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A Technology-Supported Learning Experience to Facilitate Chinese Character Acquisition

Xianquan Liu and Justin Olmanson, Ph.D.

Abstract

Chinese character Learning has been identified as one of the most challenging issues for English-speaking learners of Chinese due to the distinctions between the Chinese writing system and alphabetic languages in terms of orthography, phonology and semantics. In order to support Western students in overcoming the challenges associated with Chinese character learning a contextualized, socio-cultural approach to character learning was designed. Aimed at novice learners of Chinese, this design draws on social constructivism and Universal Design for Learning--contextualizing the learning experience and affording students to work on acquiring characters via several distinct avenues. The project-based inquiry design supports the exploration of Chinese character learning through six research-based learning tools and strategies. These tools include: educational technologies designed specifically for learning Chinese

characters, pinyin & typing, making connections between different levels of linguistic components, stroke animation, handwriting, radical positioning, and character gamification. This learning experience design integrates multiple technology tools, awareness of culture, hands-on activities, and interactive multimodal web technologies that draw on constructivist theories and approaches to language acquisition.

Keywords: Chinese character learning, social constructivist, Universal Design for Learning, Technology Integration, literacy, language acquisition, writing

Introduction

Chinese as a second language has been identified as a challenging undertaking for native English-speaking learners due to its unique properties that drastically differ from English in terms of phonology, morphology, orthography and phraseology (Shei & Hsieh, 2012). In Shei and Hsieh's research, 50% of participants experienced both morphologic and orthographic difficulties closely associated with character learning. The percentage of students reporting difficulties associated with character learning was particularly high in comparison with other difficulties associated with learning Chinese (Shei & Hsieh, 2012). Chinese character learning has become a vigorously researched topic in recent years. Most researchers have focused on improving the learning experience by optimizing presentation and by presenting Chinese characters to learners via technology applications (Chen et al., 2014; Chen, Wang, Chen, & Chen, 2014; Lam, 2014; Lu, Meng & Tam, 2014; Shei & Hsieh, 2012; Taft, M., Zhu, X., & Peng, D. 1999; Wong, Hsu, Sun, & Boticki, 2013; Yan, Fan, Di, Havlin, & Wu, 2013). However, little attention has been paid to investigating pedagogical perspectives regarding the integration of multiple contextually authentic character-learning experiences.

The Chinese character learning experience design described herein was borne out of a three-part inquiry. Namely, a survey of the existing literature on Chinese character learning—used to identify research-based scaffolds for Chinese character learning, a survey of existing language materials and educational technologies associated with those scaffolds—used to develop a resource pool, and a review of teaching and learning theories

and instructional design theories—used to design a pedagogical framework for the learning experience. A five-phase learning experience design is developed based on the mentioned preparation, and the five phases includes differentiated inquiry-based collaborative learning; collaborative e-portfolio project creation; peer review and revision; presentation and celebration; and reflection and evaluation. The identified research-based scaffolds are used to set up six stations in the phase one in order to provide differentiated instructions of character knowledge with technologies supporting respectively.

In the following sections, we outline the surveys of literature, materials, and learning theories, we describe the resultant learning experience design, and we unpack the implications such designs can have for learners of Chinese who have no prior experience with character-based literacy.

Chinese Language Learning

Chinese Characters, an Overview

As mentioned above, Chinese characters have been identified as one of the biggest challenges to learning Chinese (Shei & Hsieh, 2012). Three major challenges have been identified in Chinese character learning (Lu, Meng & Tam, 2014). The first challenge is the development of awareness of the structural makeup of characters. A Chinese written character has three tiers: strokes--the basic lines that make up the writing system; radical components--the character parts made of different combinations of strokes; and characters--the smallest meaningful units in the Chinese writing system (Wong et al., 2013). There are eight basic radicals (Lu, Meng & Tam, 2014) that generate 44 additional radical shapes, 439 chunks, and 7000 frequently used characters (Chang, Xu, Perfetti, Zhang, & Chen, 2014) following respective relational rules.

Challenges for American and Western Learners

Native speakers of alphabetic languages typically experience difficulties in comprehending and recognizing the structural rules and cues embedded in characters due to the dramatic difference in orthography. Additionally, producing characters by hand requires learners to execute the correct

stroke order, which is very challenging as well. Stroke order in Chinese character writing is considered a key to character recognition. Moreover, Western learners of Chinese often find it challenging to make connections between characters and pronunciation due to the lack of an explicit sound-symbol relationship between characters and their pronunciation. Finally, homophones (words written using the same character but different meanings) and homographs (words written with different characters but pronounced the same) (O'Grady, Archibald, Aronoff & Rees-Miller, 2010) are common in Chinese--further complicating Chinese character learning.

