



國立臺灣師範大學  
National Taiwan Normal University

# Using Technology to Enhance Language Learning and Research: An Omniform Approach of Learning, Teaching, and Assessment of Chinese as a Second/Foreign Language

**Yao-Ting Sung**

Prof., Dept. of Educational Psychology and Counseling

Dean, Office of the Aim for the Top University  
National Taiwan Normal University

# Using Technology for the Teaching and Learning of Languages

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- The evolution of hardware in learning technology
  - Desktops
  - Laptops/Tablets
  - Handhelds
  - Wearables



# Using Technology for the Teaching and Learning of Languages

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- How effective are the technology-integrated learning and teaching?
- The effect of Integrating mobile devices with teaching and learning in languages: A meta-analysis





# The Meta analysis: Methods

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- Data resource: ERIC and ISI (SSCI) databases from year 1993 to 2013
- 51 quasi/experimental articles fit the criteria
- Experimental groups used mobile-device for learning/teaching, control groups used traditional learning/teaching (e.g., paper or desktops)



## Lessons learned (1)

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- Mobile-integrated teaching and learning are not necessarily effective
- Elaborated teaching/learning strategies should be included in the programs
- Teaching-oriented software is important
- Appropriate intervention time is critical
- Logistics is important for long intervention



## Lessons learned (2)

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We need more elaborate **strategies** for implementing CALL studies:

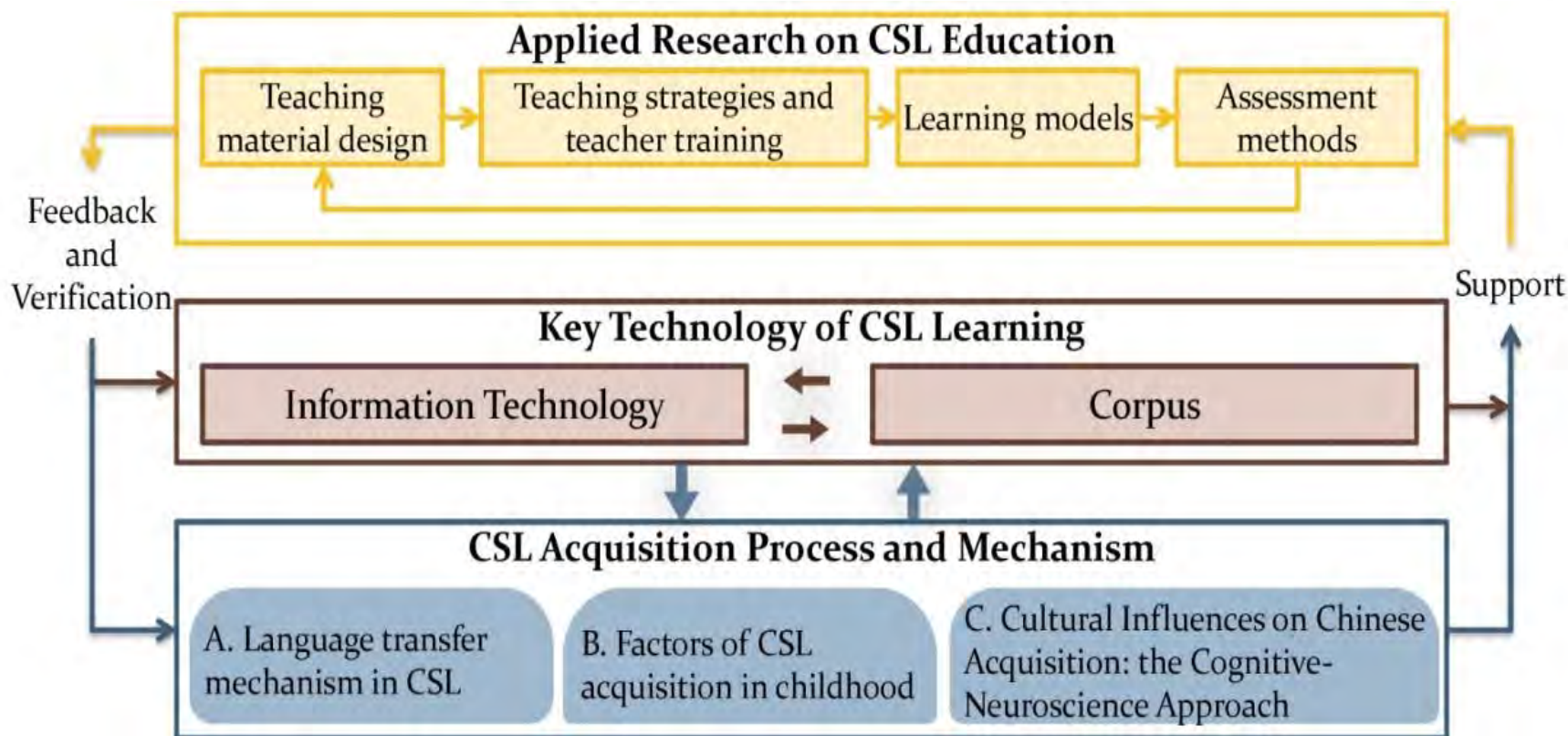
- To make CALL studies comprehensive
- To make CALL studies thorough
- To make CALL studies integrated
- To make CALL studies effective





