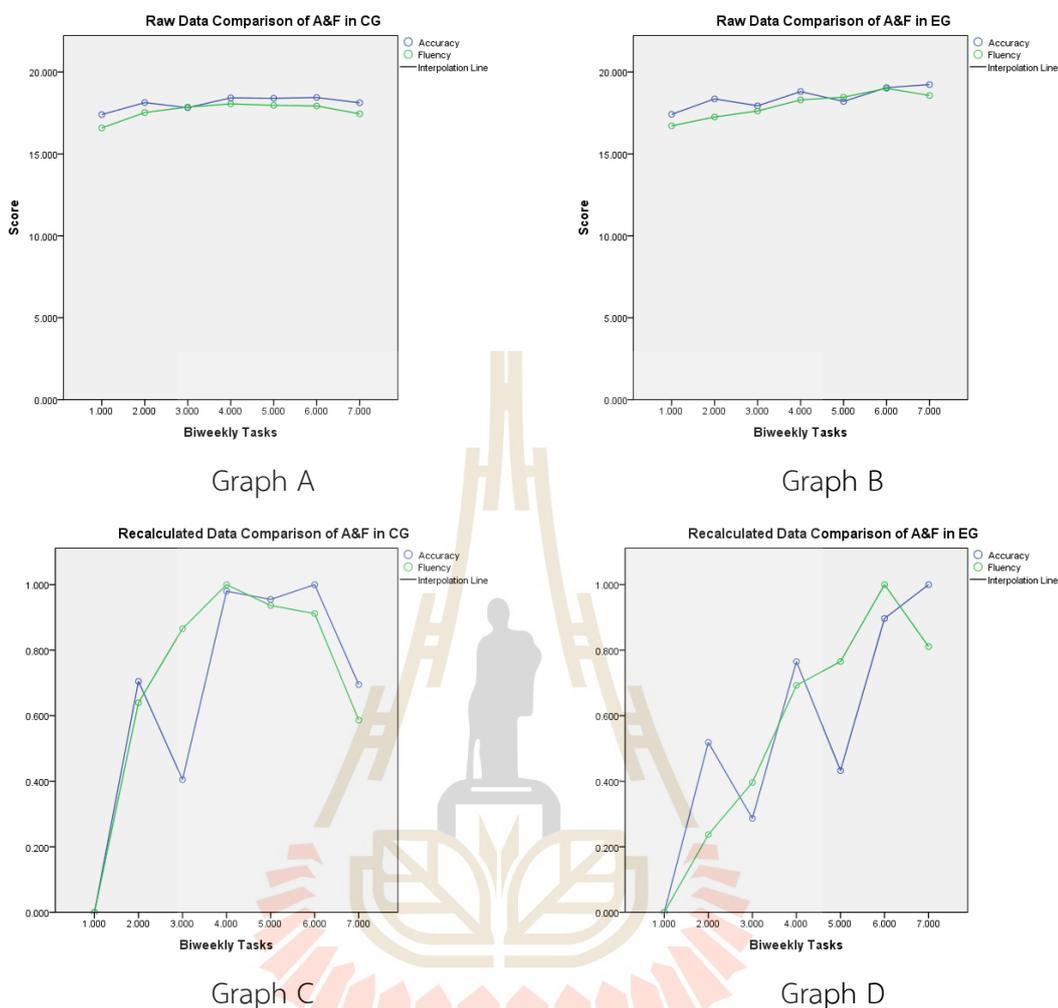


Figure 4.7 Comparison of A&F development in CG and EG

This part is targeted at answering research question 2. The interrelationship between accuracy and fluency in each group is to be presented by using the technique of moving correlation, which is effective in visualizing the dynamic developmental process and tracing the changes and degrees of variability in oral L2 production (Yu & Lowie, 2020). A visualized comparison of the interactivity of accuracy and fluency in both groups is displayed in Figure 4.7, including the raw data (Graph A, B), recalculated data (Graph C, D).

In Figure 4.7, the raw data (the mean scores) of the development of accuracy and fluency in both groups was displayed respectively in Graph A and B, which could only show the general shape of their development while the dynamic interactivity between them was less obvious. To make it more visualized, a technique of “Recalculating values to 0–1” was used with referring to the formula:

$y=(x-\min)/(\max-\min)$ , for which the originally different scaled values and interactions of different constructs can be visualized and compared to each other more easily (Verspoor et al., 2011, p.161). The recalculated values were presented in Graph C (the control group) and Graph D (the experimental group), which was much more legible in making a comparison than in Graph A and B.

From the lines in Figure 4.7 Graph C, it is clear to find that, both accuracy and fluency of the control group got improved steadily at the initial two tasks. Task three witnessed a sharp decrease in accuracy and a steady increase in fluency. However, from task four to task six, there appeared to be a peak period for both aspects even though fluency turned to a slight downward trend from task four. The last task saw a similar obvious decrease in them both. For the experimental group, as shown in Figure 4.7 Graph D, the accuracy was more unstable and had more repeated fluctuations, and it turned upward and downward alternatingly in the tasks. Contrarily, fluency had a more constant increasing trend, and it got enhanced gradually along with the tasks except the last one.

The analysis of the interpolation lines in the previous part may be limited in exploring the association between the two aspects because the association between variables is normally expressed by a correlation coefficient. However, in the present study, the association between accuracy and fluency in both groups changed over time. Verspoor et al. (2011) initiated a technique of “moving window correlation” that can be applied to the time series, which was proved effective in visualizing the changing correlation between variables (Spoelman & Verspoor, 2010; Dong, 2016; Zheng, 2016; Yu & Lowie, 2020). A moving window is a time frame that moves up one measurement each time. It is usually predetermined by taking, for instance, 3 or 5 measurements of the total (Verspoor et al., 2011). Each window partly overlaps the preceding observation points, such as: correlation (t1...t3), correlation (t2...t4), correlation (t3...t5), etc.

In the present study, aiming to obtain a relatively detailed picture of the developmental patterns, the predetermined window span was three consecutive measurement points (Dong, 2016; Chang & Zhang, 2021; Zhang, 2022), which resulted a total of 5 moving windows. The correlation values based on the 5 moving windows were then calculated and they were illustrated in the Table 4.10.

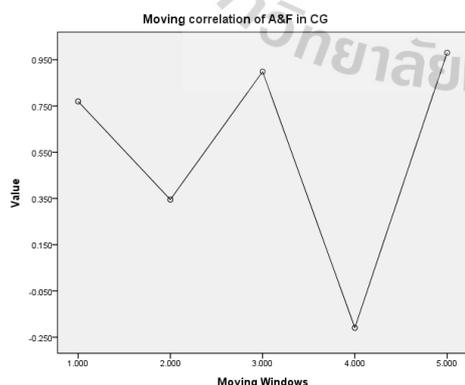
Table 4.10 Moving correlation between accuracy and fluency in EG and CG

Moving Windows	Moving Correlation Values				
	Window 1	Window 2	Window 3	Window 4	Window 5
EG	0.642	0.654	0.596	0.543	0.511
CG	0.769	0.345	0.898	-0.209	0.979

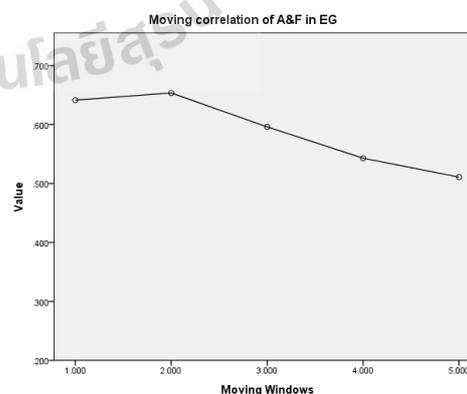
Note. EG=Experimental group; CG=Control group

The values of the moving correlation were also located between -1 to +1. Among which, a positive value meant the two variables were directly related (if one increased, the other also increased) and a negative number meant they were inversely related (one increased, the other decreased). The stronger the correlation between variables, the closer the correlation coefficient value would go to  $\pm 1$ . Generally, according to Taylor (1990), Lee Rodgers and Nicewander (1988), a positive value  $r \leq 0.35$  was considered to suggest a weak correlation, 0.36 to 0.67 a moderately significant correlation or a relatively strong correlation (especially when  $r > 0.4$ ), 0.68 to 1.0 a strong correlation or a fairly strong correlation (especially when  $r > 0.8$ ). The strongness of correlation could also be reversely applied to a negative value.

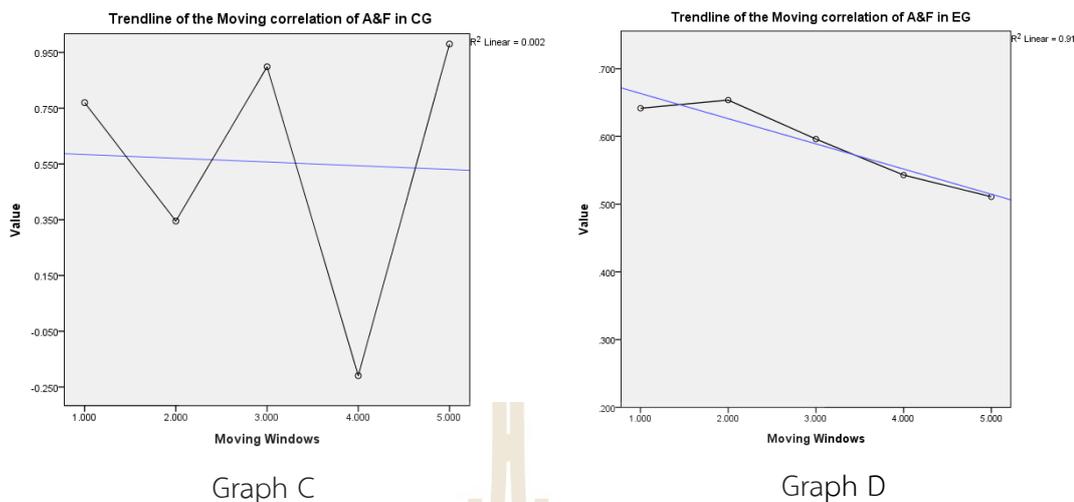
Based on the values in each moving window, the moving correlation trajectories were plotted respectively, as shown in Figure 4.8, Graph A for the control group and Graph B for the experimental group. Moreover, in order to see the general trend of the moving correlation, a trendline was also fitted for each group, as shown in Graph C and Graph D. Based on the value (see Table 4.10) and the pattern (see Figure 4.8) of the moving correlation, more details were then examined.



Graph A



Graph B



Graph C Graph D  
**Figure 4.8 Moving correlations of A&F in CG and EG**

For the control group (see Graph A and C in Figure 4.8), it is found that, there was a strong positive correlation ( $r=0.769$ ) at the initial moving window, which was regarded as a supportive relationship according to Verspoor et al. (2011), i.e., one variable got improved together with the other variable, and the two variables may support each other in development. Then the correlation decreased at the second window to  $r=0.345$ , a weak correlation, and which was followed with a much stronger correlation at the third window, with a value  $r=0.898$ . The fourth window witnessed a weak negative correlation,  $r=-0.209$ , and it means that the two aspects were developing in different directions, i.e., one increased and the other decreased, which may indicate that there was a “competitive” (Verspoor et al., 2011) relationship between accuracy and fluency. In other words, during the fourth window, the two aspects did not develop in a simultaneous way, which was possibly a slight trace or symptom of the A&F dilemma. As it came to the last moving window, the value of moving correlation increased to an even higher level,  $r=0.979$ , which was a fairly strong moving correlation.

All across the moving windows, the correlation values fluctuated alternately, and most of them were above 0 except only one negative value in the fourth moving window. It could be generally concluded that, in a large sense and across most of the moving windows, the two aspects of accuracy and fluency may develop hand in hand under the diotic context even though a casually weak competition may happen. In other words, the only negative and weak correlation value may not be sufficient to indicate that the A&F dilemma is unavoidable in the

diotic approach. Furthermore, alternative evidence may be found by examining the trendline of the moving correlations.

Viewing the trendline (Figure 4.8 Graph C), it was found that the trendline did not change too much and located at a relatively strong level except a minor decrease, with  $r$  between 0.5 and 0.6, which might mean, the average correlation value would stay generally similar at a relatively strong level for a long term in spite of the fluctuations in each window. Thus, for the control group, on the one hand, the consecutive windows would see the alternating changes of the correlation between accuracy and fluency switched from strong supportive to weak supportive, even a casually and weakly competitive; and on the other hand, the stable trendline across the moving windows may signify a constantly and relatively strong correlation between them. Putting the two perspectives together, it may possibly indicate that both aspects of accuracy and fluency were largely enhanced simultaneously in most windows as well as in a long period and the A&F dilemma would appear at a low possibility under the diotic context.

As for the experimental group, in most of the moving windows (see Figure 4.8 Graph B), the moving correlation values locate at a level between  $r=0.5$  to  $r=0.66$ , among which there is a minor increase in the second moving window and a slight decrease after the second moving window, with the lowest ( $r=0.511$ ) at the last moving window., These values may indicate that there was a relatively strong correlation between the aspects of accuracy and fluency all through the moving windows, meanwhile, it may also indicate a strong “supportive” (Verspoor et al., 2011) relationship between accuracy and fluency, i.e., they increased and decreased almost synchronously most of the time.

However, the trendline (see Figure 4.8 Graph D) of the moving correlation showed that the value was getting slightly weaker along with the moving windows. The gradually less strong correlation between accuracy and fluency may indicate a less supportive and a possible competitive relationship if, and only if, the treatment lasted long enough and a negative value appeared, even though it was less likely to happen linearly due to the complex of language learning. So, based on the experiment of the present study and with  $r=0.511$  as the lowest moving value, it is safe to say that, for most of the moving windows, the development of accuracy and fluency were correlated to each other in a positive and relatively strong way, i.e., when accuracy got increased, fluency increased, and when accuracy decreased, fluency also slowed down, which eventually shaped them into an overall

simultaneous enhancement along with the NVT treatment. Moreover, from the results, there were no traces of the A&F dilemma in the experimental group.

It is time to wind up the interrelationship between accuracy and fluency based on the abovementioned results. For the control group, both accuracy and fluency got steady increase at the first half period and got waned at the latter half period. Their interactivity changed alternately from supportive to competitive along with the treatment, and among which the A&F dilemma appeared occasionally. Contrarily, the experimental group witnessed a step wise growth in both accuracy and fluency, and the relatively strong positive correlation between them may indicate a steady simultaneous enhancement with the help of the NVT treatment.

To sum up the present section, there are multiple interesting findings based on the abovementioned results, either the inter-individual group analysis or the intra-individual variability examination.

Firstly, it is found that both groups got significant improvement in accuracy and fluency, and the experimental group outperformed the control group with a scale of 250.97% in accuracy and 214.34% in fluency in improvement.

Secondly, the development of accuracy and fluency were always in different patterns and had a distinctive character, i.e., accuracy was more likely to fluctuate while fluency was more likely to develop in a steady way, no matter it was in the control group or in the experimental group.

Thirdly, for the developmental trendline in both groups, both of accuracy and fluency went through a quick improvement at the initial period and a gradual slowdown in the ending period.

Finally, in terms of the interrelationship, both the diotic context and the NVT context may be workable in enhancing both aspects of accuracy and fluency simultaneously and largely diminishing the A&F dilemma. However, the negative value in the control group may indicate a possibility of A&F dilemma, even it was very low. In contrast, the NVT approach did much better than the diotic method since there were no traces of any competition between accuracy and fluency all through the intervention.

