



**UNIVERSITI PUTRA MALAYSIA**

***EFFECTIVENESS OF AUTOMATED WRITING EVALUATION  
FEEDBACK IN IMPROVING ENGLISH AS A FOREIGN LANGUAGE  
UNDERGRADUATE STUDENTS' WRITING PERFORMANCE***

**GENG JINGXIN**

**FPP 2022 41**



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By

**GENG JINGXIN**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,  
in Fulfilment of the Requirements for the Degree of Doctor of Philosophy**

**July 2022**

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## **DEDICATIONS**

To my parents, Geng Shaoting and Zhang Cuiying

To my son and my daughter, Yue Mucong and Yue Muhan

To all the participants who joined this study



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

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**July 2022**

**Chairman : Associate Professor Abu Bakar bin Mohamed Razali, PhD**  
**Faculty : Educational Studies**

With the rapid development of educational technology in the teaching and learning of English as a foreign language (EFL), the implementation of the automated writing evaluation (AWE) program in English writing instruction attracts researchers' and instructors' attention constantly in the past few decades. However, researchers of past studies have not been able to reach an agreement on the effects of the AWE in improving EFL students' writing performance and error correction ability. Guided by the theoretical framework of Cognitive Constructivism (Graves, 1978), the concept of Zone of Proximal Development (Vygotsky, 1978) and Scaffolding (Maybin, Mercer, & Stierer, 1992) which are rooted in Sociocultural Theory (Vygotsky, 1978), and Technology Acceptance Model 3 (Venkatesh & Bala, 2008), this thesis investigated the effectiveness the AWE (Pigai) as an assisted teaching tool in improving undergraduate students' EFL overall writing performance and analytic writing performance (i.e., content, organization, vocabulary, grammar, and mechanics) in the context of EFL undergraduate students in China. This thesis also aimed to identify student users' acceptance toward the use of the Pigai program in college English writing course in order to triangulate the results obtained from the first two research objectives. Ninety (n=90) freshmen majoring in English were enrolled in the quasi-experimental research consisting of three non-equivalent control groups (i.e., the control group (CG) which used conventional teaching approach, the experimental group 1 (EG1) which used the process-based teaching approach (PBWA), and the experimental group 2 (EG2) which used the combination of the PBWA and the Pigai program. The results indicated that among three teaching methods, the combination of the PBWA and the Pigai (EG2) was the most effective teaching method in improving students' overall and analytic writing performance after the intervention and the post-intervention (i.e., stopped training for a month) respectively, particularly in internalizing students' writing knowledge in the aspects of vocabulary, grammar, and mechanics. Also, students in EG2 were able to significantly improve their error correction ability after the intervention (the combination of the PBWA and the Pigai program). Through the survey questionnaires, students in the EG2 presented a high

acceptance toward the use of the Pigai program as an assisted teaching tool in general, where they noted satisfaction with the constructs of Perceived Usefulness, Perceived Ease of Use, the External Control, Output Quality, Result Demonstrability, Behavioral Intention, and Computer Self-Efficacy, with a neutral acceptance toward the construct termed Voluntariness and a negative acceptance toward the construct Perceived Enjoyment. This researcher recommends EFL language instructors, program coordinators, and other undergraduate studies stakeholders to adopt the Pigai program as an assisted teaching tool in teaching EFL writing. The researcher also suggests that during the implementation of the combination of the PBWA and the Pigai program, the instructors should inform student users of the pros and cons of the working system of the Pigai program in order to let the users make the best use of the Pigai program and introduce some meta-process strategies (i.e., screening automated feedback and using an online dictionary) to overcome its weaknesses. Future studies were recommended to explore the effectiveness of the AWE program in improving students' writing performance by focusing on the following areas: a) establishing an instruction model of the PBWA with Chinese intrinsic characteristics; b) investigating strategies that can motivate Chinese students to provide constructive peer feedback; c) exploring strategies that students can adopt to approach the received automated feedback; d) addressing different target samples; e) utilizing qualitative designs, quantitative designs, or mixed-method designs.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**KEBERKESANAN PROGRAM PENILAIAN PENULISAN AUTOMATIK  
DALAM MEMBERIKAN MAKLUM BALAS UNTUK MENINGKATKAN  
PRESTASI PENULISAN BAHASA INGGERIS SEBAGAI BAHASA ASING  
PELAJAR SARJANA MUDA DI CHINA**