# Framework of Technology-enhanced Chinese learning and Teaching

- OECD-T (Omniform Empowerment for Chinese Development through Technology)



## Achievement

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- Papers related with Chinese and learning technology, top 1 in Taiwan, top 5 in the world
- 2014 QS University ranking top 50 in linguistics worldwide





# Basic Research in CSL Acquisition

- Important findings of the research team include
  - There are systematic differences in the cognitive processing of CSL learners from Chinese native speakers (e.g. quantifier processing, relative clauses processing)
  - Bilinguals' native language processing doesn't not necessarily transfer to their CFL processing.
  - The average vocabulary quantity of CSL learners is roughly equal to the average vocabulary quantity of 2<sup>nd</sup> grades of native Chinese speakers.
  - Based on the neuro-image studies, the comprehension of Chinese humorous sentences involves a three-stage process

# Advanced information technology for language research and learning

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- **Speaking:** Speech recognition techniques based on innovative algorithms and mechanisms of speech perception and reproduction
- **Semantics:** Defining the conceptual difficulty of vocabulary through rule-based algorithms
- **Corpus:** Developing techniques for “Chinese word segmentation”, “Keywords Capture”, “Word co-occurrence analysis”, “Speech tagging”, “Syntax parsing”, and “Semantic category tagging”
- **Application:** CSL Automatic Speech Diagnosis System, Chinese Readability Indices Explorer (CRIE ), AES-Han, e Mandarin Platform of Words and Characters (eMPOWER)







# Corpus for Chinese languages- audio/video

- Movies, Music, Words, and Meaning combined into one, the Multimedia Corpus of Movies and Music
- Providing film clips, subtitles, full scripts, and an online dictionary integrated into a single function
- Learners can see words appear on the screen as they are being spoken, replay segments, and simultaneously click on any word to have the meaning displayed
- At any time, learners could choose to repeat any part which you want to listen





# Corpus for Chinese languages-speech

- Chinese Learner Spoken Corpus
- <http://140.122.110.34/mp3c/>
- The 770 thousand word corpus comprises Taiwan's first Corpus of Speech of Chinese Learners
- The speech was transcribed into a text file so that users can read the text and listen to the recording online

## 華語為第二語口語語料庫

國立臺灣師範大學於2011年起接受中華民國教育部補助「邁向頂尖大學計畫」，建構華語學習者中介語語料庫。華語中介語口語語料庫現階段以生語料庫的形式進行建置，由國家華語測驗委員會提供2008年起參加「國家華語測驗(TOP)」口語文能力測驗的考生口語語音檔。華語測驗的受試者分為基礎級與進階級兩個等級，本語料庫現階段以英、日、韓三個語言為母語的學習者語料為主，且主要收錄進階級語料，日後將加入高階級語料。目前已完成450人次，約77萬3千字的語料庫。

可輸入單字或短語檢索其使用情形：

語料庫


母語

排序方式  左方  右方



# Corpus for Chinese languages-written texts

- A three million word database built upon the writings of learners across varying levels and over 40 different mother tongues
- A comparison between NTNU Corpora of Chinese Learners' Compositions and Corpus of HSK Compositions

	 <b>NTNU Learner Corpus of Written Chinese</b>	<b>HSK Dynamic Composition Corpus</b>
Quantity	3 million characters	about 10 million characters ✓
Errors already marked	yes	yes
Learners' native language can be selected	yes ✓	yes ✓
Writing level can be selected	yes ✓	yes ✓
Corpus source	paper & electronic versions ✓	paper version
Traditional or simplified characters can be selected	yes ✓	no
Test type can be selected	yes ✓	no
Composition topics can be selected	yes ✓	no
Keywords can be used to search	yes ✓	no
Context of keywords is shown	yes ✓	no