In spite of the limited five moving windows and short term of experiment, the results from the present study may deepen our understanding of the development and co-development of accuracy and fluency under different contexts.

### 4.3 Students' attitudes

This section is to report the students' attitudes toward the NVT intervention and seeks to find out the answer to research question 3. There were three sources of data obtained from the experiment, including the written questionnaire, the semi-structured interview, and students' diaries. The results from the questionnaire were analyzed quantitatively, and the interview and diaries were analyzed using the qualitative content analysis technique. Holistically speaking, on the basis of the multiple sources of data, it is found that the participants, in a large proportion, had a positive attitude toward NVT approach.

#### 4.3.1 Data from the questionnaires

To answer research question 3, students' attitudes for learning to speak using the NVT approach were collected by means of questionnaire (see Appendix E). After the posttest, 32 students in the experimental group responded to the distributed questionnaires and all submitted the filled copies. The items were answered by the students using a 5-point Likert scale to signify their degree of agreement, ranging from "strongly agree" to "strongly disagree". Each statement was scored as: 5 = Strongly agree; 4 = Agree; 3 = Undecided; 2 = Disagree; 1 = Strongly disagree.

The questionnaire was composed of twelve questionnaire items. Structurally, the items were divided into three parts. The first 5 statements were to elicit a general judgement in the respondents concerning their like or dislike the NVT approach. The second part, item 6 to 9, was about whether the students believed there was a relationship between the NVT intervention and the development of their speaking proficiency as well as the two aspects of accuracy and fluency. The last part, including item 10 to 12, was about the feelings resulted from the intervention. For each item, the students' scores did not represent their speaking performance but only their opinion on each item. So, the data from the questionnaire could provide an inner view showing participants' experiences and feelings toward the NVT treatment.

Table 4.11 Results of students' attitude toward NVT

	Statements	N	SA	A	U	D	SD	M
1	NVT is helpful in speaking learning	32	6 18.75%	15 46.88%	6 18.75%	5 15.63%	0 0%	4
2	NVT is effective in speaking improvement	32	6 18.75%	16 50%	6 18.75%	4 12.5%	0 0%	4
3	NVT is interesting in speaking learning	32	5 15.63%	9 28.13%	13 40.63%	5 15.63%	0 0%	3
4	I am unhappy with NVT	32	2 6.25%	4 12.5%	8 25%	11 34.38%	7 21.88%	2
5	I prefer the diotic approach to NVT in speaking learning	32	1 3.13%	5 15.63%	7 21.88%	14 43.75%	5 15.63%	2
6	I believe that my speaking is improved by using NVT	32	4 12.5%	15 46.88%	9 28.13%	3 9.38%	1 3.13%	4
7	I believe that my speaking accuracy is improved by using NVT	32	4 12.5%	14 43.75%	10 31.25%	3 9.38%	1 3.13%	4
8	I believe that my speaking fluency is improved by using NVT	32	5 15.63%	12 37.5%	10 31.25%	4 12.5%	1 3.13%	4
9	I believe that both of my speaking accuracy and fluency get improved at the same time by using NVT	32	4 12.5%	14 43.75%	10 31.25%	3 9.38%	1 3.13%	4
10	In NVT, my attention is more raised and focused	32	4 12.5%	14 43.75%	9 28.13%	4 12.5%	1 3.13%	4
11	In NVT, I speak more automatically	32	3 9.38%	15 46.88%	9 28.13%	4 12.5%	1 3.13%	4
12	In NVT, I speak more confidently	32	5 15.63%	13 40.63%	8 25%	5 15.63%	1 3.13%	4

Note. SA=Strongly agree; A=Agree; U=Undecided; D=Disagree; SD=Strongly disagree; M=Median.

It is noteworthy that Cronbach's Alpha Coefficient was used for testing the reliability of the scores and it indicated that the results were highly reliable ( $\alpha=0.95$ ). In addition, the median (the number found exactly in the middle of the distribution) of the scores for each item was also calculated since median could show the central tendency of the responses, indicating the average respondent's opinion. The detailed results were found in Table 4.11.

First, concerning the general attitudes, the results from item 1-5 showed that the majority of the participants in the experimental group were positive towards the NVT approach. They agreed and even strongly agreed that NVT was a helpful, effective, and interesting method. For example, in Statement 1 and 2, among the participants, there were a total of 65.625% and 68.75% agreeing. When the NVT approach was put together with the diotic learning method, most of them showed their favoring attitudes toward the new approach, such as in Statement 4 and 5,

showing that only 6 participants who were not happy with NVT, amounting to 18.75%, and only 1 participant (3.13%) strongly preferred the diotic approach. Additionally, the percentage of the participants who preferred the diotic approach was 18.75%, much less than the counterparts, who preferred the NVT, a percentage of 59.38%. It should be noted that, the interestingness of NVT, as shown in Statement 3, was agreed by 43.76% of the participants, and 40.63% of them were undecided, which may indicate a necessity in making NVT more interesting.

Second, Statement 6-9 were about the students' opinions on the relationship between the NVT intervention and the development of their speaking proficiency as well as the two aspects of accuracy and fluency. From the result of these items, most of the participants admitted that the NVT approach was effective in promoting their speaking in general and in the aspects of accuracy and fluency as well. For example, a total of 59.38% agreed with Statement 6 and reported that their speaking was improved under the NVT intervention, while only 12.5% (4 participants) disagreed. When it was about accuracy and fluency, about 56.25% of the respondents agreed to the idea that their speaking accuracy was improved under NVT and 53.13% believed that their speaking fluency was improved under NVT, in other words, a majority of the participants admitted that NVT was effective in promoting their speaking accuracy and fluency. In addition, for Statement 9, most of the participants believed that both accuracy and fluency were improved simultaneously under NVT, accounting for 56.25%.

Third, it was about the feelings resulted from the NVT intervention in the participants. Most of the participants approved that the NVT intervention could raise their attention and make them speak more automatically and confidently. For example, the result from Statement 10 showed that there were 4 (12.5%) respondents strongly agreed and 14 (43.75%) agreed that their attention was more focused under NVT, reaching a total percentage of 56.25%. Statement 11 and 12 showed that most of the participants felt more automaticity and confidence in their English speaking, and only a small percentage of students (15.625% in automaticity and 18.75% in confidence) disagreed this.

Moreover, as shown in Table 4.11, among the 12 statements, 9 of them got a median of 4, 2 negative statements (statement 4 and statement 5) got a median of 2, and only 1 statement (statement 3) got a median of 3, which could indicate that, for almost all the statements, the participants who agreed with the statements outnumbered the ones who disagreed.

In sum, the results of the questionnaire showed that around two-thirds respondents agreed that NVT was helpful (65.63%) and effective (68.75%) for their speaking learning. Even though the training process was moderately interesting, their overall feeling was more likely to welcome the new approach than the diotic one. Meanwhile, for more than half of the participants, both of their accuracy and fluency got enhanced hand in hand, and finally most of them believe they could focus more and speak more automatically and confidently with the help of NVT. The positive attitudes held by the participants toward the NVT approach were encouraging for speaking learning, which will be discussed in the forthcoming chapter.

#### 4.3.2 Data from the semi-structured interviews

In order to answer research question 3, more information was collected with the conduct of a semi-structured interview. The 11 open-ended questions (Appendix H) of the semi-structured interview were pre-designed with reference to the items in the questionnaire aiming to go deeper in exploring the participants' attitudes toward NVT. 10 students (31.25%) in the experimental group were randomly selected and asked the interview questions in Mandarin Chinese. Permissions were got from the interviewees in making recordings and further analysis. They were guaranteed to be free to express their ideas, and they were also willing to share what they held. The data collected from the 10 semi-structured interviews were then transcribed verbatim, coded, and analyzed using the technique of content analysis under the guidance of the "general procedure" proposed by Creswell and Creswell (2018, p.269).

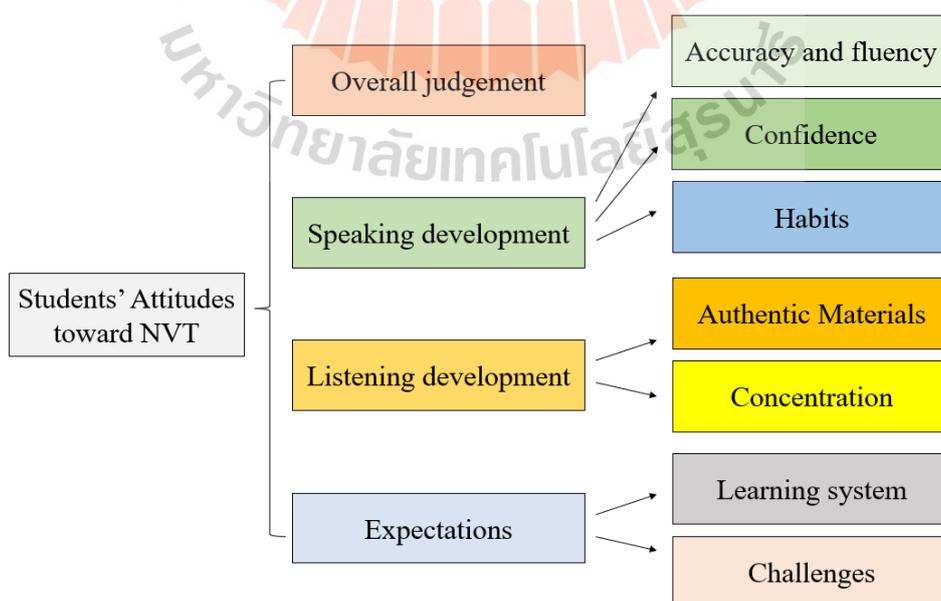


Figure 4.9 Summary of the students' attitudes

In a broader view, the data was generalized into four themes: their overall judgement, their speaking development, their listening development, and their expectations. In addition, there are also the sub-themes in each branch. The results from the semi-structured interviews are shown in Figure 4.9, and reported based on the four major themes as follows:

#### Theme 1: Overall judgement

The majority of the participants emphasized the helpfulness of NVT in their speaking learning. They mentioned that NVT was “a very good method”, and it was “creative and helpful”, “comprehensive” for speaking more “natively” and “smoothly”. Meanwhile, they also displayed their preferring attitude toward NVT. With comparison to their previous learning experience, they thought NVT was a “whole new experience”, “more interesting”, and their speaking could become better with the training. Even though some of them complained that it was not as interesting as they expected. Evidence was found from the examples shown below:

*EG13: I think this method is actually a very good method, good for our oral practice and listening practice.*

*EG6: This method seems to be more comprehensive. Learn to adjust to the model slowly. Follow it and understand it, to feel the pronunciation and intonation, well, along with such a process, and then I can internalize it.*

*EG16: it can provide me some useful oral expressions and how these expressions are spoken natively.*

*EG7: It's useful because I think it's more systematic. It's specifically for this one. After listening to it so many times, because it repeats, you would become better.*

*EG14: I felt that my speaking has been improved to a certain extent and the method was supportive for learning other aspects of English.*

*EG9: It is less interesting at the beginning, but as I listened to it more, I was happy with it.*

#### Theme 2: Speaking development

In terms of the aspects of speaking proficiency, most participants agreed that they could better express their ideas in English, and their speaking fluency and accuracy were both elevated. They were able to produce native sounds and express intonational features naturally. Moreover, most participants noted that their speaking

confidence was elevated along with the training process: they were initially “afraid of making mistakes”, and then they can “basically follow up”, and finally, their previous anxiety decreased, and they became more confident in oral expression. In addition, several participants expressed that they might have got their bad speaking habits corrected with the intense shadowing and repetition under NVT. The examples below show the evidence:

*EG2: I think yes, especially for fluency. That may be a great improvement for me due to imitation of the different intonational features.*

*EG31: I might express more authentically in the future. Those words and expressions will be more accurately used.*

*EG16: I can speak faster and more fluently with the help of the training.*

*EG6: Because there are many times of repetition. The intensity of training is higher, the number of times is more, and then we can follow the sentences more smoothly.*

*EG2: It promotes my confidence and makes me more concentrate on imitating the sentences.*

*EG7: Be a little modest, I think it gives me some self-confidence.*

*EG31: I may not dare to say before, because I was afraid of making mistakes.*

*EG2: I do think it is beneficial. I was used to practicing speaking English by myself, and a lot of errors took place, resulting to a bad speaking habit.*

*EG9: Even though you can't understand a word occasionally, but you can continue to listen, and you may be able to figure it out.*

*EG27: it can correct some of my confusions in speaking, such as the weak form.*

*EG29: I feel that my voice may be corrected. I didn't have chance to communicate with foreign teachers in high school. Maybe, those sounds from our mouths, maybe very strange for a foreigner.*

### Theme 3: Listening development

All the participants clearly admitted that NVT could raise their concentration in listening, especially when they were confronting something “new”, “attractive”, “interesting”. They also reported that the “authentic” materials related

to different settings were quite meaningful and practical for learning. Evidence was found in the examples below:

*EG29: Those words and sentences are common and daily, and authentic. I feel those sentences are practical and useful.*

*EG17: I want to learn what the native speakers actually speak. So, I think these situational sentences are useful.*

*EG16: It stimulates my concentration and makes me verbally follow the repetition.*

*EG2: Because I need to hear clearly, and to follow the speaking details. And I need to concentrate to listen to the sentences when they were read fast.*

*EG4: You have to listen hard before you can imitate. The new method requires you to concentrate very much and open your mouth.*

*EG14: Well, When the sentence is more attractive and interesting to me, my attention will be more focused.*

However, some students showed their anxiety when they encountered some unfamiliar words and expressions, also, some students expressed their worriedness when they could not follow the fast speech.

*EG24: I would be very glad to follow and imitate. But, if I listened for several times, and I still felt unsure of how the sentence was pronounced, I would be a little worried and sometimes I would think extra listening may also be useless.*

*EG6: I would have a feeling of anxiety if the words were linked to each other closely. If there is a button for slowing down the speed, that would make me feel better.*

#### Theme 4: Expectations

The participants also made advice for improving future training, such as to make learning system adaptable for mobile phone, to provide chance for controlling speech rate, either for slowing down or speed up, to employ more diversified topics, and to integrate other type of materials (e.g., movie clips) into the training, etc. There were also the challenges mentioned by them, such as the unfamiliar words, longer sentences, fast speed, and connected speeches. The examples are as follows:

*EG6: I think, it is the speed of each sentence, if there is a button for slowing it down or raising it up, it would be better.*

*EG7: Personally, what about using movie clips. Take a paragraph and learn it sentence by sentence while watching the video.*

*EG27: Reduce the number of times, and if possible, better adapt to the mobile phone.*

*EG31: I think, well, I think it's necessary to be interesting. That's for sure. When you are training, you can have more diversity of topics, conversations in different contexts, and some funny topics.*

*EG14: If there was a new word, I may need time to think about its meaning and fail to follow up. The same may happen to the long sentences.*

*EG9: Some technical problems should be improved, and, I think some sentences are read too fast, the speaker spoke in a connected way, which is really a challenge for imitation. Maybe the native people do speak like that.*

The above analysis could make it clear that the results of the semi-structured interviews and the results of the questionnaire had close correspondence to each other. Both sources of data revealed that the participants in the experimental group held a largely positive attitude toward the Neo Verbotonal Approach. They highly agreed that NVT was effective and efficient for enhancing their speaking fluency and accuracy, raising their concentration, reducing their anxiety, promoting their self-confidence, and changing their incorrect speaking habitus in learning English.