Oleh

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Dengan perkembangan pesat teknologi pendidikan dalam pengajaran dan pembelajaran Bahasa Inggeris sebagai bahasa asing (EFL), pelaksanaan program penilaian penulisan automatik (AWE) dalam pengajaran penulisan Bahasa Inggeris telah menarik perhatian penyelidik dan pengajar secara berterusan pada beberapa dekad yang lalu. Walau bagaimanapun, penyelidik kajian sebelum ini tidak dapat mencapai persetujuan mengenai kesan AWE dalam meningkatkan prestasi penulisan pelajar EFL dan keupayaan pembetulan ralat. Berlandaskan rangka teori “Cognitive Constructivism” (Graves, 1978), konsep “Zone of Proximal Development” (Vygotsky, 1978) dan “Scaffolding” (Maybin, Mercer, & Stierer, 1992) yang terdapat di dalam “Teori Sociocultural” (Vygotsky, 1978), dan “Technology Acceptance Model 3” (Venkatesh & Bala), tesis ini menguji keberkesanan AWE (Pigai) sebagai alat pengajaran yang membantu meningkatkan prestasi penulisan pelajar pra EFL secara keseluruhan dan prestasi penulisan analisis dan prestasi penulisan analitikal (iaitu: kandungan, organisasi, perbendaharaan kata, tatabahasa, dan mekanik) dalam konteks pelajar prasiswazah EFL di China. Tesis ini juga bertujuan untuk mengenal pasti sikap pelajar terhadap penggunaan program Pigai dalam kursus penulisan Bahasa Inggeris kolej untuk triangulasi hasil yang diperolehi daripada dua objektif pertama penyelidikan. Sembilan puluh orang (n=90) pelajar baru dalam jurusan Bahasa Inggeris telah didaftarkan dalam kajian kuasi-eksperimen yang terdiri daripada tiga kumpulan kawalan yang tidak setara (iaitu kumpulan kawalan (CG) yang menggunakan pendekatan pengajaran konvensional, kumpulan eksperimen 1 (EG1) yang menggunakan pendekatan pengajaran berasaskan proses (PBWA), dan kumpulan eksperimen 2 (EG2) yang menggunakan gabungan PBWA dan program Pigai. Keputusan menunjukkan bahawa antara tiga kaedah pengajaran, gabungan PBWA dan Pigai (EG2) adalah kaedah pengajaran yang paling berkesan dalam meningkatkan prestasi penulisan keseluruhan dan analitis pelajar selepas intervensi dan pasca intervensi (iaitu, latihan berhenti selama sebulan) terutamanya dalam pengetahuan penulisan dalaman pelajar dalam aspek perbendaharaan kata, tatabahasa, dan mekanik bahasa. Di samping itu, pelajar di EG2 dapat meningkatkan

keupayaan pembetulan kesilapan mereka dengan ketara selepas intervensi (gabungan PBWA dan program Pigai). Melalui borang kaji selidik, pelajar di EG2 menunjukkan sikap positif terhadap penggunaan program Pigai sebagai alat pengajaran yang dibantu secara umum, di mana mereka menyatakan kepuasan dengan konstruk Tahap Penggunaan, Kemudahan Menggunakan Teknologi, Kawalan Dalaman, Kualiti Pengeluaran, Keputusan yang Ditunjukkan, Niat Tingkah Laku, dan Keberkesanan Diri dalam Penggunaan Komputer, dengan sikap neutral terhadap konstruk Kesukarelaan dan sikap negatif terhadap binaan Tahap Keseronokan. Penyelidik ini mengesyorkan pengajar bahasa asing EFL, penyelar program, dan pihak berkepentingan pengajian prasiswazah lain untuk menggunakan program Pigai sebagai alat bantuan mengajar dalam pengajaran penulisan EFL. Penyelidik juga mencadangkan bahawa semasa pelaksanaan gabungan PBWA dan program Pigai, pengajar harus memaklumkan pelajar tentang maklum balas program Pigai ini untuk membolehkan pengguna menggunakan program Pigai, seterusnya, memperkenalkan beberapa strategi meta-proses (iaitu, menyaring maklum balas automatik dan menggunakan kamus dalam talian) untuk mengatasi kelemahannya. Kajian masa depan disyorkan untuk meneliti keberkesanan program AWE dalam meningkatkan prestasi penulisan pelajar dengan memberi tumpuan kepada bidang-bidang berikut: a) mewujudkan model pengajaran PBWA dengan ciri-ciri intrinsik Bahasa Cina; b) menyiasat strategi yang boleh memotivasikan pelajar Cina untuk memberikan maklum balas rakan sebaya yang membina; c) strategi yang diguna pakai oleh pelajar untuk mendapatkan maklum balas automatik; d) sampel sasaran yang berbeza; e) dari perspektif reka bentuk kualitatif, reka bentuk kuantitatif berbeza, dan reka bentuk kaedah bercampur.



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This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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## LIST OF ABBREVIATIONS

ESL	English as a second language
EFL	English as a foreign language
PBWA	Process-based writing approach
AWE	Automated writing evaluation
CG	Control group
EG1	Experimental group 1
EG2	Experimental group 2
ANOVA	Analysis of variance
MANOVA	Multivariant analysis of variance
MANCOVA	Multivariant analysis of covariance

# CHAPTER 1

## INTRODUCTION

### 1.1 Background of Study

In China, English is the most widely used foreign language at all layers of society. Based on the huge population, Chinese people learning English as a foreign language (hereinafter referred to as EFL learners) has been the most enormous EFL learning group all over the world. In 2021, approximately 18 million students were enrolled in colleges in the mainland of China, all of whom need to study English as a compulsory course to meet the requirements of a university degree (MOE, 2020). In addition, with the rapid development of higher education in China, the number of university enrollment will remain constant growth. However, the current situation of English education in tertiary schools requires a breakthrough so as to keep pace with the times.

Nowadays, English writing skill is considerably salient to be acquired as a medium of written communication (Imelda et al., 2019), especially in conveying information throughout the world (Cahyono, 2009). However, compared with the other three aspects of language learning, writing is seen as a more comprehensive language skill. On one hand, it is also the most challenging language skill to be taught (Timothy, 2012; Richard & Renandya, 2013), due to the ineffective teaching strategy and outdated teaching styles (Fareed et al., 2016) that many, if not most, ESL/EFL language teachers use to teach it. On the other hand, researchers have also proposed that the major dilemma of EFL students is that they faced extra difficulties and mental burdens for academic writing largely due to their insufficient language competencies (Al Fadda, 2012; Bacha, 2002; Olivas & Li, 2006), such as the lack of knowledge in grammatical features and vocabulary items (Hyland, 2003), among other concerns, such as the lack of ideas for content, the lack of organization and issues with cohesion and coherence. For example, in a study done by Yang and Gao (2015), the researchers find out many students were poor in language accuracy and they got used to using Chinglish expressions that were not correct in grammar and content caused by the word-by-word translation of their mother tongue, Mandarin, lacking the target language culture. Such findings indicated that the pervasiveness of language problems in students' writing was logical problems or poor thinking skills, which was affected by their native language expressions. That said, many students are more likely to focus on imitating the rhetorical pattern without improving their writing performance by training their thinking skills.