# Corpus for Chinese languages-written texts

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- Chinese learner Written Corpus
- <http://kitty.2y.idv.tw/~hjchen/cwrite-mtc/main.cgi>
- Conducted research on the common errors of Chinese learners as well as analyzed usage of synonyms and sentence structures



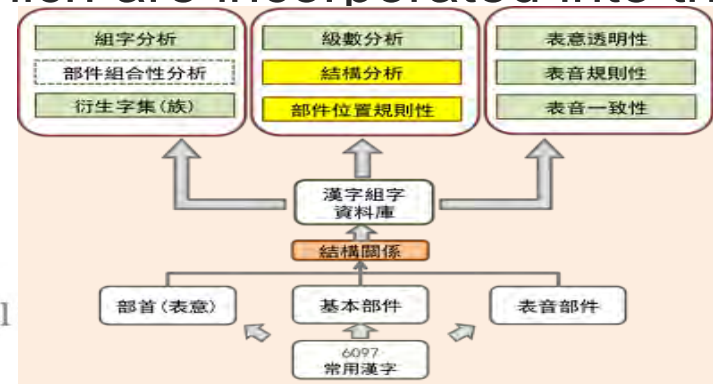


母語	來源	文體	功能	類別	級分	CEFR LEVEL	
[全選]	[全選]	[全選]	[全選]	[全選]	[全選]	[全選]	
土耳其 中 日本 巴西 比利時 巴拉圭 巴拿馬 尼加拉瓜 以色列 瓜地馬拉 布吉納法索	紙本	信件 記敘文 論說文 應用文	表達意見與說明 表達感謝之意或祈求 問候近況 描述	作業	2 3 4 5 6 7 8 9	A2 B1 B2 C1 C2	
查詢詞彙		詞性	不考慮	排序	後面詞排序	每頁筆數	十筆

查詢


# Database for orthographic rules of Chinese characters

- The Most Comprehensive and Smart Database For Rules on Chinese Character Formation
  - Including three components: radicals, character roots, and stroke order
  - Building a way of systematically displaying character formulation patterns, including both simplified and traditional characters
- Built-in categories that allow learners to compare and contrast various categories of traditional/simplified characters
  - Including nested words, character formation ratios, frequency, and differences between consistency and transparency of transliterations
- Design models for handwriting Chinese characters, as well as diagnostics and feedback, both of which are incorporated into the learning platform



# CSL Automatic Speech Diagnosis System

- Integrating empirical studies such as acoustic characteristics, speech acquisition mechanisms, assessment theories, and teaching strategies
- Compared to Nuance and MyCT

	 NTNU Chinese Listening & Speaking	MyCT Chinese communication	Nuance
Software background	Combined with Speaking Automatic Diagnostics software which developed by NTNU	The only one developed by Taiwan	World's most widely-used (multiple language) speech recognition software
Development goal(s)	Teaching and Testing ✓	Teaching	Voice Transcription
Language unit	character, word	phrase	character to paragraph
Recognition level	pronunciation, tones	pronunciation, tones, fluency & volume	unclear comparison
Feedback mechanism	comprehensive pronunciation ability test ✓	Single question pronunciation feedback	none





# Chinese Readability Indices Explorer

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- Quantitative analysis for multilevel linguistic features: words, syntax, semantics, cohesion
- Can be applied to textbook classification, assessment, compilation and editing
- Text leveling for eBooks, websites, CFL text books etc.
- Diagnosis of the linguistic features (syntax and word-difficulty levels) in texts





# Chinese Readability Indices Explorer (CRIE)

- <http://www.chinesereadability.net/CRIE/>
- Comparison between CRIE 2.0 and Coh-Metrix 3.0

	 CRIE 2.0	Coh-Metrix 3.0
Number of features analyzed	79	108 ✓
Features can be selected	yes ✓	no
Diagnostic feature function	yes ✓	no
Has multiple essay analysis	yes ✓	no
Readability formula calculation	yes	yes
Readability model types	non-linear, linear ✓	linear
Readability analysis available for online compositions	yes ✓	no