#### **4.3.3 Data from the diaries**

In order to have a further understanding about their attitudes, participants from both EG and CG were asked to make a learning diary. Students needed to report the basic information and their feelings of each training. Since there was a template provided for the students to follow, the information they needed to report included the date, place, content of each training session, as well as their reflections. As long as the data was collected, the content analysis technique was applied to analyze the reflection part only because the other parts (the training date, place, or content) were much alike for each group. The reflections by the participants were of great importance in analysis because they shared their views, comments, feelings, and expectations in this part. Then, their diaries were analyzed using content analysis, just as how the interview data was analyzed. Following the procedure suggested by Creswell and Creswell (2018, p.269), the data of the reflection part

from both groups was firstly grouped, coded, and then categorized. Finally, here were the themes emerged in both the EG and CG.

### Diaries written by the experimental group

Since the diaries were a time series memorandum that preserved the ideas occurred to the participants across the intervention, there appeared to be certain differences and changes in the themes at different stages. For the experimental group, the major themes generated from the diaries by the EG are shown in Figure 4.10.

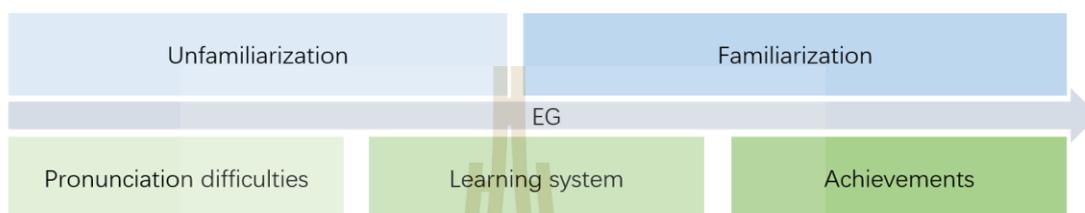


Figure 4.10 Diaries written by the EG

At the initial stage of the experiment, the participants mentioned a lot about the newness of the NVT approach (the signal, the intense repetition, etc.), and the problematic pronunciation habit that influenced their shadowing. When the experiment went on for a few weeks, they gradually became familiar with the new method. Just as what was mentioned in the questionnaire, they were at first “afraid of making mistakes”, and then they can “basically follow up”. It seemed that they might have more difficulties at the beginning and more feeling of achievements in the ending phase.

Some of them even proposed their advice for improving the learning system. Some students reported that there should be the Chinese translation together with the English text, and others required additional buttons for controlling speech speed, either slowing down or doubling it. In addition, some participants were surprised as they found how some expressions were actually expressed, and they wanted to have an extra part to explain the new words or expressions.

At the ending phase, the participants were wholly familiar with the new method, and emphasized their improvement in speaking. Generally, the majority of the participants held a positive attitude toward the NVT approach. The examples are illustrated below:

*EG15 (Week 2, Session 4): When I repeated and figured out a sentence, it would make me have more confidence in attending to the subsequent training.*

EG2 (Week 4, Session 8): It seem that the left side was a little weak in sound at first. It costed me some time to get used to repeating the sentence time and another time again since I felt hard to open my mouth and afraid of making silly mistakes.

EG17 (Week 4, Session 7): There might be some bugs in the system, because it sometimes would stop working, I clicked many times. My opinion is that why not provide a Chinese translation to each sentence, and a part for explaining the new words.

EG12 (Week 6, Session 12): I thought Gosh was a new word, but as I checked it in the dictionary, I found it is only a way to express a feeling of astonishment. I think this should be the real English the common native speaker would speak, and it attracted me to imitate more, just Do as the Romans do.

EG26 (Week 7, Session 13): It was effective in imitating the details of a sentence, especially the intonation, which made my verbal expression more fluent. And I hope we can speed up or slow down the sentences.

EG3 (Week 10, Session 19): The method pushed me to repeat and imitate, I think it is useful. At first, if I took off the earphone, I may feel at lost and I would speak like before. Now, I could express some phrases in the way of the model.

EG22 (Week 11, Session 21): The imitation of shorter sentences could not be difficult for me anymore. Longer sentences were a challenge for me initially, and I made it with multiple times of imitation. The training was effective.

EG4 (Week 12, Session 24): We may need a part of “New words” or “Glossary” to facilitate our understanding.

#### Diaries written by the control group

The result of the thematic analysis of the diaries by the control group is presented in Figure 4.11.

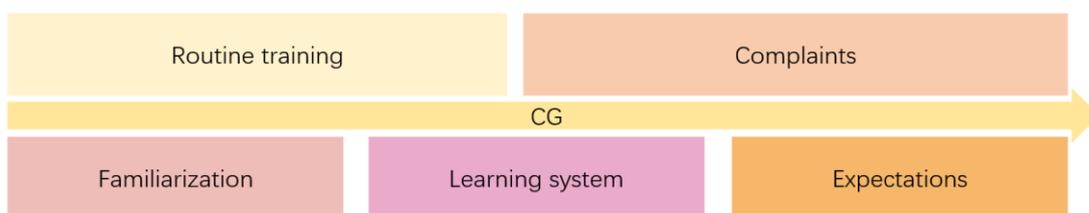


Figure 4.11 Diaries written by the CG

Students in the control group attended the diotic training in which signals for both channels were non-filtered, which was exactly the way they were used to in

their familiar listening classes. Based on the content analysis, there was also a largely positive attitude from them even though the attitude changed a little bit along the process.

At the initial stage, participants reported that they were routinely trained for two credit hours every week which was moderately acceptable, and they got familiar with the training procedure without too much difficulty except the intense repetition. They did not mention the signal. Generally, most of the participants in the control group expressed their gradual acceptance of the training procedure as the first few sessions carried out.

Certain issues related to the learning system also happened to the control group during the training process, such as the occasional button bugs, and their failure in repeating longer sentences, following fast speech rate and unfamiliar expressions.

However, at the last phase, even though the diotic way of training also witnessed a progress in students' speaking, complaints were made concerning the fluctuation of the effectiveness because they thought the latter sessions of the training were not as effective as the initial stages.

*CG8 (Week 3, Session 5): The sentences were very practical, and I finally know how to express "I've".*

*CG12 (Week 4, Session 7): I think it is similar to our listening class. I need only to repeat, and it is not difficult for me to get used to it.*

*CG4 (Week 8, Session 15): Long sentences were not easy to repeat, I should say, I might forget the initial parts of it, especially when there was new word.*

*CG20 (Week 8, Session 16): The training was effective, it enabled me to transfer what I had learned, I mean, some expressions, to my English writing and reading. But we may need some more clues for understanding the sentences, such as the explanation of some new words and phrases.*

*CG13 (Week 9, Session 17): I got stuck sometimes, and there was no response when I clicked the mouse.*

*CG17 (Week 11, Session 22): The effect was not as obvious as the initial phase of the training, multiple times of repetition would bring me a feeling of tiredness, just like today.*

*CG 25(Week 12, Session 23): The fast-read sentences were not friendly for close imitation. And I was more active in the first few sessions, but I gradually became less active when I was a little tired of the training mode.*

Based on the diaries, the main difference between them should be the fluctuations of their feelings during the process, that is, the experimental group experienced a phase of newness at the beginning and a feeling of achievement at then ending part, while the control group got used to the routine training quickly at first and turned to complain a bit at the ending phase. For the similarity between the two groups, both of them gave some advice and had a largely positive attitude in acceptance of their method.

To conclude, this part analyzed the questionnaire, the interview, and the diaries, the results showed that the experimental group had a largely positive attitude toward their learning method, the NVT approach. Meanwhile, the respondents expressed the challenges in using the learning system and proposed their own advice and expectations for improving the internet-based learning system.

#### **4.4 Data triangulation**

The elicited quantitative and qualitative data from the experiment made it possible for a data triangulation which might strengthen the reliability as well as validity of the findings and further interpretations (Merriam, 1988; Mayring, 2000; Schreier, 2012). By relating both types of data to the findings that meant to answer the research questions, it was found that multiple sources of data might be conducive to illustrate the same one finding while one source of data may be supportive to multiple findings (see Figure 4.12).

Drawing on Figure 4.12, it is shown that the data source A, C, and D could be interrelated to each other in terms of answering research question 1 and be used to support the finding 1 that there was an improvement in the overall speaking proficiency under the NVT intervention. Previously, the analysis of the results of the overall speaking proficiency pretest and posttest, using paired samples t-test and independent samples t-test, showed that both EG and CG had significantly improved in their speaking while the EG outperformed the CG in a whole round way. Moreover, the same finding was found in the questionnaire and the semi-structured interview, in which the students straightforwardly expressed their feelings of an improvement in speaking.

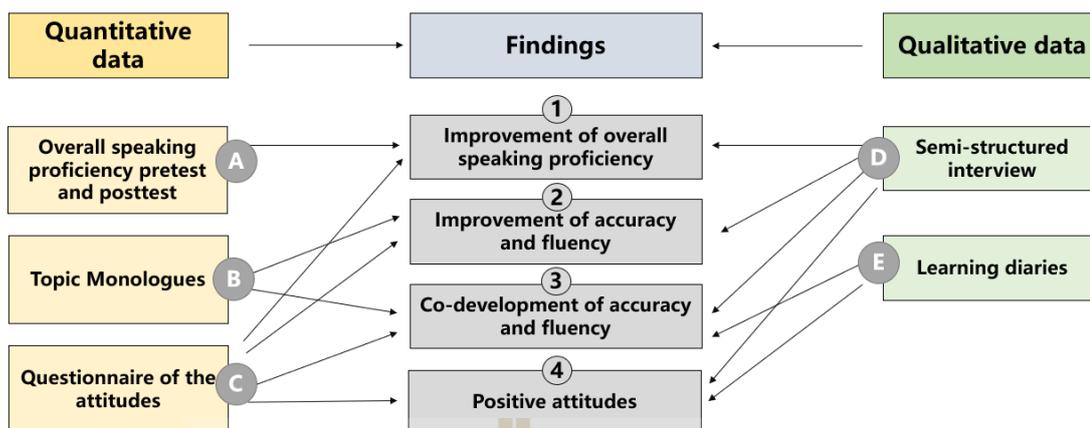


Figure 4.12 The data triangulation of the study

As for finding 2, the improvement in the speaking accuracy and fluency was multiply illustrated by the data comparison of the topic monologue pretest and posttest, the questionnaire, as well as the interview. The within-group and between group comparison of the results of the monologue pretest and posttest showed that the accuracy and fluency in each group got significant improvement and at the same time the NVT group exceeded the control group significantly. The questionnaire, especially the results from Statement 7 and 8, displayed that most of the students had a feeling of improvement in the two aspects. Then, their personal views were found from the face-to-face interview about the improvement in accuracy and fluency. Moreover, the biweekly monologue tasks also contributed more to drawing a developmental pattern of each aspect, showing how the two aspects developed in different context. With the interrelated data from different sources, the improvement in both accuracy and fluency under NVT could be more convincing.

Finding 3 was about the co-development of accuracy and fluency, and it was based on the biweekly monologues, the questionnaire, and the learning diary. The data from the biweekly monologues was analyzed using moving window correlation, and it showed that there was a tendency of simultaneous enhancement in accuracy and fluency, and the interrelationship between them also fluctuated across the intervention. The result from the questionnaire (especially Statement 9) and the diary showed the inside view from the participants that both aspects got progressed.

The last finding was about the attitudes from the participants of the experimental group, and it was found that they largely had a positive attitude toward the new method based on the data from the questionnaire, interview, and diary together (see part 4.3). Meanwhile, they also showed a preference to the NVT

approach in comparison with the diotic one. The corroboration from the alternative sources was helpful in strengthening the validity and reliability of the results.

With the combination of both the quantitative and qualitative data, it may make them triangulate each other in reducing false deduction and in enhancing the confidence of the final interpretation and conclusion.

#### 4.5 Summary

Based on the results from the experiment, the answers to each of the research questions of the present study are summarized and shown below.

**Answers to research question 1:** On the one hand, the results from the comparison of the pretest and posttest of the overall speaking proficiency within and between the EG and CG showed that NVT was effective for the Chinese university students in developing their overall speaking proficiency. Compared with the diotic method, the newly proposed brain lateralization-based signal-optimized verbotonal method, was more effective in enhancing participants' speaking in phonemes, words, passage reading and short question responding. On the other hand, based on the results from the comparison of the monologue pretest and posttest, both accuracy and fluency of the EG and CG got enhanced and the EG outperformed the CG. Meanwhile, the development of accuracy and fluency had varying patterns: in both groups, the accuracy went through a constant flux accompanying with alternating increases and decreases while fluency grew in a gradual and steady step wise way with less fluctuation than that of the accuracy. In addition, drawing from the developmental trendline, the enhancement of both aspects was quick at the initial phase but a little slow at the ending phase.

**Answers to research question 2:** As for the co-development of accuracy and fluency, under NVT, there was a constantly positive and relatively strong correlation between them, i.e., for most of the moving windows, the two aspects were strongly correlated to each other, and the strong correlation between them indicates that, with the help of the NVT treatment, a steady simultaneous enhancement of both accuracy and fluency and the diminishment of A&F dilemma was achieved: when accuracy got increased, fluency increased, and when accuracy decreased, fluency also slowed down.

**Answers to research question 3:** The result from the qualitative data analysis revealed that a great majority of the participants who participated the experiment a largely positive attitude toward the application of NVT approach for learning speaking English. They highly agreed that NVT was effective and efficient for elevating their

speaking and listening, raising their concentration, enhancing their self-confidence, and changing their false language learning habitus. The results in the current study suggested that, in general, the students were satisfied with the training.

To sum up this chapter, it presented the results of the study. Firstly, by using independent-samples t-test, paired-samples t-test, the quantitative data revealed that NVT was an effective method in enhancing learners' overall speaking proficiency. Secondly, NVT was also effective in improving their speaking accuracy and fluency. Thirdly, the interactivity between accuracy and fluency under the new method was inspected and found that there was a steady simultaneous enhancement in both accuracy and fluency under NVT. Fourthly, the result from the questionnaire, semi-structured interviews, and diaries, indicated that the NVT approach was helpful and effective in improving participants' speaking learning, and it elicited a positive attitude from the participants.



## CHAPTER 5

### DISCUSSION

The purpose of this chapter is to make a discussion based on the research findings presented in the previous chapter. The first section deals with the reasons for the participants' performance in the overall speaking tests. The second section discusses the developmental patterns and the interrelationship between the speaking accuracy and fluency. The third section focuses on the students' attitudes toward the NVT approach. The fourth section is to make a reflection on the implementation of NVT. Finally, a summary will wind up this chapter.

#### 5.1 The improvement of speaking

The result of the study demonstrated that participants in both groups improved their scores significantly in terms of their overall speaking skill, accuracy, and fluency, when the experiment ended. However, the Experimental Group (NVT group) recorded a much larger improvement. Additionally, in number, the experimental group had more students progressing and fewer regressing than the control group in each component of the overall speaking test even though the difference was not statistically significant. These findings demonstrate that the NVT approach outperformed the diotic method in general, and it was effective in promoting the overall speaking proficiency of the learners. It should be noted that these significant differences in PRODUCTION skills were achieved not through any methodological manipulation or improvement, but simply by exposing learners to a dichotic signal – all other things remained equal. In other words, just exposing the students to this kind of dichotic signal will result, automatically, in enhanced speaking performance. However, due to the unavoidable limitation of the quantitative measurements in the pre/post-tests, such as the type of exercises and the granularity of measurements, a different approach would probably have yielded much better results.