As such, in order to improve students' writing performance, advanced writing teaching approaches which were derived from native English-speaking countries were introduced into the classroom in China, most especially the use of the Process-based Approach (hereafter will be referred to as PBWA) to write. Represented by Graves (1978), western linguists proposed on that students' writing process should be focused, not the final draft. He thinks that the writing process is not a linear activity, but also a recursive procedure, including information collection, making plans, writing stage, peer evaluation, peer

editing, and so on. In the process approach to writing, the continual interactions among learners, instructor, and peers during the process are stressed (Tribble, 2002), aiming to enhance students' cognitive development. The implementation of PBWA demonstrates a transformation from a teacher-centered teaching model to a student-centered teaching model. Through actively exploring and constructing writing knowledge, the PBWA can provide great help to enhance students' writing performance. However, along with the practical development of the PBWA, researchers point out this teaching approach is time-consuming (i.e., Harmer, 2007), not to mention the large-class-capacity teaching environment in China which is a huge challenge for a teacher by increasing the labor burden of the teacher.

In addition, with the rapid development of the educational technology tool, the implementation of an automated writing evaluation (hereafter will be referred to as AWE) program in writing instruction was recommended to serve as an assisted tool for teachers in order to release them from their heavy workload, such as daily scoring (Stevenson & Phakiti, 2019; Palermo & Wilson, 2020). More than that, with pedagogically attractive features, the potential value of the adoption of the AWE in writing teaching has been given attention widely. To be more specific, sophisticated AWE tools (i.e., *Criterion*<sup>®</sup>, *Writing Roadmap*, *MY Access!*, *Correct English*, and *WriteToLearn*) can provide both diagnostic holistic scores and artificial intelligent feedback on writing samples (Phillips, 2007) in terms of multiple linguistic traits (Li et al., 2014). Bai and Hu (2017) proclaimed further, online AWE systems tools, such as *Criterion*<sup>®</sup> and *MY Access!*, also can display bar charts revealing the strengths and weaknesses of submitted essays and the individualized diagnostic automated feedback focuses on providing both microstructural level (e.g., grammar, mechanics, and usage of conventions) and macro-structural level (e.g., focus and unity, content and development and organization) of student essays. However, researchers found AWE tools which were designed in Western countries were not able to detect typical Chinese EFL learners' grammatical errors – Chinglish which was mainly caused by the negative transfer from their mother tongue (Liu & Kunnan, 2016). In addition, due to the monolingual automated feedback (the target language: English), students cannot really benefit from interacting with AWE programs; instead, it increases their mental burden (Ding, 2008).

In such a situation, the Pigai program was designed by Beijing Word Network Technology Co., Ltd., which is one of the most extensively implemented AWE programs in China. According to interpretation by Wang (2019) about the Pigai's Intelligent Online English Writing Correction System from [www.pigai.org](http://www.pigai.org), the Pigai program aims at solving problems, such as the negative transfer, over-generalization of English grammar, the unbalance of linguistic competency at the side of learners, the low efficiency in correcting at the side of teachers. According to estimation by the service provider, Pigai.org, more than 6,000 schools, including technological vocational schools and universities (some of them are renowned institutions, such as Tsinghua, Nanjing University) in China are using this system for their instruction of English writing, and 3.9 billion of English writings have been corrected or given feedback by both the system itself and the teachers/lecturers and students who are using this AWE system, by January 1st, 2018. It's the largest and most popular commercial AWE system in China and examines students' uptake of the feedback in revision and their perceived value of

Pigai's different categories of feedback in a Chinese EFL context (Bai & Hu, 2017). Moreover, compared to the other AWE systems, the Pigai program has the advantage that all its automated feedback is provided in the integrated use of English and Chinese, which benefits Chinese EFL learners in understanding the feedback clearly and effectively. In addition, students' interaction with the Pigai program is out of the constraint of time, to which students can revise their essays as many times as they want. Thus, they have sufficient time to repeat the recursive writing process in order to improve their writing performance with countless writing practice opportunities. In other words, to the large extent, the implementation of the Pigai program can make the needs of the Process-based writing approach.

Therefore, the purpose of this study is to investigate the effectiveness of using such an online AWE system, i.e., the Pigai program, in improving Chinese undergraduate EFL students writing performance, and students' acceptance of the Pigai program. The main concern of the research in this study is the EFL learners' writing performance. All the learners were divided into three groups with three different treatments: one group was taught by the traditional teacher-centered teaching approach, another group was taught by the cognitive Process-based writing approach, and the last group was instructed by the Process-based writing approach embedded in the use of the Pigai program as a supplementary teaching tool. Since a teaching method significantly contributes to students writing performance, the need to find out which is the most effective teaching method is regarded as the essential objective of this research. There is little doubt about the significance of improving undergraduates' writing performance. Because in the EFL context, writing competence in English is thought to be decisive for students both in academic paper writing at tertiary school and in professional or vocational writing at work (Grabe & Kaplan, 1996; Leki et al., 2008). Lastly, students' acceptance of the use of the Pigai program was addressed in order to triangulate the result of students' writing performance and shed some light on the implementation of the Pigai program in the future.