Elements to Facilitate Character Learning

In order to support students in overcoming the multiple challenges involved in the process of learning Chinese characters, government, language educators, and researchers have worked to develop and investigate the efficacy of a range of elements that support Chinese character learning (see Table 1).

Where there are a range of supports for developing literacy in the Chinese writing system, there is no consensus as to which approaches are the most efficacious facilitators of character learning. Many of these approaches and scaffolds overlap. For example, Pinyin, making connections, and gaming could all be combined within a technology application to support and engage students to learn (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005, Wong et al., 2013). In the next paragraph the use of Pinyin is discussed.

Pinyin is the phonetic system developed by the Chinese government in 1958 for transcribing Mandarin into the pronunciation system of the Latin syllabary. Pinyin is widely used in Chinese education and it is also used as one of the many input methods to enter Chinese characters into digital mediums. Pinyin is not an official way to write the Chinese language, rather it is the first way most students of Chinese are taught to write and read spoken Chinese. Pinyin spelling is different from character writing, thus, learning Chinese means that learners need to first learn pinyin and then learn how to write characters.

Figure 1 (See Appendix A) created by Taft, Zhu, and Peng (1999) illustrates a complicated multilevel activation framework for conceptualizing the Chinese phrase 现代 (xiàndài, 'modern'). To read this phrase students need to make connections between characters, meaning and

Table 1. Chinese Character Learning Strategies and Supports Culled from the Existing Literature

Chinese Learning Facilitators	Description
Character-specific technology	Facilitate Chinese character learning by implementing multimodal technologies specifically designed for Chinese characters (Wong et al., 2013, Lu, Meng & Tam, 2014)
Pinyin & Typing	Pinyin is a popular precursor to character learning (described later in this section) and is used as the primary input method for creating characters within digital mediums pinyin helps students to combine phonetics and writing system (Chung, 2003, Chang et al., 2014, Guan, Liu, Chan, Ye, & Perfetti, 2011)
Making Language Connections Explicit	Making explicit connections between different Chinese linguistic components during learning and teaching episodes creates the concept of "continuity" in Chinese language—referring to the close relationships and interactions between phonology, morphology, orthography, vocabulary, and phraseology in Chinese (Shei & Hsieh, 2012, Wong et al., 2013, Guan, et al, 2014)
Stroke Animation	Modeling stroke production with voiceover—in order to elicit better performance in character writing (Chen et al., 2014, Chang et al., 2014)
Handwriting	Integrating handwriting practice meant to produce a refinement of visual-spatial understanding—character recognition as well as the strengthening of sensory-motor memory via the act of physical writing (Guan et al., 2011)
Gamification and Serious Games	Leveraging game-like elements to motivate students to engage and persist in Chinese character learning—from traditional Chinese games to devise-based games to character training games adapted for the general language classroom (Hao, Hong, Hwang, Su & Yang, 2010; Lai,Leung, Hu, Tang & Xu, 2010)

pronunciation. To write this phrase, students have to additionally identify the different radicals and the different strokes and stroke order that make up each character. Finally, students need to understand how to combine characters to make words and phrases.

Theoretical Framework

Social constructivism, UDL, and participatory design form the framework for this learning experience design. Specifically, this design is a social constructivist application of Universal Design for Learning (USD) (Edyburn & Gardner, 2009). UDL is an approach designed to support a wide range of learners within individual and collaborative learning settings. It does this by creating multiple pathways to and through content—allowing learners to make their own choices regarding which pathways they follow and what types of artifacts they create as a result of their learning and to demonstrate their understanding.

Participatory design principles were also used in the design of this learning experience. Participatory design approaches seek to ensure ongoing dialogue among designers, classroom teachers and language learners to facilitate design modifications based on classroom dynamics and learner needs.

Social/Cultural Constructivism

According to Vygotsky, learners construct knowledge during interaction with peers or "more knowledgeable others" this constitutes a unique zone of Proximal Development [ZPD]. Social/Cultural Constructivism includes three ontologies: the subjective (internal) reality, the objective reality (external) and the contextual reality (intersubjective). This means learners make meaning in three corresponding ways, based on their senses, rationally via their logic and thinking, and collaboratively through interactions with others (Porcaro, 2011). The corresponding pedagogical strategies related to the three ontologies mentioned above feature prominently in the creation of individual and group meaning via a variety of collaborative hands-on tasks in authentic contexts (Porcaro, 2011). The learning experience design described herein seeks to promote low anxiety, collaborative learning opportunities that allow students to negotiate meaning and

co-construct knowledge with their peers and more knowledgeable others along a variety of pathways.