On the basis of the results from the experiment, the verbotonal theory-based, signal-optimized, brain lateralization-involved NVT approach highlighted its value in offering a potential alternative for EFL students learning to speak English among the Chinese university students. Generally, the reasons behind the success of NVT may involve multiple facets.

### 5.1.1 Refined perception boosted better production

The effectiveness of NVT may be attributed to its fundamental theoretical principles, especially the perceiver-producer principle (see part 2.2.1). Verbotonalists strongly emphasized that individual speakers could be simultaneously treated as both perceivers and producers of language, and further argued that it is possible to change their productions through the change of their perceptions. “If his perception changes, his speech will also change” (Guberina & Asp, 1981, p1). Since the verbotoanl principle was taken as the guiding principle in designing the NVT activities, the results of the present study could reciprocally reflect and illustrate the significance of the underpinning principle. Previous studies have also highlighted the strong correlation between perception and production (e.g., De Bot & Mailfert, 1982; Bradlow et al., 1997; Wang et al., 2003; Derwing & Munro, 2005), and found that the enhancement of auditory perception could benefit positive linguistic production (Lian, 1987; Renard & van Vlasselaer, 1976; Lešić, 2012; Lian & Pineda, 2014; Ursache, 2017). The results of the present study provide an alternative illustration to the perception and production principle under which the NVT approach may have properly created a condition for raising the awareness of learners and where learners’ perceptions may have been boosted. In the experiment, with repetitive training, it would be possible for the respondents to form refined perception mechanisms due to the plasticity of the brain (Cambiaghi, et al., 2021; May & Gaser, 2006), which may possibly explain why the participants in the present study appear to have concentrated more effectively through the intervention and changed their speaking habits.

Additionally, in the current research, the NVT approach may have properly constructed a “scene for potential learning” (Hinkel & Fotos, 2001, p.6) and for raising the learner’s awareness. Since one may not perceive the thing that matters unless one becomes aware of it, it should be noted that “awareness-raising is the first step in the reconstruction of personal operational histories” (Lian & Pineda, 2014, p.20) and it is of paramount importance to make the learners aware of the features of the target language ideally with the support of proper tools (Lian & Sussex, 2018). Designed to enable learners to discover, observe and reflect (Hymes, 1996), the learning conditions of NVT emphasize the learner’s comfort levels and respect the learner’s hemispheric differences in linguistic function. NVT uses the technique of dichotic listening for feeding the favored signal to the favored ear. The dichotically fed signals may work well at the neurological level in lightening the processing load and stimulating the lateralized cerebral hemispheres to function to

their best in analyzing and synchronizing the signals, which is also confirmed by the studies of Cai, Lian et al. (2021) and Lian, Cai et al.(2020), as well as previous studies (He & Sangarun, 2015; Sheppard & Ellis, 2018; Wang, 2020), evidencing that a learning-friendly environment should be facilitative for raising one's awareness. In the present study, even though what happens inside the brain may not be easy to trace and observe, NVT's effectiveness in raising the awareness of the participants is reflected in their better performances in the overall test and greater concentration during the training.

Even though the relationship between perception and production is complex and their connection needs to be further explored (Hattori & Iverson, 2010; Hardison, 2013), and the means for awareness-raising is still arguable (Sheppard & Ellis, 2018; Lucas, 2020), the present study, due to its effectiveness, may be meaningful in deepening the understanding of how to boost the participants' verbal production through refining their perception.

#### **5.1.2 Optimized input facilitates better production**

Another possible reason for the enhancement of participant's speaking proficiency under NVT may be pertinent to the physically altered signals. In the present study, the altered signals that processed under the low pass filtering technique, together with the unfiltered signals, were reorganized into a stereo with its left channel transmitting the filtered signals and the right channel the unfiltered. Previous studies (Friederici, et al., 2000; Chambers, et al., 2017; Moore & Gockel, 2012; Vigneau et al., 2006) have shown that different type of signals may arouse attention from different sides of the brain. In our case, this means preserving the low frequency filtered signal for the right hemisphere and the unfiltered signal for the left hemisphere. As it was discussed in the previous part, the perception of the optimized signals may be refined by the functionally lateralized brain since "the phoneme perception in adults relies on a specific and highly efficient left-hemispheric network" (Dehaene-Lambertz et al., 2005) and the right hemisphere is mainly for processing emotional and prosodic features (Witteman et al., 2014).

The significance of listening materials as a basic component in the acquisition process has long been recognized by all theories of second language acquisition and second language learning (Gass & Mackey, 2006). Since the auditory signal was modified and reorganized at the physical level, it is possible to make certain characteristics of the audio signals more salient for perception. Based on the results of the pre/post-tests, the experimental group's performance outweighed that of the control group (attending to non-filtered signals) either in terms of the

phonemic examination or the prosodic evaluation. In particular, the low pass filtering technique used in the current study, a digital method for modifying language signals and highlighting the prosodic features, has been extensively and successfully used by verbotonalists (e.g., Lian, 1980; He, 2014; Yang, 2016; García, 2018; Roberge, 2019; Wen et al., 2020). Thus, presumably, and reciprocally, the better performance in the experimental group in EFL speaking might be partly attributable to the exposure to the optimally altered signal.

### 5.1.3 Brain-compatibility may bring better performance

The last reason for the effectiveness of NVT may be due to its brain-compatibility (Johnson, 1983), or specifically, hemispheric-optimality. The principle of optimality is central for verbotonalism and requires any intervention to feed optimal stimuli to the listener to obtain the best possible effects in learning a language (Guberina, 1972; Lian, 1980; Asp, Kline, & Koike, 2012; Lian et al., 2020). Given the biological foundation and neural bases (Lenneberg, 1967) of language learning, the brain has its own cognitive model that can make language learning happen (Friederici, 2017). The functional specialization of each hemisphere in language processing makes them better suited for different stimuli, the right side for tonal patterns while the left side for speech (Zatorre, 2001). Thus, there is a general agreement that, the right hemisphere has an important role in the processing of linguistic prosody and the left hemisphere focuses more on the semantic processing (Bryan, 1989).

In the present study, the NVT approach may also have successfully taken advantage of the Mandarin shaped brain by sending to each hemisphere optimal signals and enlarging the perception of the favored signals, in accordance with previous studies. In the case study conducted by Lian et al. (2020), to understand how the Chinese participant's brain processed foreign languages when feeding different stimuli to the ears, three modes of synthesized signals, including the FL-R mode (filtered stimuli in the left ear and unfiltered stimuli in the right ear), the L-FR mode (unfiltered stimuli in the left ear and filtered stimuli in the right ear), and the FL-FR mode (filtered stimuli in both ears) were separately presented to a Chinese participant dichotically, and the result indicated that, among the three modes, FL-R would be optimal in facilitating foreign language comprehension, which was the configuration adopted by the current research. The optimality of the FL-R mode of dichotic listening was further confirmed in another study conducted by Cai et al. (2021), which used the techniques of event-related potential (ERP) and functional magnetic resonance imaging (fMRI) to detect the processing of the signals in the

brain, and the results identified that the FL-R mode did provide optimal auditory linguistic signals by attending to the hemispheric advantages of the brain, i.e., the left hemisphere's dominance for language processing and the right hemisphere's dominance for melodic processing. In the present research, NVT may have highlighted and confirmed the optimality of the FL-R mode, as well as the potential value of using physically altered signals in learning a second (foreign) language.

Meanwhile, the participants in the current study were all Chinese native speakers, and they were learning English as their foreign language. The functions of their hemispheres in processing English linguistic features may have been shaped by their mother tongue experience (Weiss, Cweigenberg & Booth, 2018; Pleisch, et al., 2019, Nakada et al., 2001; Tan et al., 2003). For example, using functional magnetic resonance imaging (fMRI), Gandour et al. (2003) found Chinese intonation was processed predominantly in the right hemisphere of participants. Cerebrally, there seems to be greater density in grey and white matter of the right anterior temporal lobe in Chinese speakers than the nontonal multilinguals (Crinion et al., 2009). So, the purposefully designed signals may enable their brains to better attend to the feeding signals with respect to the right/left-hemispheric dominance for language processing.

To sum up, the reasons behind the effectiveness of the NVT approach may reside in the abovementioned aspects even though exactly what happened in the brain and exactly how NVT influenced individual subskills is still to be answered in future studies. However, the most prominent finding from the study—that the sheer altering of the physical signals together with optimally brain-based feeding mode may work well for language learning—was of paramount importance in both the areas of language acquisition and neuroscience. Thus, the positive results from the NVT approach may point to promising related research in the future.

## **5.2 The simultaneous and interrelated development of accuracy and fluency**

The second research question of the study was to explore the interrelationship between accuracy and fluency, and the purpose was to see whether they could be promoted together (in contradiction to common belief that they cannot) under NVT. As reported in the previous chapter, with the help of the NVT treatment, the experimental group witnessed a step wise growth in both accuracy and fluency even though the two aspects developed in different patterns, and the moving correlation between them might indicate a steady simultaneous enhancement. Possible reasons

for their development as well as the simultaneous co-development are explained as follows.

### 5.2.1 Simultaneous development under NVT

As reported in the previous chapter, there was a relatively strong moving correlation between accuracy and fluency with the value of  $r$  between 0.66 to 0.5 across the moving windows, and the derived correlation trendline started from a value of 0.64 and 0.65 in the first two moving windows, then went through a step wise decrease from the third moving window to a value of 0.51 at the last moving window, which suggested that the correlation was getting less strong and there was a slight decreasing trend along with the moving windows. The positive and relatively strong value indicated that the aspects of accuracy and fluency increased and decreased almost synchronously most of the time.

As “connected growers” (Robinson and Mervis, 1998), the subsystems of language proficiency may support each other’s growth under the same intervention. In the present study, the synchronous development of accuracy and fluency could then be interpreted by referring to a “supportive” (Verspoor et al., 2011) relationship between them. As what Verspoor et al. (2011) argued, a supportive relation would appear when variables grow in unison, a competitive relation exists when one goes up and the other goes down, and a conditional relation when one variable was a necessary precondition for another to develop (e.g., word and syntax). In the current study, the “supportive” relationship between accuracy and fluency can be explained from two interconnected neuroscientific perspectives: hemispheric complementarity and hemispheric specialization.

On the one hand, under the NVT approach, both hemispheres of the brain might be activated differently because the two hemispheres were fed different types of signals because of the dichotic listening technique (Van den Noort, Specht, Rimol, Erslund, & Hughdahl, 2008), and the synthesized audio signals might better take advantage of the special roles of each hemisphere (Gregory et al., 2009). One of the distinct characteristics of the NVT approach was that it was constructed on the basis that fluency features were processed predominantly in the right hemisphere while accuracy features were processed predominately in the left hemisphere (Friederici, 2017). Given the hemispheric asymmetries in phonological processing, sending a favored signal to the optimal side might better activate the favoring hemisphere independently while making them work simultaneously more effectively in processing the accuracy and fluency features (Li et al., 2010).

On the other hand, with a “perfect match” (Danesi, 2003) of the cerebral hemispheres, segmental and suprasegmental parameters might find their residence in appropriate parts of the brain (Qi & Legault, 2020). It should be reasonable that both hemispheres have some ability to perform the same task and one hemisphere might be more effective than the other (Hellige, 1993). With natural evolution and innate dispositions, different hemispheric functions are complementary in the sense that specialization in one hemisphere is complemented by another specialization in the other hemisphere. The functional complementarity between the two hemispheres of the brain may enable a new “perfect match” under the optimization of the NVT approach in the field of learning a second language. In conjunction with each other, the two hemispheres would simultaneously process the signals. Moreover, when learning involves greater complexity, a functional shift from right to left hemisphere would occur and the interhemispheric communication would increase (Deng et al., 2018). So, the retention of one linguistic feature may support the retention of another due to the collaboration of both hemispheres, evidence of which we might find in the correlation between accuracy and fluency in the NVT intervention.

It is known that functional specialization and plasticity are fundamental organizing principles of the brain. To date, a set of studies have emphasized the involvement and collaboration of both hemispheres (Deng et al., 2018; Zhang et al., 2009; Wang et al., 2003) as well as the asymmetric roles of each hemisphere in successful language learning (Qi et al., 2019; Hisagi et al., 2016; Hosoda et al., 2013; Mamiya, Richards, & Kuhl, 2018). The brain is viewed both as a parallel processor and an entity full of functional connectivity between hemispheric regions. In the present study, the hemispheres of the brain may be optimally stimulated in processing the signals both cooperatively and independently due to the optimization of the audio signals as well as the FL-R mode. Furthermore, the long-standing A&F dilemma may thus be reduced by referring to a steady co-development in accuracy and fluency as well as a relatively strong supportive relationship between them.

Along with the trendline, the moving correlation value decreased a little after the second moving window, meaning the correlation was getting slightly weaker as the experiment proceeded, which may indicate a less simultaneous relationship between accuracy and fluency if the treatment lasted long enough. A possible explanation may be because the language learners had limited attentional capacity (Ellis, 2012; Munro & Derwing, 2015), and as greater complexity got involved in learning, it was hard for the learners to attend to both aspects simultaneously, which may result in the unequal allocation of attentional resources, and a possible

competition between the accuracy and fluency may appear. But, in the present study, according to the trendline, the moving correlation value kept being positive ( $>0$ ) and stayed at around 0.5 to 0.6 for a long period despite a slight decrease, which indicated that the relationship between accuracy and fluency might not be easy to reverse from supportive to competitive. Thus, under the NVT intervention, the A&F dilemma, with a high possibility, may not appear again if the intervention went on for a longer time.

### 5.2.2 Differing developmental patterns

Consistent with the results of the studies done on the developmental patterns of L2 production (Yang & Sun, 2015; Mora & Valls - Ferrer, 2012; Kim, Nam & Lee, 2016; Amiryousefi, 2016), the results of the present study suggested that the developmental patterns of accuracy and fluency were also in different shapes. The fact that learners do not progress through stages of development in a consistent manner (Larsen-Freeman, 2006) may explain why the developmental patterns varied in them.

A possible reason for it may be due to the different cognitive resources the two aspects involved, among which accuracy required more focus on linguistic form conformity while fluency focused more on automatization (Housen & Kuiken, 2009), or as Ellis (2008) argued, the development of knowledge analysis and knowledge automatization may influence the acquisition of the two aspects. Skehan's Limited Attention Model (1998, 2009) and its trade-off effect may also have potential influence on the developmental patterns of accuracy and fluency since the attention may not always be distributed in balance over a long period of time, and thus constant vibration and instability in both aspects was natural characteristics in language learning. In other words, the vibration and instability could be interpreted as the traces of the language learners restructuring and dynamically adapting their internal logical and representational systems into new operational histories (Lian & Pineda, 2014; Lian & Sussex, 2018).

It should be noted that, based on the trendlines, the development of accuracy and fluency under NVT went through a quick enhancement at the initial stages, and then a slight slowdown at the ending part, which indicated that the developmental paces may change over time. The reason for it may be because much learning was likely to happen within the first phases when the learners were situated in a new context (Mora & Valls-Ferrer, 2012; Vercellotti, 2018; Segalowitz & Freed, 2004). For example, in Saito and Hanzawa's study (2018), students showed quick improvement in fluency and lexicogrammar within the first semester as the

initial phase occurred. Moreover, Learner's limited previous English experience may also contribute to the potential room for improvement (Schepps, 2014) because they may get themselves tuned into the new condition and have a quick and obvious increase in common and repeated expressions.