## **1.2 Problem Statement**

In the Chinese EFL context, English education has been placed on the crucial status for the last two decades. Most of the Chinese undergraduate students in China have studied English for at least 9 years before they are enrolled into the university or college. In this regard, according to the current English curriculum system and teaching objectives, Chinese undergraduate students should be able to write fluently and proficiently. However, being in the EFL context, there is an obvious practical gap between the ideal teaching goal and the actual students' English writing performance in China. According to the report of Test for English Majors – Band 4 as a major instrument to test Chinese undergraduate students' English competence, it was found that the passing rates in the writing part for candidates are 53.76%, 52.19% and 54.07% in 2017, 2018, and 2019 respectively, ranking the lowest passing rate among the other three aspects (i.e., Listening, Linguistic Knowledge, and Reading). Zhou (2015) also addresses the present situation of English writing teaching is unsatisfactory in China. On top of that, most teachers devote much time to teaching students how to write during the class but achieve little. Secondly, students commonly reflect that it's not easy for them to write an essay.



The effectiveness of English writing teaching has suffered numerous disputes constantly. However, thesis writing for graduate students is the essential basis of their academic triumph and future career (Sevcikova, 2018), especially with the fact that being able to issue their written works in reputable journals can make them sought after in the job market (Cotos, 2014). In other words, undergraduate and postgraduate students' writing performance cannot be improved without teacher's traditional instruction and corrective feedback. Therefore, it is necessary to investigate the effectiveness of an advanced teaching approach in improving Chinese EFL learners' writing performance.

Although teachers aim to improve their students' writing performance by improving their own teaching methods, another glaring practical gap also exists between theories of writing instruction and actual practices of classroom teaching, such as the unbalanced teaching syllabus cannot meet the needs of letting students experience writing practice based on the PBWA. Based on the PBWA, English writing teaching activity has conversed the conventional teacher-centered model into a student-centered teaching model. Rooted on Grave's thoughts, Flower (1981) developed writing process theory into a cognitive process theory which stresses the writing process is not only constructed by recursive stages but a mental process, including a set of distinctive thinking processes (i.e., the written text, the long-term memory, planning, goal-setting, translating, reviewing and the monitor); a hierarchical system embedded recursive sub-processes; a goal-directed process and the creating sub-goals; and regenerating goals processes. By emphasizing the importance of learners' creativity, students are expected to be able to explore ideas, develop, act on, test, and regenerate their own goals (Flower, 1981). This cognitive process writing theory shows a shift in emphasis in teaching from the product of writing activities and the transformation of learners' passive learning model into autonomous learning (Jiang, 2003). However, as noticed by harmer (2007), it is indisputable that the implementation of PBWA is time-consuming. In addition, Chinese students' strong intrinsic personalities were considered the obstacle to the implementation of peer feedback during the writing process (Caffarella & Barnett, 2000; Wang & Li, 2008). Therefore, there is a strong need to investigate whether the AWE and PBWA as the western country-oriented teaching method can benefit EFL learners and whether it is applicable in a large class capacity learning environment in China.

Also, a policy-practice gap comes into view. To guarantee the education quality, MOE also specifies the requirement for the structure of English major teachers in Standards: student-teacher ratio is no more than 18 (MOE, 2018). Every student is expected to be instructed effectively by the teacher – especially with the lower ratio between teacher and student. According to statistics analysis data in 2018, around 17 million undergraduates were at tertiary schools while 1 million teachers were teaching. (MOE, 2019) That said, the national student-teacher ratio has met the requirement on average in 2018. However, due to the unbalanced distribution and development of educational resources, the teacher-student ratio in some provinces cannot meet the requirement of Standards. The statistic shows there are 10 provinces the student-teacher ratio is beyond 18 in China. For example, the highest student-teacher ratios are 19.37 in Sichuan province and 19.35 in Yunnan province respectively. The area, Shanxi province, where this research is carried out is also with a low student-teacher ratio which is 18.28 on average. As such, it is essential to investigate whether the AWE-Pigai assisted PBWA



can facilitate the teacher's instruction in a large-class-capacity teaching environment, such as in China.

Furthermore, although there have been many studies that focused on the use of AWE software, such as *Criterion@*, *Writing Roadmap*, *e-rater*, *MY Access!*, *Correct English*, *Write to Learn*, and so on, some researchers point out the weakness of the implementation of Western-designed AWE programs in EFL context, such as the monolingual feedback which was offered by the AWE system in the target language, i.e., English, which can neither provide much help to less skillful students nor increase their learner autonomy to improve their writing, due to the frustration of understanding the nature of such limited feedback (Ding, 2008). Furthermore, these Western-developed AWE programs fail to detect Chinese learners' grammatical errors caused by the negative transfer from their mother tongue. On the other hand, for the Pigai, as one of the most popular and commercial AWE programs in China, it is important to identify the most effective way to implement it. In addition, although the Pigai program is famous for offering automated feedback in the hybrid use of Chinese and English to student users and detecting Chinglish phenomena, there are insufficient studies investigating the effectiveness of the Pigai program in improving Chinese students writing performance in the aspect of an experimental study. Hence, there is an urgent need to investigate the effectiveness of the Pigai program in enhancing Chinese students' writing performance.

Last but not least, students' acceptance of the adoption of any technical device is regarded as one vital indicator to evaluate the success or effectiveness of its implementation (Davis, 1989; Wilson & Roscoe, 2020). However, insufficient empirical research examined students' acceptance of the AWE program (Zhai & Ma, 2021), not to mention Chinese students' acceptance of the Pigai program. That said, in order to bridge the gap in previous literature, it is necessary to explore Chinese EFL students' acceptance of the Pigai program.