# CRIE—Homepage



文本可讀性指標自動化分析系統  
Chinese Readability Index Explorer

## 文本可讀性指標自動化分析系統2.0

Chinese Readability Index Explorer, CRIE 2.0

### 可讀性研究團隊

#### 心理組

陳茹玲、林維駿、吳銘達

#### 語言組

查日猷、杜齊羽、洪嘉麒

#### 育工組

李宜憲、曾厚強

#### 程式組

謝冠生、李廷敏

帳號： 密碼： | [註冊會員](#) | [忘記密碼](#) | [操作範例](#) |

請選擇登入系統：

English

### CRIE 文本對象的母語為中文

分析的文本是給中文為母語的讀者使用  
Analysis of texts written for native Chinese readers

### CRIE - CFL 文本對象的母語非中文

分析的文本是給中文為外語的讀者使用  
Analysis of texts written for learners of Chinese

### CRIE - DK 領域知識文本分析

### 中文斷詞與句法剖析服務



國立臺灣師範大學  
National Taiwan Normal University

【主持人】宋麗廷 教授 【共同主持人】張道行 教授  
【系統維護】謝冠生 E-mail : elearning.ntnu@gmail.com

引用本網站：

1. Sung, Y.-T., Chang, T.H., Chen, J.-L., Cha, J.-H., Huang, C.-H., Hu, M.-K., & Hsu, F.-Y. (2011, July). The construction of Chinese Readability Index Explorer and the analysis of text readability. Paper presented at 21th Annual Meeting of Society for Text and Discourse Process, Poitiers, France.
2. 宋麗廷、陳茹玲、李宜憲、查日猷、曾厚強、林維駿、張道行、張國恩 (2013)。中文文本可讀性探討：指標選取、模型建立與效度驗證。《中華心理學刊》，55 (1)，75-106。
3. Chen, J. L., Cha, J. H., Chang, T. H., Sung, Y. T., & Hsieh, K. S. (2012, Nov). CRIE: A tool for analyzing Chinese text characteristics. Paper presented at 42nd Annual Meeting of the Society for Computers in Psychology (SCiP 2012). Minnesota, USA.



# Automated Chinese Essay Scoring — AES-Han

- The composition analytics and feedback system for CFL learners
- Comparison between the composition analytics and feedback systems of AES-Han and AES-ETS

	 AES-Han	AES-ETS
Language	Chinese ✓	English
Rating features	vocabulary, content, grammar, structure & organization all equally weighted ✓	Grammar is weighted most heavily
Quantity of documents required for training	few ✓	numerous
Score accuracy rate	high	high
Teaching feedback applications	yes	yes
Nonsensical text detection	multi-level detection ✓	single-level detection

# eMandarin Platform of Words and Characters (eMPOWER)

- <http://empower.ecloud.ntnu.edu.tw/empower/Default.aspx>
- Digital learning platform
  - Theory-based CFL textbook
  - Learning-strategies embedded
  - Simultaneously learning listening, speaking, reading, writing
  - Real time feedback
  - App for anytime, anywhere





# e MPOWER—Homepage



首 頁  
Home

自 學 模 式  
Self-Study

瀏 覽 模 式  
Browse mode

sam

## 第一課 這是我的家人 Lesson 1 These Are My Family Members



## 第一課 這是我的家人 Lesson 1 These Are My Family Members

安娜娜：如娟，這是你媽媽嗎？

Ān Nàna: Rújuān, zhè shì nǐ māma ma?

姜如娟：不是，這是我外婆。

Jiāng Rújuān: Búshì, zhè shì wǒ wàipó.

安娜娜：那女孩是你的姑姑嗎？

Ān Nàna: Nà nǚhái shì nǐ de gūgu ma?

姜如娟：她是我媽媽的姐妹，我叫阿姨。

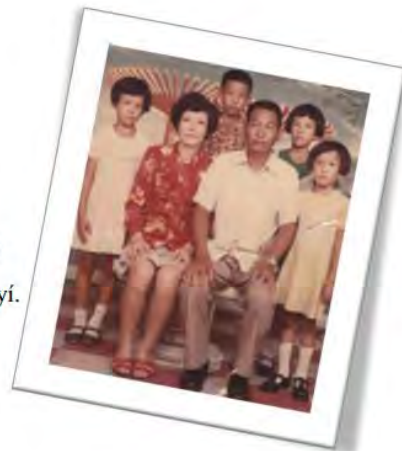
Jiāng Rújuān: Tā shì wǒ māma de jiěmèi, wǒ jiào āyí.

安娜娜：這是你媽媽的爸爸嗎？

Ān Nàna: Zhè shì nǐ māma de bàba ma?

姜如娟：是，他是我外公。

Jiāng Rújuān: Shì, tā shì wǒ wàigōng.