However, language development is unlikely to be linear (Verspoor, 2011), and the emergence of the slowdown in the latter phase might indicate a possible setting-in of a "languid period" in accord with the signs of boredom and fatigue reported in the diaries of the participants. If the languid period or the slowdown could be regarded as little or no further improvement in the two aspects, a potential ceiling effect (Milton & Meara, 1995; Rifkin, 2005) may be largely responsible for that when learners reached a higher level. The ceiling effect means the scores were limited at the top of a scale, which, in a certain sense, was seen as a sign that a significant amount of learning has already taken place even though certain deficiency remained (Thewissen, 2013, p87), or the participants have already restructured their knowledge and reached a temporary suspension and saturation. Previous research pointed that there might be a significant correlation between the ceiling effect and instruction time (Rifkin, 2005), or a moderate correlation between the ceiling effect and the number of sessions (Meier & Feeley, 2022), which may indicate that more time might be needed, or the number of training sessions should be taken into consideration in the future research.

In sum, the fluctuation and variability in developmental patterns may be in part because language learners might dynamically adapt their linguistic resources to new settings, or partly attributable to the distinct cognitive resources involved. Moreover, despite the constant changes in developmental patterns across the whole intervention, either a quick initial increase or a slowdown at the ending phase, the effectiveness of the NVT approach in promoting both accuracy and fluency should not be neglected even though the unevenness in the patterns may require further exploration.

### **5.2.3 Disappearance of the A&F dilemma**

According to what was reported in the previous chapter (see part 4.2.2), across the five moving windows, the moving correlations between accuracy and fluency was always positive in the EG, and almost the same in the CG except only one weak negative value, which may mean that both the diotic context and the NVT context may be workable in enhancing both aspects of accuracy and fluency simultaneously and largely diminishing the A&F dilemma. This finding may be contradictory to the commonly held opinion that it was impossible to improve

accuracy and fluency hand in hand in a single task because they were normally regarded as exclusive to each other in language learning.

Ever since Brumfit proposed the concepts of accuracy and fluency in the 1980s, the two items have been discussed for decades with no unified definition for them so far. Based on Brumfit's (1984) concepts of accuracy and fluency, there appears to be two different directions for teaching speaking. The former is the accuracy-oriented approach in which instant error-correction is strictly needed. The latter is the fluency-oriented approach which believes that grammatical or pronunciation errors are insignificant, especially in the early stages. This approach regards errors as tolerable and probable. Both approaches have been largely taken into practice and reshaped the tasks in classroom, where classroom activities are subsequently categorized as accuracy targeted or fluency targeted. Under this mindset, if the purpose of one task is set for accuracy or fluency, which will presumably deem that there is a linear cause-effect or investment-production relation between the type of task and the anticipated improvement in language. The split in activity categorization brings about a split classroom practice, while the split practice would only bring a split mindset. Right now, it is commonly taken for granted that the accuracy-oriented approach could improve accuracy while the fluency-oriented approach could enhance fluency. Conversely, if a single approach could enhance both, it would be unacceptable and even unbelievable. Of course, finding an ideal approach that might improve both aspects is impossible if our mindset is still rooted in Brumfit's concepts.

The Neo Verbotonal Approach, neither as accuracy-oriented nor fluency-oriented in categorization, may provide a way of observing the "A&F dilemma" due to its potential from the optimality principle and the balanced input in practice. The principle of optimality asks for a tailored condition through good organization of tasks to optimally enhance perception in the learners and bring about optimal language production. According to the performance of the NVT group (EG), the relatively strong and positive relationship between accuracy and fluency may suggest that the possibility of enhancement in both aspects does exist if the learning activities are optimally organized. Contrarily, once the learning activities have been well (if not optimally) organized, accuracy and fluency may also have the possibility to naturally co-develop hand in hand despite the diotic listening mode, as in the case of the control group. This too could challenge the commonly held concept of competing accuracy and fluency. This is in line with the previous studies. In his case study, Luchini suggested that "foreign language classrooms should create opportunities for

learners to participate in both forms (accuracy and fluency) of instruction, since both are believed to contribute to second language acquisition” (Luchini, 2004, p.18). Nishimura (2000) reviewed the history of EFL teaching pedagogy and educational environments in Japan and suggested finding ways for teaching grammatical items in communicative activities in which both accuracy and fluency were reached. In another study, Willerman (2011) suggested modifying existing speaking tasks such as impromptu monologue, impromptu dialogue, prefabricated monologue, prefabricated dialogue to foster both accuracy and fluency in communicative activities. Dincer et al. (2012) focused on promoting both speaking accuracy and fluency through motivating positive affective factors while reducing the negative factors in learners. Considering L2 development as a complex and nonlinear process (Kusyk, 2017) might help us figure out more ways to handle the issue. Additionally, the present study may also highlight the idea that “accuracy and fluency” should be applied mainly as dimensions for examining linguistic production rather than for principles for designing learning activities. The “A&F dilemma” could then be largely seen as the result of a “vicious circle” if we insist on holding the demarcated concept while expected to achieve both sides in practice.

So, based on the experiment of the present study, it is safe to say that, for most of the moving windows, the two aspects were positively correlated to each other, i.e., when accuracy increased, fluency increased, and when accuracy decreased, fluency also slowed down, which shaped them into an overall simultaneous enhancement along with the NVT treatment, and the simultaneity of the two aspects in development may indicate a lower occurrence of the A&F dilemma. The simultaneity in both aspects may, on the one hand, indicate the significance of the optimality principle in designing learning condition, and on the other hand, make the bonded mindset unbonded in tackling the issue of accuracy and fluency.

### **5.3 Students’ positive attitudes toward NVT**

The attitudes of the students toward NVT were also explored with the assistance of data analysis from triangulated sources, questionnaires, interviews, and diaries. The result indicated that a great majority of the NVT group students had positive attitudes toward the approach due to their reformulation of speaking learning, and the unneglected challenges accompanying the implication of the new method.

### 5.3.1 Reformulation of speaking learning

Almost all the participants reported a feeling of enhancement in speaking with the help of NVT and held a positive attitude toward it. What was commonly stressed by them about the new approach should be that they had to listen to the materials and at the same time to open their mouths to imitate, which made them feel quite unaccustomed at the beginning. This may be explained in comparing with their previous “mute English” learning experience (Lin, Min, & Yuqian, 2021; Fu, et al, 2020; Huang, 2020; Zhang, 2012). Many scholars referred to the fact that a large number of Chinese students cannot speak English well and have poor listening comprehension as the “mute English” or “deaf and dumb English” phenomenon (Du & Guan, 2016; Siemon, 2010), which was partly due to the pressure derived from the college entrance examination, and its counterpart, the “reading and writing”-oriented teaching methods (Yu & Huang, 2012). Such kind of English learning context provided rare chances for the students to listen to authentic materials and even fewer opportunities to open their mouth to speak. However, in the NVT approach, they were required to repeatedly imitate what they heard, and they were also encouraged to make free conversation using what they had newly learned, which challenged their usual mode of English learning. The sharp contrast demanded the participants a certain time to adapt to the new method.

Moreover, as the training went on, it seemed that most of the students became more confident and less anxious in speaking English. They reported that in their traditional English class they were afraid of making mistakes and would choose to be silent, which prevented them from improving their speaking even though they were fully aware of the significance of a good command of communication skills in English. The speaking anxiety raised in the speaker was caused by multiple reasons, such as minor errors or flaws in pronunciation and intonation, small vocabulary size, grammatical mistakes, or the uncomfortableness of being the focus of attention in class (He, 2013), which may further divert energy and attention from language learning and block possible oral expression (Schumann, 1986). Some scholars believed that not having the feeling of anxious was almost impossible for language learners and considered anxiety as positive language learning variable (Sutarsyah, 2017; Daley, Onwuegbuzie & Bailey, 1999). However, given that second language acquisition is largely driven by what learners pay attention to (Schmidt, 2012), it should be facilitative for language learning if the interruption was minimized, and the attention be focused. The shadowing technique in the NVT approach appears to have the potential effect of making the learner allocate most attention to the inputs

and avoid possible distractions, which was in line with the study by Hulstijn and Hulstijn (1984), arguing that shadowing tasks were possible to direct attention voluntarily to one source of information, while ignoring another. Along with shadowing, the shadowers were designed to orally repeat word for word and they were left limited room for other activities, which may result in a more focused attention to the audio signals and less emergence of anxiety. Moreover, with a gradual accumulation of linguistic perception and production, progress in language learning may possibly illustrate their increase in confidence.

Most participants also stated that NVT was helpful in making their speaking errors corrected, and one of the factors they emphasized was their strong motivation in following a native English model. The possible explanation for it might be that the teaching materials was significant in learners' model preferences (Lantolf & Poehner, 2014; Wang, Z., 2015). The EFL education in China seems to favor the traditional American and British models for instruction (Kung & Wang, 2019), which might have influenced the preferences of students in their English learning. The learning materials of the present study were native British, and the exposure to the authentic language appears to make the learners more motivated. Take "Gosh" for example, one student mentioned it in his diary and regarded it as a new word, and as he checked and found its meaning, he expressed his shock about how gosh was used, since the way the Chinese people expressed surprise was quite different under the same context. Moreover, given that second language acquisition is seen as part of acculturation, the imitation of authentic materials was essential in narrowing the gap between the learner and the target language culture (Rost, 2013), which may be more appealing to the learner because cross-cultural ability was proposed as a potential motivation for students in learning English (Suwartono, 2021).

### 5.3.2 Unneglected challenges

Apart from the abovementioned aspects of benefits, there were also the challenges reported by the participants. Some students said that the linking, assimilation, elision, and other features in speaking English were difficult to handle. They also mentioned that the occasional occurrence of long sentences may make them fail in shadowing them. There were also difficulties in speaking speed of the materials because some students complained that they were not able to understand the meaning even though they can merely follow in imitating the pronunciation. A plausible explanation for their feeling of difficult may be in the differences between the two languages' phonological systems, their Chinese mother tongue and English, in the aspects of stress and rhythmic patterns, intonation and tone, and phonemes

(Zhang & Yin, 2009). Another reason might be the limited exposure to the authentic listening and speaking materials and their long-standing writing and reading habits under the local instruction. As Du and Guan (2016) argued that, in the Chinese context, spoken form of English developed from its written form, which might mean learner's prior experiences with limited pronunciation instruction may influence their achievement with current efforts. An additional possible reason might be their underdeveloped English proficiency. The size of vocabulary, the familiarization of grammar, and the management of prosodic features might be hindrances in developing their speaking skills.

#### 5.4 Reflections on NVT

By referring to the research questions, the findings of the present study have confirmed the effectiveness of the NVT approach in developing EFL learners' speech and reducing the A&F dilemma. More importantly, the present study was valuable in deepening our understanding of language learning in aspects of both theory and pedagogic practice.

Firstly, the effectiveness of NVT highlights the value of the Verbotonal theory. Regarding the individual speaker as both a producer and a perceiver, Verbotonal theory endeavors to achieve an optimal correction in language production by creating an optimal condition for raising the learners' awareness and changing their perceptions. Guided by the optimization principle, the NVT approach was designed to reorganize auditory perception by taking the optimized signals, the optimized mode, as well as the functional specialization of the cerebral hemispheres into consideration. As to what the results demonstrated, the NVT group outperformed the control group in a whole round way, either in the total score or the sub-scores, which could reciprocally prove the value of the principles of Verbotonal theory.

Secondly, the present study also emphasizes the role of the brain in language learning, especially the lateralization of the brain and its interplay with language. When the functional lateralization of the brain hemisphere was considered, the construction of an optimal neural learning environment would be significant in challenging the traditional classroom education. As most studies have concluded, the right side of the brain is advantageous in processing prosodic features while the left side is good at linguistic processing, i.e., categorizing and organizing. In the present study, centering on the brain and guided by the Verbotonal principle of optimality, the NVT approach was formed in search for optimal conditions, optimal

stimuli, and optimized signal feeding mode that could create proper sensitization and awareness raising.

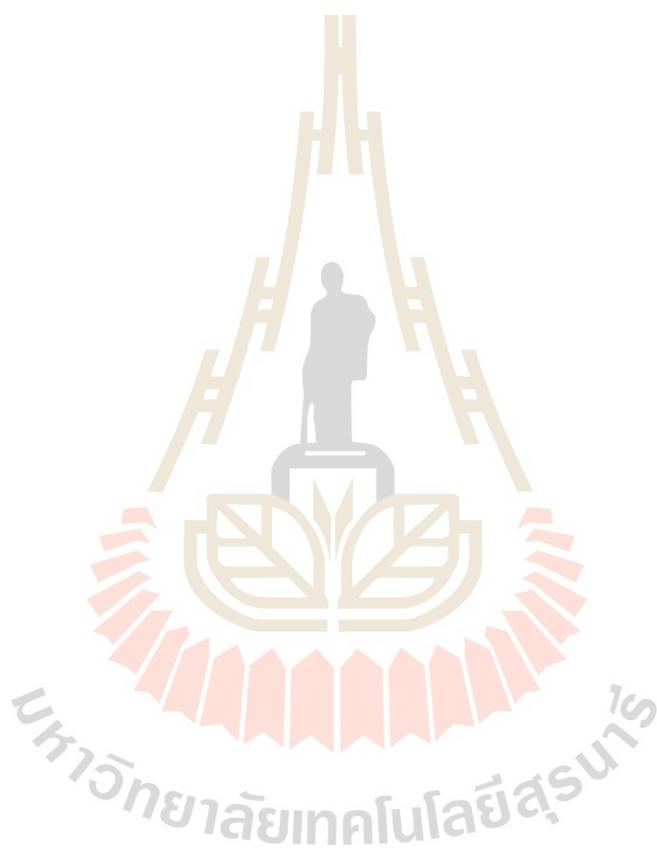
Thirdly, from the present study, it should be noted that the optimized audio signals might benefit perception as well as production in second language learning. As the neural basis for language perception, the lateralized sensory systems would attend to the sound features based on their functional preferences. Altering the signal based on the learner's lateralized sensory system may better raise the perception of the targeted features. The use of low frequencies is a typical means in verbotonal approaches for developing acceptable prosodic speech productions since the right side of the brain is in dominance of prosodic processing, i.e., melodic processing. All the signals would be firstly processed in the right side of the brain and then flow to the left side, and during the process different features would be selected according to the hemispheric specialization, something new, flexible, contextual would be processed by the right hemisphere, and something familiar, fixed, concrete, and highly detailed by the left hemisphere. For the right hemisphere, the altered signals may be better perceived due to the newness in them. With the signals being processed effectively, the perception and production of the learner would thus be potentially enhanced. Altering the audio signals may be the first step for a form of brain-based and optimized learning.

Finally, the co-development of accuracy and fluency in the present study may bring a reflection on the organization of learning activities, and more creative and suitable methods should be encouraged to help arrive at "a set of high-level coherent solutions for (language) teaching and learning" (Lian, 2004, p.2). Because second language speaking proficiency is indeed a multi-dimensional and multi-componential concept (Ellis, 2009), thus, on the one hand, the development in learner's language may seem to be more comprehensive if the learning tasks are well or optimally organized; on the other hand, only if our mindset be more open, can we propose more innovative approaches in the language learning field, or other fields.

## 5.5 Summary

This chapter makes a thorough discussion based on the results reported in the previous chapter by referring to the research questions. It firstly discussed the effects of NVT on participants' overall speaking skill, followed by the co-development of speaking accuracy and fluency, and the attitudes of the participants. Then a

reflection was made by taking the whole project into consideration, and finally a summary ended the chapter.