### **1.3 Research Objectives**

The general objectives of this quantitative study are to determine the effectiveness of an online automated writing evaluation (AWE) system, called the Pigai program, to mediate peer feedback, revision process on undergraduate EFL Students' writing performance, as well as the users' acceptance of the Pigai program.

1. To determine the effectiveness of using the automated writing evaluation program (Pigai) to improve EFL students' overall writing performance and analytic writing performance (i.e., content, organization, vocabulary, grammar, and mechanics) respectively.
2. To determine the effectiveness of using the automated writing evaluation program (Pigai) to improve EFL students' error correction ability in the aspects of the content, organization, vocabulary, grammar, and mechanics in academic writing.

3. To identify the learners' acceptance of the use of the automated evaluation program (Pigai) in college English writing.

#### **1.4 Research Questions**

To address the problems of current study, three research questions were examined in this study:

1. How effective is the automated writing evaluation program (Pigai) in improving EFL students' overall and analytic writing performance (i.e., grammar, vocabulary, content, organization, and mechanics)?
2. How effective is the automated writing evaluation program (Pigai) in improving EFL students' error correction ability in the aspects of grammar, vocabulary, content, organization, and mechanics in academic writing?
3. What are the EFL learners' acceptance levels of the use of the Pigai program in Academic English writing?

#### **1.5 Research Hypotheses**

All hypotheses of the current study were corrected as directional hypotheses because in terms of the literature review of online automated writing evaluation tool which can improve students' writing ability. Therefore, hypotheses of this study were proposed based on literature reviews as follows:

- a) H<sub>1</sub>-1: The overall writing performance of the experimental group 1 is significantly higher than the performance of the control group, after the intervention among the undergraduate students.
- b) H<sub>1</sub>-2: The overall writing performance of the experimental group 2 is significantly higher than the performance of the experimental group 1, after the intervention among the undergraduate students.
- c) H<sub>1</sub>-3: The overall writing performance of the experimental group 2 is significantly higher than the performance of the control group, after the intervention among the undergraduate students.
- d) H<sub>2</sub>-1: The overall writing performance of the experimental group 1 in the delayed test is significantly higher than the performance of the control group, even after the intervention has stopped for a month.
- e) H<sub>2</sub>-2: The overall writing performance of the experimental group 2 in the delayed test is significantly higher than the performance of the experimental group 1, even after the intervention has stopped for a month.
- f) H<sub>2</sub>-3: The overall writing performance of the experimental group 2 in the delayed test is significantly higher than the performance of the control group, even after the intervention has stopped for a month.

- g) H<sub>3</sub>-1: Analytic writing performance of the experimental group 1 (i.e., content, organization, vocabulary, grammar, and mechanics) is significantly higher than the performance of the control group, after the intervention among the undergraduate students.
- h) H<sub>3</sub>-2: Analytic writing performance of the experimental group 2 (i.e., content, organization, vocabulary, grammar, and mechanics) is significantly higher than the performance of the experimental group 1, after the intervention among the undergraduate students.
- i) H<sub>3</sub>-3: Analytic writing performance of the experimental group 2 (i.e., content, organization, vocabulary, grammar, and mechanics) is significantly higher than the performance of the control group, after the intervention among the undergraduate students.
- j) H<sub>4</sub>-1: Analytic writing performance of the experimental group 1 (i.e., content, organization, vocabulary, grammar, and mechanics) in the delayed test is significantly higher than the performance of the control group, even after the intervention has stopped for a month.
- k) H<sub>4</sub>-2: Analytic writing performance of the experimental group 2 (i.e., content, organization, vocabulary, grammar, and mechanics) in the delayed test is significantly higher than the performance of the experimental group 1, even after the intervention has stopped for a month.
- l) H<sub>4</sub>-3: Analytic writing performance of the experimental group 2 (i.e., content, organization, vocabulary, grammar, and mechanics) in the delayed test is significantly higher than the performance of the control group, even after the intervention has stopped for a month.
- m) H<sub>5</sub>: The writing quality of students' last drafts of their last assignment in the aspects of the content, organization, vocabulary, grammar, and mechanics is significantly higher than that of the first drafts of their first assignment in the experimental group 2

## 1.6 Significance of Study

Compared to other language skills, writing is a more complicated skill to grasp, especially for EFL students and in the EFL context. The conventional teaching approach cannot satisfy nowadays teaching requirements because the writing process is full of writer's creative thinking, rather than simple imitation (Flower & Hayes, 1981). Therefore, figuring out how to provoke EFL writing learners' cognition of the writing process is a crucial way so as to make them progress and perform better in their writing. The researcher believes that the exploration of AWE software, such as the Pigai software, may inspire great benefits on learning English writing.

This study investigates the effectiveness of using the Pigai program as a supplementary tool for the process-based approach to the teaching of writing on improving students' writing performance. The results of this study might inform the teacher on the potentials to use the Pigai program as a helpful teaching tool, which would save their time and

energy to focus on giving corrective feedback in terms of content and organization, so that more effective and timelier instructor's feedback is given to the students. Secondly, the results provide a Pigai program mediated teaching model to apply the process writing approach in the academic writing course. The results of this study would also illustrate that the Pigai program might not only create an out-of-school learning and recursive writing practice environment which breaks time limitations but also promote learners to join online peer feedback actively. Finally, students' learner autonomy could be aroused by multiple chances to engage in writing online, and they also may be in addition to beating for the system scores, which can be utilized to motivate their learning interests.