# e MPOWER —learning characters & words

The screenshot shows the eMPOWER website interface. At the top left is the logo "eMPOWER" with the tagline "e-Mandarin Platform of Words and Characters" and "華語文全字詞教學平台". Navigation links include "首頁 Home", "自學模式 Self-Study", and "測驗模式 Practice Mode". A user profile "sam" is visible in the top right. The main content area is titled "第一課 這是我的家人 Lesson 1 These Are My Family Members". Below this is a navigation bar with five icons: "回到主頁 Home", "認識字詞 Characters & Words" (circled in red), "對話與課文 Dialogue & Text", "句型練習 Sentence", and "自我評量 test". The main content area is divided into three sections: "Radical characters" (部件) with the characters "女 父", "Character-Family" (字族) with "女: 奶她如安妹姑姐姓姜姨娜娟婆媽" and "父: 爸 爺", and "Others characters" (其它字) with "家人這是你嗎不我外那孩的叫阿他公也".

# E MPOWER —dialogue & texts

## 第一課 這是我的家人 Lesson 1 These Are My Family Members



回到主頁  
Home



認識字詞  
Characters & Words



對話與課文  
Dialogue & Text



句型練習  
Sentence



自我評量  
test

1. 全聽 >

2. 聽讀 >

3. 跟念 >

4. 重聽 >



00:00



01:45



# e MPOWER —sentences



首頁  
Home

自學模式  
Self-Study

測驗模式  
Assess Mode

sam

## 第一課 這是我的家人 Lesson 1 These Are My Family Members



回到主頁  
Home



認識字詞  
Characters & Words



對話與課文  
Dialogue & Text



句型練習  
Sentence



自我評量  
test

一、是

二、不

三、嗎

四、的

五、也

一、是

我是姜如嫻。

我是\_\_\_\_\_。 {美國人}

我是\_\_\_\_\_。 {英國人}

我是\_\_\_\_\_。 {安娜娜}

我是安娜娜。

\_\_\_是安娜娜。 {你}

\_\_\_是安娜娜。 {她}

她是我媽媽的姐妹，我叫她 阿嫻。

她是我爸爸的姐妹，我叫\_\_\_\_\_。 {她 姑姑}

他是我媽媽的爸爸，我叫\_\_\_\_\_。 {他 外公}

她是我媽媽的媽媽，我叫\_\_\_\_\_。 {她 外婆}

他是我爸爸的爸爸，我叫\_\_\_\_\_。 {他 爺爺}

他是我爸爸的媽媽，我叫\_\_\_\_\_。 {她 奶奶}

我姓姜，我叫姜如嫻。

我姓\_\_\_，我叫\_\_\_\_\_。 {安 安娜娜}

# Learning for communication and interaction

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- 3D Online Virtual Environment Second Life (SL)



# Superior-multimedia, multilevel, multinational —CSL Teaching Materials

- **初級華語學習詞典**: The first sentence-based book globally, the first promotion overseas
- **Chinese CUBES**: iF Communication Design Award
  - The first award in character materials globally
- **Hello·華語**: The maximum sales in Chinese material for children globally





# Innovative hardware—EyeNTNU-180

- Natural Light Eye Tracker & Low-cost Eye Tracker
- Innovative Eye Movement Detection Technology
- The first eye tracking system that does not rely on infrared light

	 EyeNTNU-180	Tobii X120	Tobii TX300
Price	less than NT 150,000 ✓	NT 750,000	NT 1,500,000
Sampling frequency	180Hz	120Hz	300Hz ✓
Angle of error	0.3 degrees ✓	0.5 degrees	0.5 degrees
Quantity of infrared LED	2 W/st ✓	60 W/st	60 W/st
Tester's head can move	no	yes ✓	yes ✓
Has hardware and software technologies	yes ✓	no	no
Customized software can be developed	yes ✓	no	no

# Feature Productions-System Design

- EyeNTNU180
  - A parity and competitive eye tracker in the world





# Global Network of Chinese Learning

UK, Lancaster  
UK, Leeds  
UK, Cambridge

UH, Germany  
MU, Czech

Peking University

Waseda, Japan  
TUFS, Japan

NTNU



CUHK, H.K.  
PolyU, H.K.  
NTU, Singapore

Monash University  
Griffith University

Canterbury

Simon Fraser

Illinois CMU  
Ohio

PSU  
UP ETS

Maryland



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Thanks for your attention !

Yao-Ting SUNG  
[sungtc@ntnu.edu.tw](mailto:sungtc@ntnu.edu.tw)

