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具有聲調診斷與回饋機制之遊戲式華語學習系統對於促進發音成效之影響研究

The Effects of a Game-based Mandarin Learning System with Tone Diagnosis and Visualization Feedback Mechanism on Pronunciation Effectiveness

指導教授：陳志銘 博士

Adviser: Dr. Chih-Ming Chen

研究生：辛佳珈 撰

Author: Jia-Jia Xin

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摘要

華語是全球廣泛使用的語言之一，相較於其他語言而言，其獨特的聲調特性是以華語為第二語言學習者進行發音學習時的困難挑戰。在語言能力訓練中，「發音」是溝通表達的關鍵要素，然而目前並沒有結合電腦輔助發音訓練，以及數位遊戲式語言學習，並將其應用於華語學習之相關研究。綜合以上所述，本研究發展具「聲調診斷與回饋機制」之遊戲式華語學習系統，輔助華語為第二語言學習者在訓練發音時能獲得個人化即時診斷與回饋，並且透過比較自己與母語者的聲調輪廓方式來改善自己的華語發音，同時促進其華語聲調感知與發音成效，以及對於華語變調規則之理解。此外，探討學習者使用有無「聲調診斷與回饋機制」之遊戲式華語學習系統輔以學習時所經歷的學業情緒差異，並探討正負面情緒與華語發音成效之關聯性。最後，本研究進一步分析實驗組高低不同成效學習者在「遊戲行為」與「發音學習行為」的行為模式差異，以及其對於發音成效的影響。

本研究採用真實驗研究法，招募台灣大專院校母語非華語之國際學生，共計 14 名研究對象，並將其隨機分派為實驗組與控制組進行線上實驗。實驗組使用具有「聲調診斷與回饋機制」之遊戲式華語學習系統，控制組則使用不具「聲調診斷與回饋機制」之遊戲式華語學習系統輔以華語發音學習。實驗為期一個月，兩組學習者的系統教材皆相同，並且可自行決定每日上線時間與學習進度，藉以比較兩組在華語聲調感知成效、華語發音成效、科技接受度、學業情緒，以及學習行為之差異。另外，亦透過質性訪談分析了解兩組學習者的使用感想與建議，並將其歸納後提出教學實施與系統改善建議，以及未來研究方向。

研究結果顯示，使用具有「聲調診斷與回饋機制之遊戲式華語學習系統」較能有效提升華語聲調感知與華語發音成效，對於華語變調規則的理解亦有所助益。此外，實驗組的科技接受度略高於控制組，表示「聲調診斷與回饋機制」

兼具有用性及易用性。在學業情緒方面，兩組在學習過程中均有偏高的正面情緒體驗，負面情緒感受則偏低。其中實驗組的華語發音先備能力與羞愧、無望呈現高度負相關；華語後測成績與焦慮、羞愧，以及無望呈現高度負相關；而其發音進步幅度則與享受、自豪呈現高度正相關，並且與無趣呈現高度負相關。除此之外，實驗組高成效學習者使用「聲調診斷與回饋機制」之遊戲式華語學習系統輔以華語發音學習之預設詞彙學習次數與發音進步幅度呈現完全正相關，證明此一機制是提升華語發音成效的關鍵。最後，透過高成效學習者的學習行為模式可知，將「聲調診斷與回饋機制」搭配其他遊戲式學習功能輔以學習，不但可以增進持續使用此一系統學習之意願，並且可同時提升其華語發音成效。本研究發展之「聲調診斷與回饋機制之遊戲式華語學習系統」具有創新性與實用性，可有效支援個人化之華語發音自主學習。

關鍵詞：以華語為第二語言；電腦輔助發音訓練；數位遊戲式語言學習；聲調診斷與回饋機制；華語變調；華語聲調感知；華語發音學習；學業情緒；學習行為

Abstract

Mandarin Chinese is one of the most widely spoken languages in the world, and its unique tones pose a significant challenge for Chinese as a second language (CSL) learners. Pronunciation skills play a crucial role in language proficiency, but so far there is a lack of research combining Computer-Assisted Pronunciation Training (CAPT) and Digital Game-based Language Learning (DGBLL) to aid language pronunciation learning, specifically for Mandarin Chinese. Therefore, this study developed a Mandarin Tones Learning Game (MTLG) with a "Tone Diagnosing and Visualization Feedback Mechanism" to assist CSL learners in personalized and real-time feedback during pronunciation learning. The system enables learners to improve their pronunciation by comparing their pitch contours with those of the native speaker, hoping to enhance their Mandarin tones perception, Mandarin pronunciation performance, and Mandarin tone change rules. Additionally, this study also examines the differences in achievement emotions experienced by learners in different groups and investigates the correlations between positive/negative emotions and Mandarin pronunciation. Finally, the study analyzes the behavioral patterns of learners with different proficiency levels in the experimental group and the impact on "game behavior" and "pronunciation learning behavior" in relation to pronunciation performance.

This research adopts a true-experimental design, recruiting a total of 14 international students from universities in Taiwan whose native languages were not Mandarin Chinese to be research participants. Each participant was randomly assigned to the experimental and control group respectively using "MTLG with/without Tone Diagnosis and Visualization Feedback Mechanism" for an experiment that lasted for one month, with both groups using the same materials and having the flexibility to autonomously decide their daily online learning time and learning progress. This study compares the differences between the two groups regarding Mandarin tone perception, Mandarin pronunciation performance, technology acceptance, achievement emotions, and learning behaviors. The interview was conducted to gather participants' feedback and suggestions, which were analyzed to provide recommendations for teaching implementation, system improvement, and future research directions.

Based on the experimental results, the experimental group of learners was found to significantly enhance Mandarin tone perception, Mandarin pronunciation performance, and understanding of tone change rules, but not being found in the control group of learners. Besides, the experimental group of learners showed slightly higher levels of technology acceptance than the control group, indicating that the Tone Diagnosis and Visualization Feedback Mechanism is useful and user-friendly in aiding Mandarin pronunciation learning. In terms of achievement emotions, both groups experienced relatively high levels of positive emotions and relatively low levels of negative emotions during the learning process. Among the experimental group of learners, there was a strong negative correlation between prior knowledge and shame, hopelessness, as well as a strong negative correlation between post-test scores and anxiety, shame, and hopelessness. Furthermore, the improvement in Mandarin pronunciation was highly positively correlated with enjoyment and pride, while showing a strong negative correlation with boredom.

Moreover, among high-performing learners in the experimental group, the frequency of learning must-learn vocabulary words with the Tone Diagnosis Mechanism and the improvement in pronunciation showed a strong positive correlation, confirming the critical role of this mechanism in enhancing Mandarin pronunciation performance. The learning behavior patterns of high-performing learners revealed that combining the "Tone Diagnosis and Visualization Feedback mechanism" with other game-based learning features can improve the willingness to continue using the system and simultaneously enhance Mandarin pronunciation performance. Overall speaking, the “MTLG with Tone Diagnosis and Visualization Feedback Mechanism” developed in this study is innovative and practical, and can effectively support personalized and autonomous learning of Mandarin pronunciation.

Keywords: Chinese as a second language; Computer-Assisted Pronunciation Training; Digital Game-based Language Learning; Tone Diagnosis and Visualization Feedback Mechanism; Mandarin tone sandhi; Mandarin tone perception; Mandarin pronunciation performance; Achievement emotions; Learning behaviors