Findings from the study may shed light on how the Pigai program can improve students' writing competence by providing automated feedback and online peer feedback and teacher feedback during their writing process. Also, tertiary education institutions can benefit from this study, especially in their future implementation of AWE programs. Since the Pigai program has been one of the most popular AWE programs in China so far, which can provide timely automated feedback, an online peer feedback platform, teacher corrective feedback, as well as other useful functions. However, only a few institutions in China notice its potential use. They can benefit from automated holistic scores and comments as the summative evaluation. Insofar, if the instructor can blend the integrated use of the Pigai program into a process-based writing approach effectively in the future, the writing performance of the Chinese tertiary students would be expected to be improved greatly, and the heavy corrective burden of the instructors may also be reduced to a large extent, in order to make the teaching activity be more targeted. Finally, the study can also help inform these institutions not only on the benefits of the Pigai program but also on the limitations of the Pigai program, which might be overcome with the results from this study.

## **1.7 Scope and Limitations**

The current empirical results reported herein should be considered in light of some limitations. First, one of the limitations derives from the research methods of the current study. Since this study was conducted using quantitative research design, in particular, the use of the quasi-experimental design adopting the non-probabilistic sampling strategy, it makes the findings of this study may not be 'generalizable' but 'transferable' to the other members of the population (Brown, 2006). This constraint also cannot guarantee this study to offer findings from a more in-depth perspective. Another limitation of the study was the duration. The study was planned and conducted in only one semester (5-6 months), so the findings could be more fruitful if its duration could last longer. Apart from the time factor, another limitation concerns individual differences, such as students' language proficiency (especially, the quality of students' peer feedback), motivation, learning styles, and instructor's differences, led the findings of this study to be different. For this reason, the participants of this research were fully explained on the peer feedback procedures that they were required to undertake in the study.

In addition, the repeated measures in pre-, post-, and delayed tests design led to the special focus on students' writing performance. That said, any significant or non-significant changes in students' writing scores across the pre-, post-, and post-delayed tests must be attributed to the intervention of this study in order to generalize reliable and valid results. However, for the sake of ensuring the internal validity, some items were put under control, such as all the participants were freshmen in English major who had no relevant experience of using AWE or training by PBWA so that their academic writing performance was able to be reflected and evaluated only based on argumentative essays. Also, since all the participants were enrolled from three intact classes in a real setting, insufficient male participants led to the results of the current study to lack of generalizability. Finally, due to the non-normal distribution and violation of the homogeneity of variance of some data sets, the inference generalizability of the results of the current study may be influenced. In all, the results of this study were too limited to be generalized to all levels of Chinese English major students.

## **1.8 Constitutional and Operational Definitions of Key Terms**

Before reviewing the related literature in the next chapter, related key words of the study are defined constitutionally and operationally.

### **1.8.1 Writing Performance**

There are five basic predictors of writing performance, which are: grammar, vocabulary, content, organization, and mechanics. Based on Analytic Writing Traits (Jacobs et al., 1981), the quality of grammar is evaluated in terms of constructions, errors of agreement, the tense, number, word order/function, articles, pronouns, and prepositions; the quality of vocabulary is evaluated based on range, choice, form, usage, and meaning; the high quality of content should be knowledgeable, substantive, thorough development of the thesis and relevant to assigned topic; the quality of the organization is inspected based on expression, the statements of ideas, succinct, logic sequence, and cohesive; the quality of mechanics is examined in terms of conventions, spelling errors, punctuation, capitalization, paragraphing, as well as handwriting (due to the online writing environment, this element was not considered). In this study, the main dependent variable is the notion of writing performance, which would be translated into five aspects of writing qualities (i.e., grammar, vocabulary, content, organization, and mechanics) were evaluated as the main sub-dependent variables so as to find any improvement in writing performance between three groups of participants after different kinds of instruction.

#### **1.8.1.1 Grammar**

The first sub-dependent variable is the grammar component. Grammar refers to a system of sounds, words, sentences, and meaning of a language (Saengboon, 2017). EFL learners need to develop communicative competence by constructing a solid foundation



of grammatical competence, especially in writing. For the purpose of this research, when students submit their essay through the Pigai program, grammatical competence would be reflected and evaluated sentence by sentence automatically through demonstrating the error of basic grammar (i.e., parts of speech, tense, agreement, voice, and so on) and sophistication of sentence structure with complex and compound sentences. For example:

1. He is the teacher who speak English in our school.

In this sentence, the Pigai program would provide a hint to suggest “speak” needs to be corrected into “speaks”, interpreting it’s an agreement error simultaneously in the feedback area beside this sentence. So, the writer is lacking of grammatical knowledge in the aspect of agreement.

2. None can negative the importance of money.

Regarding automatic feedback of Pigai program, in this sentence, there is a grammatical error in the aspect of parts of speech. It would suggest the writer transfer “negative” into deny.

#### **1.8.1.2 Vocabulary**

The second sub-dependent variable is the vocabulary component. Vocabulary Learning is an essential part of mastering a second language (Schmitt, 2010). Previous studies have shown vocabulary knowledge is a strong predictor of writing quality (Albrechtsen, Haastrup, & Henriksen, 2008; Nation, 2001). That is to say, the quality of essays for EFL learners depends largely on their lexical quality (Fritz & Ruegg, 2013). In the case of this study, vocabulary performance will be presented by the Pigai program in terms of demonstrating the choice of vocabulary items, correct idiomatic use of vocabulary, correct collocation, and correct word form, to show to what extent the writer has achieved the goal. For example: *They use at least one hour to learn English knowledges a day.* Here, the system of the Pigai program would present feedback both on collocation suggestion and word form. In terms of collocation, the automated feedback would say “learn...knowledges” sounds weird to native speakers, the writer should pay attention to this expression way. As for word form, it would say “knowledges” is an uncounted noun, it has no plural form.