## CHAPTER 6

### CONCLUSION

This chapter winds up the thesis. Structurally, there is a total of 4 sections in this part, with the first section making a summary of what the study achieved and the subsequent main findings, the second section presenting the pedagogical implications, the third section displays the strengths and limitations of the study, and the last section proposes recommendations for future research.

#### 6.1 Summary of the study

The current study was conducted to examine the effects of the NVT on Chinese EFL learners' speaking proficiency, the co-development of speaking accuracy and fluency, and the students' attitudes toward it. 64 first-year non-English major students in two intact classes were recruited from a local university in China and were randomly assigned as the experimental group and control group. Based on the pretest of overall speaking skills, there were no significant differences between them. The intervention was then conducted under the same pedagogical procedure: Awareness raising, Audition and Repetition, Externalization and Communication, and both groups attended the same online course and the whole process was under the management of the participants. The only difference was in the mode of signal input: dichotic versus diotic, i.e., the control group used the diotic mode, which was the same as what a class normally did; The experimental group attended to the dichotic listening mode, which was purposefully constructed on the basis of the verbotonal theory and by referring to lateralization of the brain. Based on verbotonal theory, it was assumed that the filtered signals sent to the left ear could lighten the syntactic processing load in the right hemisphere and at the same time make the prosodic features salient for perception (Lian, 1980; Lian & Sussex, 2018). Technically, for the experimental group, filtered signals were sent to the right hemisphere through the left ear and the unfiltered signals were sent to the left hemisphere through the right ear. Positive effects were expected in the linguistic productions and the participants' overall speaking proficiency under the new signal feeding mode. In order to examine the co-development of sub-dimensions of speaking proficiency, accuracy and fluency, under the new approach, biweekly monologue tasks were used to elicit step

wise data. When the intervention ended, immediate posttest questionnaire and semi-structured interview were conducted, and students' diaries were also collected.

The results showed that there was a positive effect of the NVT approach in developing learners' speaking proficiency, and the NVT group outperformed the control group both in terms of the total score and the subscores of the overall speaking test. This indicated that the verbotonal theory-guided new approach was effective for learning a foreign language.

Also, in the present study, due to the differences of the two groups in listening mode, dichotic listening for the experimental group and diotic listening for the control group, the better performance of the dichotic group reflects the fact that the dichotic mode of learning condition better raises the awareness of learners and is helpful for enhancing both perception and production in learning the target language.

Moreover, the results of the study also supported the new "optimal assumption": to feed optimal stimuli to the optimal hemisphere is appropriate for maximizing the learning of alternative languages.

The result of the present study also unveiled the potential of the functional lateralization of the brain in foreign language learning. Even though there was no direct evidence from inside the brain (i.e., instrumental studies), the better performance of the NVT group highlighted the value of each hemisphere's special role in language processing as well as the perception and production of target linguistic features.

In addition, the simultaneous development of speaking accuracy and fluency in the NVT group's speech may indicate that each hemisphere would attend to the favored linguistic features and process the linguistic features hand in hand with the other side of the brain. The highly supportive relationship between the two hemispheres as well as their possible competition in language processing may have potential influence in second language learning.

According to the reflections from the participants, a preferred attitude toward the NVT approach in learning to speak English was found. In their opinion, the NVT approach was helpful in improving their English speaking, promoting their confidence, and raising their concentration. Moreover, their incorrect speaking habits were also corrected and reformulated. In addition, they felt that their speaking accuracy and fluency was also enhanced, and this is triangulated by the scores from the biweekly monologues.

## 6.2 Implications

The findings of the present study were conducive to deepening the understanding of second language learning and teaching, and there are several significant implications, either theoretical or practical.

Firstly, in the present study, thanks to the application of NVT, the experimental group's speaking performance was significantly improved, and they also showed a preference for the newly constructed approach, which makes it meaningful to apply NVT in more contexts of language learning, especially when learning has become more digitalized, globalized, and individualized. One of the underpinning expectations of NVT was to construct a more learner centric approach to counter the forthcoming predictable or unpredictable situations. NVT respects the independence of students and puts them in the center of learning by providing a self-regulated optimal condition, whereby the students only need to login and attend to the online resources to learn whatever they need. On the one hand, as reflected by the students, the implementation of NVT could develop their learner autonomy, a goal of all developmental learning (Little, 2007); On the other hand, the NVT approach could bring the learners more freedom in navigating their foreign language learning since they could select, repeat, and assimilate the unknown based on their own needs. As a learner centric approach, NVT should be recommended to more EFL learners as well as educators in this field.

Secondly, NVT, affiliated with cerebral operations, successfully incorporated the brain into EFL education may imply an alternative way of brain-compatible or brain-based learning. There have been a number of studies concerning how to relate brain functions to student learning, and various of concepts were also proposed, e.g., brain-compatible classroom (Erlauer, 2003), brain-compatible curriculum (Westwater & Wolfe, 2000), and brain-based learning environments (Jensen, 2008). However, in the present study, what NVT prioritizes is the neuro level functions of the two cerebral hemispheres rather than the broad environment outside of the brain, either the school or the classroom. Moreover, NVT underscores the significance of learning in accordance with how the human brain works, and this was shown to be conducive to enhancing students' EFL learning. The positive attitudes from the students showed the effectiveness and comfort of learning under NVT. Also, the co-development of speaking accuracy and fluency supports the view of the brain as a parallel processor because each side of the brain, or different regions of the brain could work independently and supportively in a simultaneous manner. Other linguistic features could also be included in the NVT approach and sent appropriately

to the part of brain that favors them. Thus, regarding the brain as a sensitive neuro setting for language learning, the advantages of each hemisphere could be enlarged or even made full use of if they were well integrated into the lesson or course design.

Thirdly, the importance of the modified physical signals and the mode of signal feeding for enhancing perception was highlighted in this study, and more attention should be paid to the lowpass filtering technique and the dichotic listening technique in the language learning field. As the source and starting point, sensory input from the surroundings is the first step of any information in people's learning process. Language learning begins with the perception of optimized audio signals and ends with proper production of these sounds. The technique of lowpass filtering was widely used in NVT approach since it could make the prosodic features more salient for perception and added directly on the right brain. Individual differences in perception could also be taken into account when a diagnosis was conducted in advance, such as the handedness of learners, which could potentially make learning more optimal. In the meantime, the technique of dichotic listening was introduced into the NVT approach and made the favoring signals optimally sent to the favoring side of the brain, which facilitated the perception and processing of the optimized salient features. The optimization of both the physical signals and feeding mode made the NVT, an alternative brain-compatible or brain-based approach, contextualized and workable in practice.

Fourthly, the quasi disappearance of the teacher in the NVT class may have a possible implication for teacherless language education. The teacher was assumed traditionally to be the source of knowledge, and when teaching happened, there should be a transmission of knowledge from the teacher to the learner. However, in the NVT approach, what the teacher needs to do is to set up a self-managed online system and focus more on the technical problems students may encounter. In other words, the teacher just provides opportunities for learners to access the brain-based dichotic listening course without too much monitoring and instruction. Based on the online activities and their perception, students could discover and construct knowledge for themselves, as well as achieve progress in linguistic production. Along with the development of students' autonomy, the teacher's load in language instruction is largely reduced, which does not mean a total disappearance of the teacher because the teacher's role under an implementation of NVT may become more that of an assistant rather than being dominant, supportive rather than directive, cooperative rather than authoritative for the purpose of quality learning.

Lastly, the present study highlighted the concept of optimization in education. The effectiveness of NVT signifies the value of optimization in learning to speak English as a second language, which not only sheds light on the understanding of learning to speak a language, but also suggests an extension of the principle of optimization to learning other aspects of language, like reading, writing, or translating. Supported with the fast-developing technology, learning conditions could be optimized on the basis of people's linguistic backgrounds, operational histories, and personal needs, which concurs with the concept of precision education (Lian & Sangarun, 2017). As the world comes to be more digitalized and globalized, learners would increasingly encounter more unpredictable situations where just-in-time knowledge would be more needed than just-in-case knowledge. The heterogeneity in individual needs makes it hard to use a one-size-fits-all approach in handling unpredictable problems. With the assistance of the optimal condition, as shown by NVT, positive effects could be reached. It is possible for each individual to attend to the optimal content and learn in an optimal way in the future. In the present study, nevertheless, NVT is still very general in scope, much effort should be paid to move to a more precise education, one that may have left enough room for future studies.

### **6.3 Strengths and limitations**

The study employed a quasi-experiment to investigate the effectiveness of the NVT on speaking proficiency as well as the co-development of accuracy and fluency. The pedagogical procedures were designed and tailored for a specific purpose based on the previous research by Andrew Lian (1980) and Yang Yan (2016). With the feasibility and adequacy of research instruments being tested and validated in a pilot study, the full-scale study was then conducted, and multiple sources of data were collected, either quantitative or qualitative, including pretest, posttest, questionnaires, semi-structured interviews, and diaries, which triangulated and validated the findings of the study. Meanwhile, this study integrated techniques and evidence from disciplines of physics, neuroscience, and language learning, which may add more weight to the reliability and validity of the outcomes.

Although this study yielded significant findings for language learning, some inevitable limitations of the present study should also be noted. Firstly, the participants of the present study were all right-handed Chinese university EFL learners, it should be cautious to generalize the findings to other subjects and contexts. On the one hand, the limited sample size, and the small population it represented might not be large enough for fully generalizable results; on the other

hand, their right-handedness and tonal language background should also be well considered when the findings were to be translated into other settings.

Secondly, when the technological limitations were considered, the present study relied more on the examination of the participants' performance than observation of what happened to their brains. Technologically, for each participant, the statements (the level of lateralization in each hemisphere, the plasticity of the brain in cognition) and the actual neuro activity mode (the related regions activated and the interhemispheric communication) of their brains before and after the intervention, could not be easily and non-intrusively pre-specified and evaluated with convenient measures.

Thirdly, taking the short term of the study into account, certain important non-immediate effects of the experiment may be missed in the aspects of language learning and neuro restructuring. Moreover, materials (interview, diary) elicited from the participants may not cover every live detail of their lives during the conduct of the experiment. Hence, this study cannot predict the effects of the experiment over a long period of time and the effects caused in real time.

#### **6.4 Recommendations for future research**

By referring to the abovementioned strengths and limitations, future studies may go even further in different directions as recommended below.

Firstly, due to the small number of the study's sample size, replication studies should be extended to larger groups of participants to obtain various data for more convincing generalization. Moreover, it should also be extended to the learners with different backgrounds, from tonal languages to non-tonal languages, from the right-handed to the left-handed, as well as learners different in gender, age, and cultural background.

Secondly, the present study relied more on the dichotic listening and delayed evaluation of the participants' language performance, which would not be enough in exploring how the brain was influenced by the optimized signals. More creative measures are encouraged to be employed in observing the immediate effects of the intervention, both inside the brain and outside the brain. In the meantime, for the non-immediate effects, more longitudinal studies and long-term evaluations are also worth conducting.

Thirdly, this study focuses the verbal production of the Chinese EFL learners under the intervention of NVT using a limited range of tests, and the results support that it was meaningful in enhancing the speech of the learners. However, the effects

of NVT on other aspects of language learning, reading, writing, or translating, are still unknown. It is necessary to extend the application of NVT to more fields or aspects of language learning, or learning in other fields, e.g., music (James et al., 2020; Koelsch et al., 2000).

Fourthly, the present study only measured the effects of NVT intervention on the static and unitary aspects of language as well as the co-development of speaking accuracy and fluency. It is much more challenging to explore the development of multiple sub-systems over time and in relation to each other. These facets may deserve more rigorous, systematic, and focused research in the future.

Fifthly, the verbotonal theory emphasized the facilitation of linguistic production by reorganizing auditory perception. Given the significant value of physical signals and the feeding mode, it is of great importance to explore more types of signals, as well as alternative feeding modes that may better enhance the perception and production of the learners.

Sixthly, with regard to the popularity of the concepts of accuracy and fluency, it is meaningful in finding more creative approaches to develop the two aspects simultaneously while not being confined by the sharply and illogically polarized “exclusive relationship” between them.

Last but not least, more enhanced optimal conditions, self-regulated contents are also needed to be included in future research. Each person perceives, interprets, encodes, and analyzes the world differently, and the difference in operational history might also have shaped the brains into different level of plasticity, different degrees of lateralization, and distinct preferences for certain frequency band of sound, which makes optimization even more challenging and valuable. Along with the development of technology, such as artificial intelligence, neuro imaging, and brain computer Interfaces, it is likely to be more possible for each person to have the opportunity to attend to a well-tailored learning condition, either for language or other areas of need.

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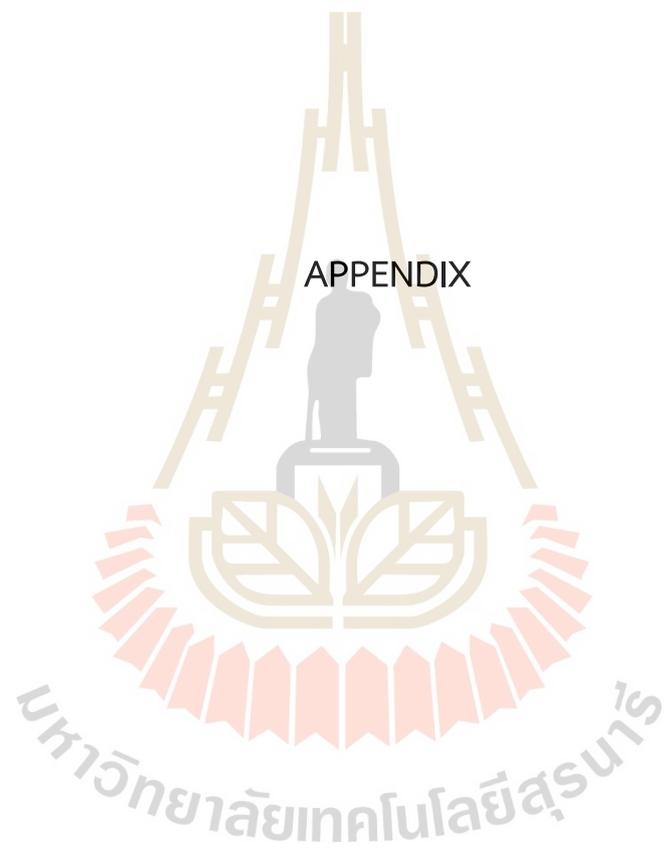
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APPENDIX



## APPENDIX A

### Edinburgh Handedness Inventory - Short Form

Name .. ..... Age ..... Gender ..... Class .....

Please indicate your preferences (with/v) in the use of hands in the following activities or objects:

	Always right	Usually right	Both equally	Usually left	Always left
Writing	<input type="checkbox"/>				
Throwing	<input type="checkbox"/>				
Toothbrush	<input type="checkbox"/>				
Spoon	<input type="checkbox"/>				

**Scoring:**

For each item: Always right = 100; Usually right = 50; Both equally = 0; Usually left = -50; Always left = -100

To calculate the Laterality Quotient, add the scores for the four items in the scale and divide this by four:

Writing score	
Throwing score	
Toothbrush score	
Spoon score	
Total	
Total ÷ 4 (Laterality Quotient)	

Classification:	Laterality Quotient score:
Left handers	-100 to -61
Mixed handers	-60 to 60
Right handers	61 to 100

## APPENDIX B

## Edinburgh Handedness Inventory - Short Form

(Chinese Version)

## 爱丁堡利手测试——简化版

姓名 ..... 年龄 ..... 性别 ..... 班级 .....