#### **1.8.1.3 Content**

The third sub-dependent variable is the content component. Content is defined as the development of and logical consistency between ideas or meanings (Freedman, 1979). The content of an engaging essay must have excellent support; be interesting to read; have unity and completeness and adhere to assignment parameters. It’s the most crucial indicator for the writer’s writing performance, being the specific target of writing that the other writing traits are thought of as the means for contribution (Bae, Bentler, & Lee,

2016).

In the case of this study, the automated feedback of the Pigai program in terms of content would only focus on testing the plagiarism, relevance between the content and the assignment. That's the limitation of this AWE program, without showing the specific feedback, however, it's also the main reason for the study why peer feedback and teacher feedback are essential. Especially for teachers, they can focus on feedback in the aspect of the content which saves their energy and makes their feedback more targeted and effective, when they use the Pigai program as a supplement tool to teach writing.

#### **1.8.1.4 Organization**

The fourth sub-dependent variable is the organization component. Boardman and Frydenberg (2008) have created a criterion for the organization of academic writing. It has two dimensions in a piece of writing. On one hand, it refers to paragraphing, including having a topic sentence with a clear controlling idea, having supporting sentences, having concluding sentence, and having coherence and cohesion. On the other hand, it also refers to the organization of an essay, involving having an introductory paragraph with a clear thesis statement, having body paragraphs with good organization, having a concluding paragraph, having coherence and cohesion.

In this study, according to the automated feedback of the Pigai program, the performance of the organization would also be presented in two aspects. In terms of the organization of the whole essay, automated comments will present the comments on the structure in a general way. Regarding the sentence level, the automated feedback would be provided in details sentence by sentence. For example: *Some victims lost money, some lost their lives justly because of making friends on the Internet.* The system of the Pigai program would suggest the writer to check whether a conjunction is needed in this sentence.

#### **1.8.1.5 Mechanics**

The fifth sub-dependent variable is the mechanics component. Boardman and Frydenberg (2008) have pointed, the mechanics of academic writing should include good paragraph format, demonstrating good control over use of capital letters, periods, commas, and semicolons, demonstrating control over spelling, not have fragments, comma splices, or run-on sentences. In this study, the AWE-Pigai program would provide the automated feedback on the use of punctuation and spelling forms. For example: in my family, there are two pets:a dog and a cat. In this sentence, automated feedback of the Pigai program would suggest the writer that there are errors in the aspect of mechanics, which need to be corrected. Also, it would provide the relevant knowledge in detail further: 1) a space comes after each punctuation mark; 2) the first letter at the beginning of the sentence should be capitalized.

## **1.8.2 Process-based Writing Approach**

Based on the Cognitive Constructivism Theory, the process-based writing approach was first put forward by Graves in 1978. He states that writing is not a linear but a recursive process, and he also stressed the importance to raise the awareness of the writer being an audience by peer review activity. By using think-aloud composing protocols to investigate learners' composing processes, Flower (1979) and Flower and Hayes (1980) extended their research findings to develop the theory into establishing a cognitive process writing theory model (Flower & Hayes, 1981) which focused on writer's mental development and problem-solving during the writing process.

In this current research, the process-based writing approach was adopted by the instructor in Experimental Group 1 and Experimental Group 2. That said, according to the process-based writing approach, the instructor should focus on the development of students' cognition which is evaluated through the performance of students' multiple writing drafts during the writing process, instead of just giving a summative assessment.

### **1.8.2.1 Task Environment**

According to Flower and Hayes (1981), the initial writing stage of the writing process the task environment consists of two sub-processes: the rhetorical problem and the written text. In the current study, the writing task environment refers to two different writing conditions, namely classroom-based writing environment in EG1 and Pigai-based writing environment in EG2. To be more specific, participants in EG1 received their writing task in the classroom, while those in EG2 needed to respond to their writing task which was posted by the teacher via the Pigai program.

### **1.8.2.2 Long-term Memory**

Long-term memory is the second main component of the process-based writing model which was proposed by Flower and Hayes (1981). It is associated with a writer's knowledge that can underpin a certain writing topic. In the current study, students in EG1 retrieve their writing knowledge that was stored both in their minds and relevant books, while students in EG2, compared their writing knowledge to those in EG1, their writing knowledge was also supported by the online resources via the Pigai program.

### **1.8.2.3 Composing Stage**

The main component of the cognitive writing model which was raised by Flower and Hayes (1981) is the composing stage. It consists of four cognitive sub-processes, i.e., planning, translating, reviewing, and the monitor. In the current study, students in EG1 finished their composing process in the classroom, including planning their ideas,



translating their thoughts, accepting and receiving peer feedback, and monitoring the processing of their composing stage; as for students in EG2, they sampled their whole composing stage via the Pigai program. They finished their drafts after each class.

### **1.8.3 Writing Feedback**

#### **1.8.3.1 Teacher Feedback**

Teachers' writing competence is more sophisticated than students. Thus, the students' writing competence cannot be improved without the teacher's scaffolding of the knowledge, as well as teacher corrective feedback being an essential part of the teaching process. However, the writing instruction must be individualized (Reid, 1993). In other words, teacher feedback is the diagnosis of students' writing, which makes the students notice their deficiencies in their writing performance respectively, in order to improve their writing competence effectively.

In this study, teacher corrective feedback would be given by written form and online form. Both in the control group and the experimental group 1, teacher corrective feedback would be presented in written form after students submitted their assignments on paper. In experimental group 2, teacher feedback would be given through the Pigai program online by replacing automated holistic comments with instructor's comments and providing corrective feedback of each sentence after each students' submission of the assignment. The teacher also can change the automated score to a new score. Students will receive the teacher's feedback automatically as soon as the teacher finishes the corrective task online. The process of students' learning cannot be without the guidance of teacher feedback. It's an important factor that can affect students' learning product profoundly. Thus, in this study, it's one of the independent variables.

#### **1.8.3.2 Peer Feedback**

Peer feedback is regarded as an effective tool for enhancing writing (Simmons, 2003). Fletcher and Portalupi believed through sharing students' writing drafts with their peers, it would arouse students' awareness of being an audience and enhance their sense of revision. In addition, students demonstrated advanced critical ability during the engagement in peer feedback activity (Moran & Greenburg, 2008).

In this study, classroom-based peer feedback was conducted in Experimental group 1. Before the treatment, students were trained how to provide peer feedback in terms of ESL Composition Profile adapted from Jacobs et al. (1981). And each quality of writing trait would be evaluated by 5-point Likert Scales in the light of these 5 writing traits listed in the ESL Composition Profile (i.e. grammar, content, vocabulary, organization, and mechanics). So, after the submission of each writing assignment, the instructor would divide the students into 15 groups to do peer feedback activity. Each group would

take turns to give peer feedback on another group anonymously and respectively. Finally, the teacher would collect all the ESL Composition Profiles and send back the feedback to each writer after such activity.

The treatment of Experimental group 1 would only focus on the effectiveness of classroom-based peer feedback on improving students' writing performance. Since classroom-based peer feedback is regarded as a vital factor that may impact students' learning effects, it's an independent variable in this research. Through peer feedback activity, the effectiveness of students' revision process would be expected to be improved and their awareness to be a quality writer would be expected to be aroused, so as to improve their writing performance finally.

### **1.8.3.3 Online Peer Feedback**

Not only time-consuming, but the implementation of the traditional peer feedback model also confronts hindrance from the perspective of social interaction, because students "from certain cultures may feel uncomfortable" (Rollinson, 2005, p. 26) when they provide critical comments to others. Hence, the emergence of digital technologies can help to alleviate these concerns by changing the face-to-face peer review to an online one (Choi, 2014). Therefore, the online peer feedback activity as one of the sub-IVs was carried out in Experimental group 2, consisting of providing and receiving sections.

To be more specific, on one hand, providing peer feedback was guided by a peer feedback card via the Pigai program. Namely, students were trained how to give peer feedback before the intervention at first. Then, during the treatment, each writing product was submitted online through the Pigai program. After the submission, students would receive automated feedback timely and they were required to revise their essay according to automated feedback. After the first round of revision, they began to do online peer feedback activity through the Pigai program. Each student received one essay to provide peer feedback randomly assigned by the system in each assignment. On the other hand, each student received online peer feedback via the Pigai program from their peers with a different font color to distinguish with system automated feedback. Again, the writer was asked to revise the essay in terms of online peer feedback. Finally, the teacher gave the corrective feedback through the Pigai program, such as giving analytic and holistic comments. The whole process of the use of the Pigai program is not a linear routine, but a recursive one. Especially, students can repeat the online peer feedback activity again and again when they were after the class. Thus, the successful implementation of high quality of online peer revisions may contribute to the improvement of students' writing performance. The treatment of the Experimental group 2 was involving the online peer feedback in an out-of-class model. The effectiveness of the online peer feedback on improving students writing performance were tested. Because the online peer feedback is regarded as a crucial factor that may impact students' learning effect, it's another independent variable in this research.

#### **1.8.4 AWE-Pigai Program**

Among various kinds of Chinese AWE systems, the Pigai program is the most widely implemented in writing classroom instruction in China. It was claimed on its web page <http://www.pigai.org/> that it was introduced to the market in 2011 as a commercial online assessment platform developed especially for Chinese EFL learners. Its design based on the application of Corpus Linguistic of a large scale of human-scored essay, Artificial Intelligence, Cloud technology, by making a comparison between learners' essays and the corpus through lexicon, sentence, organization, and content these four aspects, and after a certain algorithm, it will show the score and corrective feedback comments to the learners in split seconds after their writing is submitted. On the student's interface, students will receive the overall scores, comprehensive comments, comments for each sentence. In addition to completing the writing assignments published by the teacher, the student can carry out self-essay, participating in the essay Player Killing model, log in to the writing alliance, writing forums, and other independent self-learning activities. While, on the teacher's interface, except for publishing assignments, the teacher can receive the systematic diagnostic report on the students' writing performance, including score distribution, error analysis, dimensional analysis, and data comparison after the students' submission. What's more, the instructor also can recommend an excellent essay for students to appreciate.

In this study, the Pigai program is a facilitating instrument to improve participants' writing performance. Since the use of the Pigai program is not a linear activity, but a recursive process, it accommodates the cognitive process writing approach perfectly. It provides infinite practice opportunities for the writer, in order to improve learners' writing performance by engaging in practicing process-based writing. Thus, the Pigai program is thought of as an important factor to influence Chinese EFL learners writing competence. It's one of the independent variables in this study.

#### **1.9 Summary**

In this chapter, the researcher elaborately introduced the background of this study, presented the statement of the problems, illustrated the purpose of the current study individually, followed by research objectives, research questions, and research hypotheses. Also, the researcher highlighted the potential significance and acknowledged some limitations of the current research, as well as interpreted operational definitions of the terms that were treated as independent variables and the dependent variable of the current study. In the next chapter, the relevant literature review, theoretical and conceptual frameworks of the current study will be provided.

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