请使用(√)标注你在参与以下活动或物品使用时更喜欢用哪一侧的手:

	总是右手	经常右手	两者均等	经常左手	总是左手
写字	<input type="checkbox"/>				
投掷	<input type="checkbox"/>				
使用牙刷	<input type="checkbox"/>				
使用汤勺	<input type="checkbox"/>				

## 计分:

按项计分: 总是右手=100; 经常右手=50; 两者均等=0; 经常左手= -50; 总是左手= -100

利手值计算: 将四个项目分数合计后除以四:

写字分数	
投掷分数	
使用牙刷 分数	
使用汤匙 分数	
合计	
总分 ÷ 4 (利手值)	

利手分类: 利手值:

左利手 -100 ~ -61

混合手 -60 ~ 60

右利手 61 ~ 100

## APPENDIX C

### Paper A for Pretest

#### Part I: Phoneme reading (20%)

Direction: There are 20 phonemes in this part, please read them out.

Every phoneme should be read only once.

1. [best]	2. [hæd]	3. [bɔɪ]	4. [ʃə:t]	5. [kænt]
6. [stiə]	7. [dʒəuk]	8. [mil]	9. [jiə]	10. [θiŋ]
11. [rait]	12. [si:m]	13. [neim]	14. [trʌŋk]	15. [drai]
16. [krɔp]	17. [puə]	18. [greip]	19. [preiz]	20. [praud]

#### Part II: Words reading (30%)

Direction: There are 30 words in this part. Please read them out.

Either British or American pronunciation is acceptable.

1. yesterday	2. daughter	3. drive	4. baby	5. worker
6. pair	7. building	8. friends	9. rain	10. encourage
11. visitor	12. win	13. less	14. accident	15. twentieth
16. spend	17. remember	18. minute	19. greeting	20. national
21. furniture	22. hear	23. bank	24. football	25. traffic
26. cough	27. question	28. strawberry	29. vacation	30. continue

#### Part III: Passage Reading (25%)

Direction: Please read the following passage out.

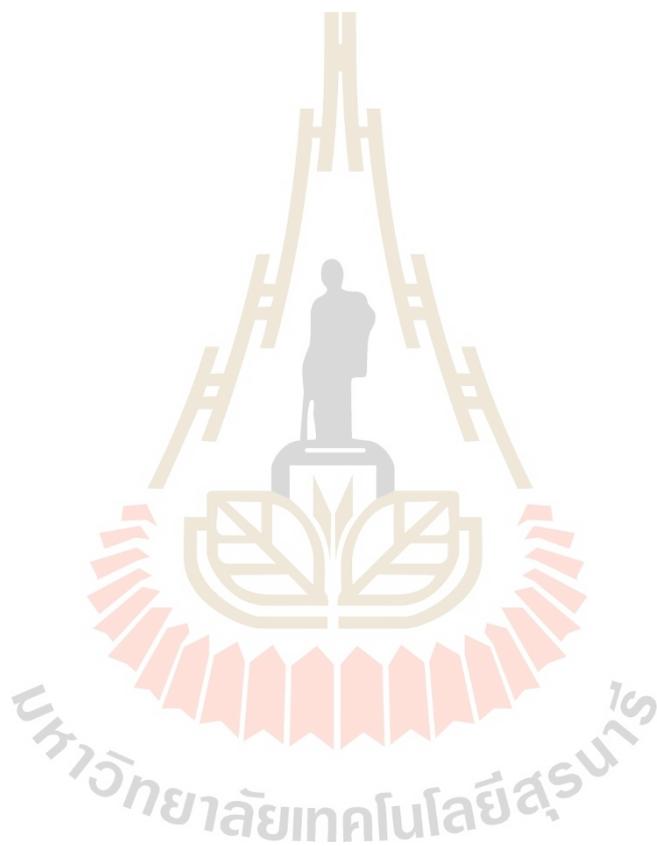
*Look at this picture. It's the London Tea Trade Centre. As you can see, it is on the north bank of the river Thames. It is the center of an important industry in the everyday lives of the British people. Tea is the British national drink. Every man, woman, and child over ten years of age has on average over 4 cups a day. Or some 1500 cups annually. About thirty percent of the world's exports of tea makes its way to London. And Britain is by far the largest importer of tea in the world.*

#### Part IV: Short question responding (25%)

Direction: Please answer the following interview questions. Use 2-3 sentences to answer each question.

1. Tell me a little bit about yourself.
2. Do you work well under pressure?

3. *What does success mean to you?*
4. *How do you handle change?*
5. *If you want to borrow your friend's bike, what would you say?*



## APPENDIX D

### Paper B for Posttest

#### Part I: Phoneme reading (20%)

Direction: There are 20 phonemes in this part, please read them out.

Every phoneme should be read only once.

1. [ben]	2. [bæd]	3. [ʃə:t]	4. [hænd]	5. [fiə]
6. [su:p]	7. [tʃil]	8. [ʃəun]	9. [θimbl]	10. [lait]
11. [frai]	12. [trip]	13. [trʌŋk]	14. [dres]	15. [dri:m]
16. [praud]	17. [print]	18. [kreiv]	19. [krɒp]	20. [gri:n]

#### Part II: Word reading (30%)

Direction: There are 30 words in this part. Please read them out.

Either British or American pronunciation is acceptable.

1. choose	2. dress	3. film	4. cabbage	5. farmer
6. leave	7. throw	8. snow	9. sweater	10. rainy
11. everywhere	12. form	13. towards	14. information	15. object
16. decision	17. wife	18. farther	19. pleasure	20. arrive
21. group	22. weekday	23. noisy	24. eye	25. know
26. problem	27. judge	28. walkman	29. yourself	30. giraffe

#### Part III: Passage Reading (25%)

Direction: Please read the following passage out.

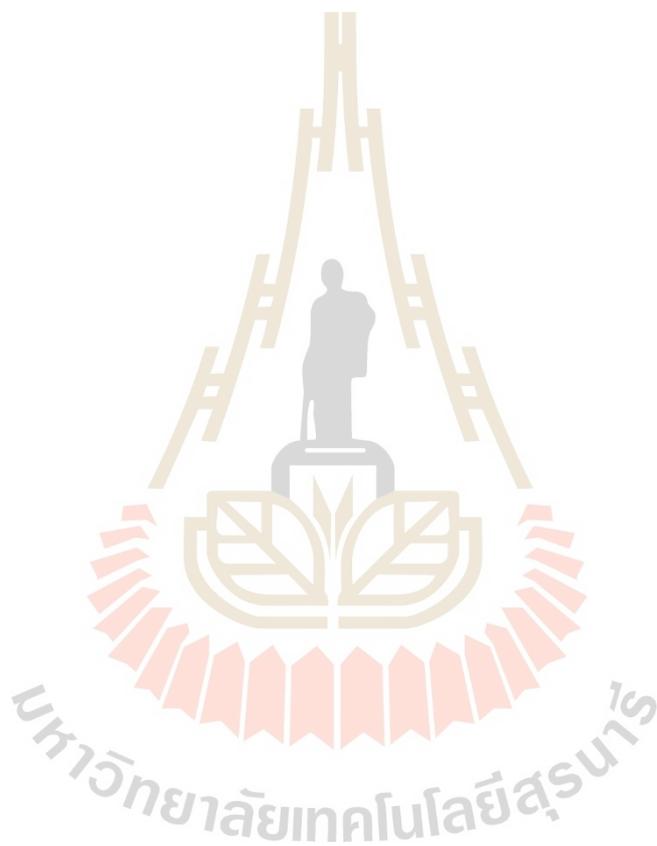
*Now, look at this picture, you can see how tea is tasted in the Tea Trade Center before it is sold. Here, different types of tea are tasted by skilled teatasters before they're sold at each week's tea sale. It's amazing to see them at work. Over a hundred kinds of tea are laid out in a line on long tables. The tasters generally taste teas with milk since that is how the majority of British people drink their tea. The tasters move down the line with surprising speed, tasting from a spoon and deciding what is a fair price for each tea.*

#### Part IV: Short question responding (25%)

Direction: Please answer the following interview questions. Use 2-3 sentences to answer each question.

1. Tell me something about yourself.
2. Do you manage your time well?

3. *What do you want to be doing five years from now?*
4. *How do you make important decisions?*
5. *If you want to ask for leave in class, what would you say to the teacher?*



## APPENDIX E

### Questionnaire on Students' Attitudes for Learning to Speak Using the Neo Verbotonal Approach (NVT)

Dear students,

This questionnaire is to investigate your opinions about the improvement of your English speaking through a Neo Verbotonal Approach (NVT) intervention. Please feel free to respond to the statements that is being asked. Your responses will be kept confidential.

Thank you for your cooperation.

#### Part I Personal Information

Gender:  Male  Female

Age (years):  below & 17  18-19  20-21  22 & above

Ethnic group:  Han  Ethnic minority

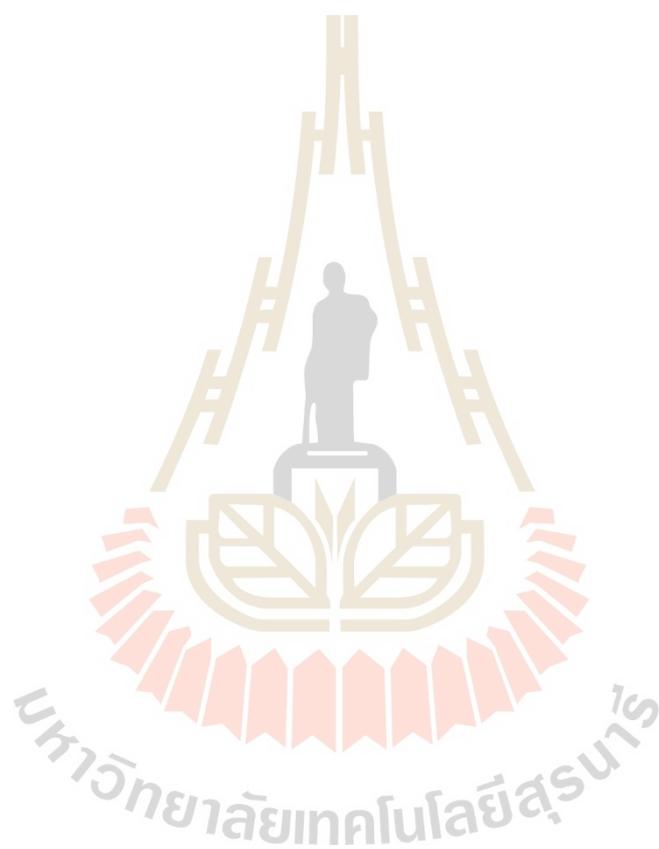
#### Part II Students' attitudes of Neo Verbotonal Approach (NVT)

##### Directions:

- 1) This questionnaire is designed to gather information about your opinions on learning English speaking via NVT guided online course "Listening and Speaking".
- 2) Please read each statement carefully and tick (✓) the number which represents your opinions.
- 3) The numbers 5 to 1 stand for the following responses: 5 = strongly agree (SA), 4 = agree (A), 3 = undecided (U), 2 = disagree (D), 1 = strongly disagree (SD).

No.	Statements of students' attitudes	SA	A	U	D	SD
1	NVT is helpful in learning to speak	5	4	3	2	1
2	NVT is effective in speaking improvement	5	4	3	2	1
3	NVT is interesting	5	4	3	2	1
4	I am unhappy with NVT	5	4	3	2	1
5	I prefer the diotic approach to NVT in speaking learning	5	4	3	2	1
6	I believe that my speaking is improved by using NVT	5	4	3	2	1
7	I believe that my speaking accuracy is improved by using NVT	5	4	3	2	1
8	I believe that my speaking fluency is improved by using NVT	5	4	3	2	1
9	I believe that my speaking accuracy and fluency get both improved.	5	4	3	2	1
10	In NVT, my attention is more raised and focused	5	4	3	2	1

No.	Statements of students' attitudes	SA	A	U	D	SD
11	In NVT, I speak more automatically	5	4	3	2	1
12	In NVT, I speak more confidently	5	4	3	2	1



## APPENDIX F

Questionnaire on Students' Attitudes for Learning to Speak Using the  
Neo Verbotonal Approach (NVT)

## (Chinese Version)

## 关于新语音听觉法 (NVT) 条件下学生使用态度的调查问卷

亲爱的同学，你好！

本次问卷意在全面了解以英语为外语的学生在新语音听觉法 (NVT) 条件下英语口语能力的提高情况。为了获取真实反映你们这两方面的情况，请如实回答每一个问题。你的回答内容将会严格保密。谢谢你的配合！

## 第一部分 个人信息

性别：男           女  
年龄：17 及以下   18-19   20-21   22 及以上  
民族：汉族           少数民族

## 第二部分 学生对新语音听觉法 (NVT) 的使用态度

说明： 1) 本问卷旨在收集你对于此次训练的观点，即如何看待通过基于 NVT 理念的《英语听说》课程进行英语学习。  
2) 请认真阅读问卷的题项并在代表你观点的数字上面打勾 (✓)；  
3) 数字 5 到 1 分别代表： 5 = 非常同意； 4 = 同意； 3 = 不确定； 2 = 不同意； 1 = 非常不同意

题项	学生态度					
1	NVT 有助于口语学习	5	4	3	2	1
2	NVT 对口语提高有效	5	4	3	2	1
3	NVT 有趣	5	4	3	2	1
4	我在 NVT 条件下感觉不好	5	4	3	2	1
5	与传统的口语学习方式相比，我不太喜欢 NVT	5	4	3	2	1
6	我相信 NVT 提高了我的口语水平	5	4	3	2	1
7	我相信 NVT 提高了我的口语准确度	5	4	3	2	1
8	我相信 NVT 提高了我的口语流利度	5	4	3	2	1
9	我相信 NVT 同时提高了我的口语准确度和口语流利度	5	4	3	2	1
10	NVT 条件下,我更能集中注意力	5	4	3	2	1
11	NVT 条件下,我说的更自然	5	4	3	2	1
12	NVT 条件下,我说的更自信	5	4	3	2	1

## APPENDIX G

## IOC ANALYSIS FOR Students' Attitudes for Learning to Speak Using the Neo Verbotonal Approach (NVT)

Items	Experts					Result of Analysis
	1	2	3	4	5	
Q1	+1	+1	+1	+1	+1	√
Q2	+1	+1	+1	+1	+1	√
Q3	+1	+1	+1	+1	+1	√
Q4	+1	+1	+1	+1	+1	√
Q5	+1	+1	0	+1	+1	√
Q6	+1	+1	+1	+1	+1	√
Q7	+1	+1	+1	+1	+1	√
Q8	+1	+1	+1	+1	+1	√
Q9	+1	+1	+1	+1	0	√
Q10	+1	+1	+1	+1	+1	√
Q11	+1	+1	+1	+1	+1	√
Q12	+1	+1	+1	+1	+1	√
Total	12	12	11	12	11	

**Notes:**

1. +1= the item is congruent with the objective
2. -1= the item is not congruent with the objective
3. 0=uncertain about this item

**Result of IOC:**

$$(IOC = \sum R/N)$$

Item number: 12

$$R = 12 + 12 + 11 + 12 + 11 = 58 \text{ (Scores from experts)}$$

N = 5 (Number of experts)

$$IOC = 58/5 = 11.6$$

$$\text{Percentage: } 11.6/12 \times 100\% = 96.7\%$$

The table above shows that the analysis result of IOC is 11.6, and the percentage is 96.7% which is higher than 80%. Therefore, the items are suitable for adoption in a questionnaire.

## APPENDIX H

### A Semi-Structured Interview on Learning to Speak Using the Neo Verbotonal Approach (NVT)

Dear students,

This oral interview is to investigate your opinions of improving English speaking accuracy and fluency through Neo Verbotonal Approach (NVT) intervention. There is no right or wrong answer. Please feel free to respond to the questions that is being asked. Your responses will be kept confidential. Thank you for your cooperation.

#### Part I Personal Information

Gender:  Male  Female

Age (years):  below &17  18-19  20-21  22 & above

Ethnic group:  Han  Ethnic minority

#### Part II Interview Questions

1. Is NVT interesting? If yes, in what ways?
2. Do you feel comfortable with NVT? If yes, in what ways? If not, why not?
3. Is NVT helpful to your speaking? If yes, in what ways? If not, why not?
4. Comparing the diotic approach to NVT, which one do you prefer? Why?
5. Do you believe that NVT will improve your speaking accuracy? Why?
6. Do you believe that NVT will improve your speaking fluency? Why?
7. Do you think your attention is equally allocated to both of your ears under NVT? If yes, in what ways?
8. Under NVT, do you think your attention is more focused? Or do you hear more clearly? If yes, in what ways?
9. Do you think your confidence, or any other aspects, in speaking has been enhanced via NVT?
10. What other aspects do you think NVT has helped you to in learning to speak English?
11. What else would you like to say about NVT?

## APPENDIX I

A Semi-Structured Interview on Learning to Speak Using the Neo  
Verbotonal Approach (NVT)  
(Chinese Version)

**关于使用新语音听觉法(NVT)进行英语口语学习的半结构式访谈**

亲爱的同学，你好！

本次访谈是为了全面了解英语作为外语的学生使用新语音听觉法（NVT）来提高英语口语能力的情况。本次访谈只是为了获取真实反映你们在新语音听觉法（NVT）条件下的口语准确度和流利度等方面的学习情况。请如实回答每一个问题，你对所有问题的回答不存在正确或者错误的分别。此访谈内容只作为此次研究使用，访谈的内容将会严格保密。

谢谢你的配合！

第一部分 个人信息

性别：男

女

年龄：17 及以下

18-19

20-21

22 及以上

民族：汉族

少数民族

第二部分：访谈问题

1. 新语音听觉法 (NVT) 有趣吗？如果是，在哪些方面？
2. 在新语音听觉法 (NVT) 中，你感觉舒服吗？如果是，在哪些方面？如果不是，为什么？
3. 新语音听觉法 (NVT) 对你的口语有帮助吗？如果是，在哪些方面？如果不是，为什么？
4. 新语音听觉法 (NVT) 与传统方法相比较的话，你更倾向选择哪个方法？为什么？
5. 你认为新语音听觉法 (NVT) 能提高你英语口语的准确度吗？为什么？
6. 你认为新语音听觉法 (NVT) 能提高你英语口语的流利度吗？为什么？
7. 你认为在新语音听觉法 (NVT) 条件下，左右耳有没有注意力分配的差异？体现在哪里？
8. 你认为你的注意力更集中了吗？是否能听的更清楚了？在哪些方面？
9. 新语音听觉法 (NVT) 对你的自信心等方面有影响吗？为什么？
10. 新语音听觉法 (NVT) 还在哪些方面对你的英语学习起到了作用？
11. 你对新语音听觉法 (NVT) 还要其他什么看法？

## APPENDIX J

**IOC Analysis for Semi-Structured Interview on Learning to Speak Using  
the Neo Verbotonal Approach (NVT)**

Items	Experts					Result of Analysis
	1	2	3	4	5	
Q1	+1	+1	+1	+1	+1	√
Q2	+1	+1	+1	+1	+1	√
Q3	+1	+1	+1	+1	+1	√
Q4	+1	+1	+1	+1	+1	√
Q5	+1	+1	+1	+1	+1	√
Q6	+1	+1	+1	+1	+1	√
Q7	+1	+1	+1	+1	+1	√
Q8	0	+1	0	+1	+1	√
Q9	+1	+1	+1	+1	+1	√
Q10	+1	+1	+1	+1	+1	√
Q11	+1	+1	+1	0	+1	√
<b>Total</b>	<b>10</b>	<b>11</b>	<b>10</b>	<b>10</b>	<b>11</b>	

**Notes:**

1. +1= the item is congruent with the objective
2. -1= the item is not congruent with the objective
3. 0=uncertain about this item

**Result of IOC:**

$$(IOC = \sum R/N)$$

Item number: 11

$$R = 10 + 11 + 10 + 10 + 11 = 52 \text{ (Scores from experts)}$$

$$N = 5 \text{ (Number of experts)}$$

$$IOC = 52/5 = 10.4$$

$$\text{Percentage: } 10.4/11 \times 100\% = 94.55\%$$

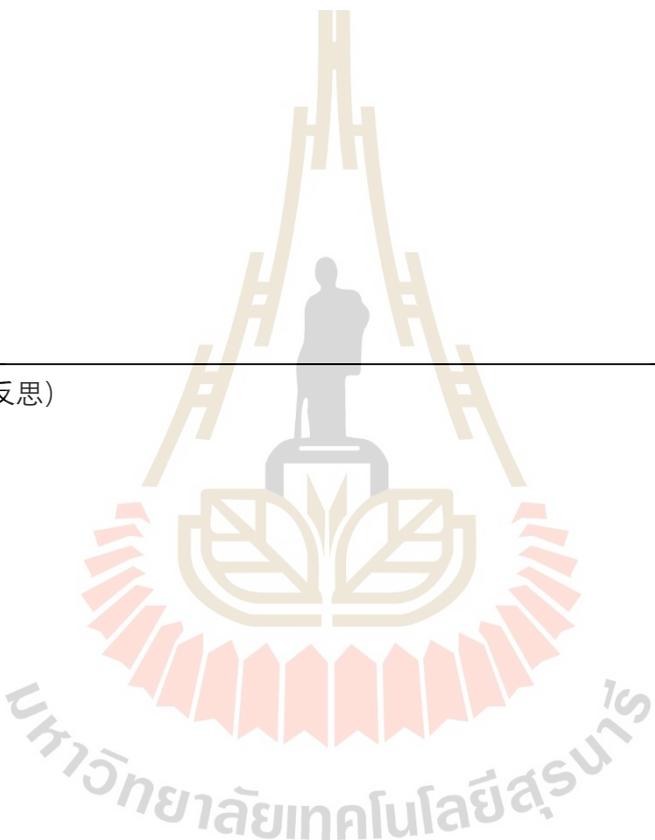
The table above shows that the analysis result of IOC is 10.4, and the percentage is 94.55% which is higher than 80%. Therefore, the items are suitable for adoption in a Semi-Structured Interview.

## APPENDIX K

## Learning Diary

(学习日记)

Date (日期)		Student ID (学号)	
Series Number (次数)		Training Place (地点)	
Content of the session (节次内容)			
Reflection (反思)			



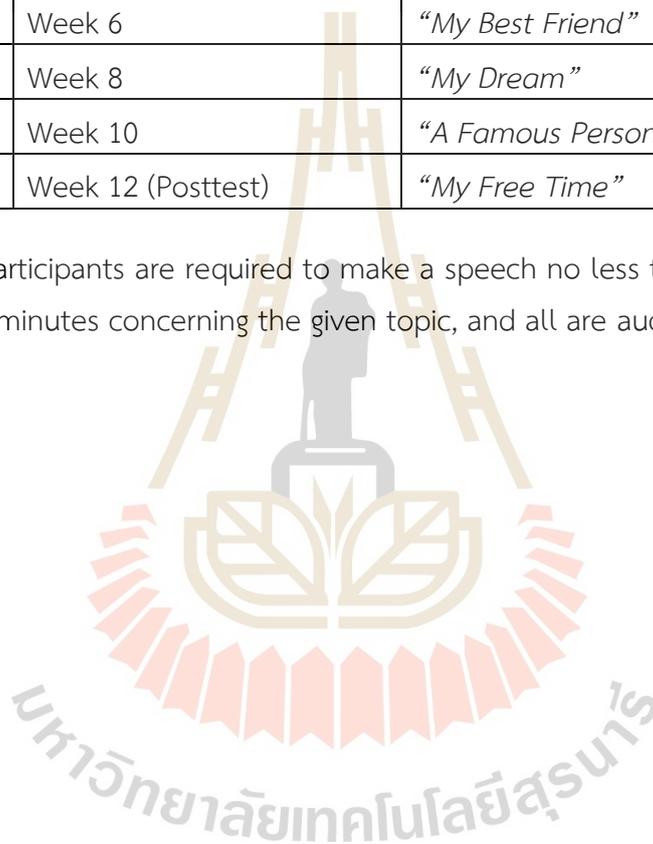
## APPENDIX L

### Biweekly Topic Monologue

Topic for each time:

Number	Time	Topics
1	Week 1 (Pretest)	<i>“My Campus Life”</i>
2	Week 2	<i>“My Favorite Book”</i>
3	Week 4	<i>“A Place I Want to Go”</i>
4	Week 6	<i>“My Best Friend”</i>
5	Week 8	<i>“My Dream”</i>
6	Week 10	<i>“A Famous Person I Know”</i>
7	Week 12 (Posttest)	<i>“My Free Time”</i>

Notes: Participants are required to make a speech no less than 1 minute and no more than 3 minutes concerning the given topic, and all are audio-recorded.



## APPENDIX M

### Rubrics for Pre/Post Test (The Overall Speaking Test)

Dear Colleague,

Thank you for your cooperation.

You are invited to rate students' recordings of the Overall Speaking Test. In the test, there are a total of five parts. The current rubrics are about the first four parts, and the fifth part, for the reason of consistency in rating, is separated out, renumbered, and piled together with the recordings of biweekly topic monologue, whose rubrics will be displayed in the next APPENDIX.

This time, you are going to rate the listed four parts: Phoneme reading, Word reading, Passage Reading, and Short question responding. The total score for each part is shown below:

Description	Total Score
Part I: Phoneme reading	20
Part II: Word reading	30
Part III: Passage Reading	25
Part IV: Short question responding	25

The rubrics for scoring these four parts are outlined as follows.

#### Part I: Phoneme reading

This part is to assess students' pronunciation of segments, i.e., vowels and consonants. Students are required to read aloud the 20 phonemes. The maximum score of this part is 20. This part will be scored dichotomously (phonologically correct or incorrect).

Description	Score
Phonologically correct	1
Phonologically incorrect	0

### Part II: Word reading

This part is also to assess students' pronunciation of segments, i.e., vowels and consonants. Students are required to read aloud the 30 words. The maximum score of this part is 30. This part will be scored dichotomously (phonologically correct or incorrect).

Description	Score
Phonologically correct	1
Phonologically incorrect	0

### Part III Passage Reading

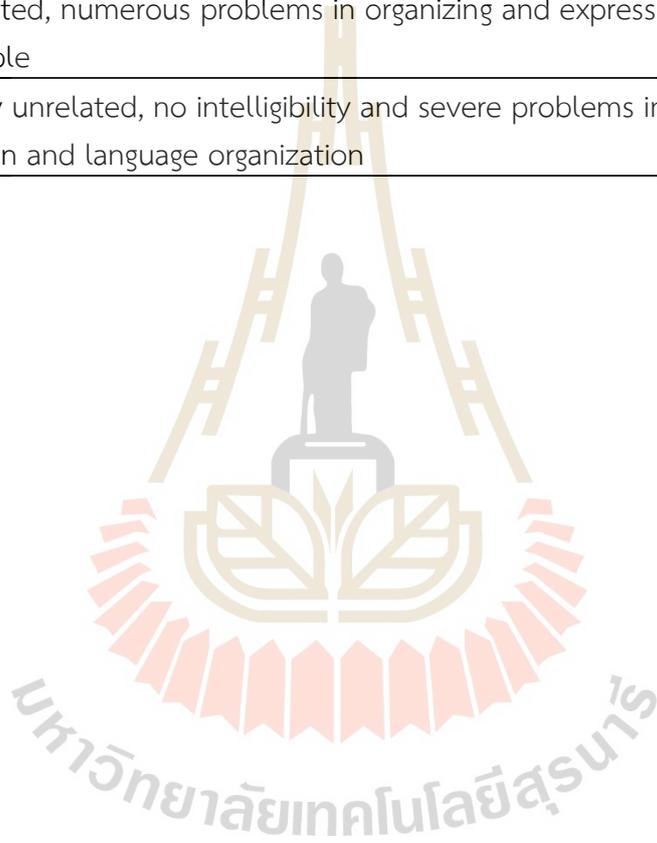
This part is to assess students' pronunciation of both segmental and suprasegmental in reading the passage out. And the maximum score of this part is 25.

Description	Score
Advanced Fluency; accurate pronunciation of individual sounds; no or very few minor phonemic/phonetic errors; natural speech rate, intonation, and rhythm; fully comprehensible	21-25
Good fluency; some problems with pronunciation of individual sounds, speech rate, intonation, and rhythm; no serious problems in comprehensibility	16-20
Intermediate fluency; numerous problems with pronunciation of individual sounds, speech rate, intonation, and rhythm; moderately comprehensible	11-15
No fluency; severe problems with pronunciation of individual sounds, speech rate, intonation, and rhythm; slightly comprehensible	6-10
No Fluency; insufficient information to score or completely incomprehensible	0-5

### Part IV Short question responding

In this part, students are required to answer 5 questions, and using 2-3 sentences for each question. This part is to assess students' speaking skills in terms of pronunciation, grammar, vocabulary, fluency, and comprehensibility. You are required to give scores based on your judgment on their responding of the questions. The overall maximum score for this part is 25.

Description	Score
Strongly related to the question, perfect in explanation, fluent in organizing languages, in a natural and logical manner, accurate in pronunciation, high intelligibility	21-25
Topic related, clear explanation, few problems in organizing languages and logic, minor problems in pronunciation, intelligible	16-20
Topic loosely related, moderately acceptable in pronunciation and manner of expression, intermediate in pronunciation and language organization	11-15
Topic unrelated, numerous problems in organizing and expressing ideas, less intelligible	6-10
Topic totally unrelated, no intelligibility and severe problems in pronunciation and language organization	0-5



## APPENDIX N

### Rubrics for Biweekly Topic Monologue

Dear Colleague,

Thank you for your cooperation.

You are invited to rate students' recordings of Topic Monologue test. In the test, students are required to present a speech within 1-3 minutes on a given topic.

You are to rate the recordings into two parts: accuracy and fluency, with a full score of 30 for each part:

Category	Description	Score
Accuracy	Few minor errors or perfectly accurate in grammar, pronunciation, and meaning explanation	21-30
	Intermediate errors in grammar, pronunciation, and meaning explanation	11-20
	Numerous errors in grammar, pronunciation, and meaning explanation	0-10
Fluency	Highly smooth or completely smooth in expression, clear and natural in explanation, topic strongly related	21-30
	Moderately acceptable in smoothness of expression, numerous errors in stress and intonation, topic loosely related	11-15
	Less comprehensible in expression, severe errors in language use, time expired, topic unrelated	0-10

## CURRICULUM VITAE

Zhang Shaobing holds a Bachelor's degree in English from Xinyang Normal University and a Master's degree in Linguistics and Applied Linguistics in Foreign Languages from Henan University of Technology, China. In 2017, he began to study for a Ph. D degree in English Language Studies at the School of Foreign Languages in Suranaree University of Technology, Thailand. He is currently working as a lecturer at the Department of Foreign Languages, Guangdong University of Petrochemical Technology, China. His research interests include EFL teaching and learning, verbotonalism and neurolinguistics.