Universal Design for Learning

Universal Design for Learning (UDL) was initiated by David Rose, Anne Meyer and colleagues at CAST (Center for Applied Special Technology). It aimed to use contemporary understanding about human neurology and learning in the design of learning experiences for students with disabilities in general classrooms (Edyburn & Gardner, 2009). In order to meet specific needs of students with disabilities, UDL emphasizes the principle of understanding student needs neurologically. In considering the receptive, cognitive, and affective differences students categorized as disabled have in comparison with neurotypical students UDL scaffolds the creation of multiple accessible pathways and outputs into, through, and beyond the instructional goals. Universal Design for Learning advocates multiple means of representation of knowledge, multiple means of expressions for students to demonstrate their learning and multiple means for student engagement (Chita, Gravel, Serpa, & Rose, 2011/2012; Edyburn & Gardner, 2009, Hitchcock, Meyer, Rose & Jackson 2002). This mandate for multiplicity is organized by an awareness of the needs of learners with unique physical and neurological capacities to process and interact based on their receptive (visual, aural, tactile…), cognitive (executive function and reasoning), and affective (emotions and empathy) makeup.

In the design described in the next section, the spirit of UDL is used as one of the guiding frameworks in the design of this constellation of character-learning interventions.

Participatory Design

Participatory design involves soliciting user feedback throughout the design process as well as in the planning and integration stages (Könings, van Zundert, Brand-Gruwel, & van Merriënboer, 2007). Participatory design seeks: to address the needs of all parties involved; to illuminate the possibilities to improve for both designers and users; to promote a collective generation of ideas through dynamic project management. Participatory design also generates autonomy and ownership in not only designers

but also participants (Könings et al., 2007). Participatory design seeks to ensure that there is ongoing dialogue between the designer, classroom teacher (facilitator), and students in order to make adequate adjustments to meet the specific able to make decisions about their own learning experience--since they are granted the freedom to choose how to learn character knowledge; how and when to participate in chosen activities within their selected or assigned learning approach; and how to present, perform, or demonstrate what they have learned in the way they prefer. Teachers are invited to make decisions in facilitating and directing students as well--since they are most likely best positioned to make informed student-specific pedagogical decisions.

Learning Experience Design

Background of the Design

As stated earlier, Chinese character learning has been identified as one of the biggest challenges for western learners of Chinese. This intervention is intended to facilitate Chinese character learning for 7-12 graders who have learned pinyin yet have not had any systematic character-learning experiences. At this point, novice-low level Chinese learners have been only passively exposed to characters. The learning experience design described below aims to facilitate a multifaceted technology-supported collaborative learning experience with six research-based Chinese character-learning activities embedded in the thematic narrative context of Chinese New Year.

Objectives of the Design

In order to support learning in this character exploration experience, the objectives of this narrative-based multifaceted social constructivist learning experience design are listed below in Table 2.

A Brief Overview of the Design

This five-phase Chinese character learning experience unit or curriculum is based on notions of inquiry-based collaborative learning,

Table 2. Objectives of the Learning Experience Design

Objectives	Ways to achieve in the Design
Create a learning environment with a low-affective filter	a. Learners are working individually or in a group at their own pace b. Teachers monitor the classroom and provide individual help
Motivate students with engaging and meaningful inquiry-based projects	a. Students are assigned to work in groups of six to learn Chinese characters presented in unique ways at several learning stations b. Students at learning stations engage in tasks that support inquiry and exploration, for example, one task asks students to find out the evolutionary history of Chinese characters, another assigns learners to find out rules of stroke order
Contextualize character exploration within authentic culture and language-related tasks	Chinese New Year serves as the overarching theme or throughline for the learning experience
Integrate character exploration in developmentally appropriate ways	Materials are adjusted based on student language proficiency
Differentiate learning experiences based on students' preference	a. Different options in terms of representation of knowledge, learning activities, and means of demonstration of knowledge are provided for students b. Students are able to plan their own explorations —with support from both teachers and peers
Encourage collaborative learning while supporting individual growth	a. Students work in collaboration with peers b. Activities are structured to ensure positive interdependence, individual accountability, equal participation, and simultaneous interaction

Table 2. Objectives of the Learning Experience Design *(continued)*

Objectives	Ways to achieve in the Design
Strive for different forms of peer interaction	a. Character recognition tasks provide opportunities for students to practice interpretive reading b. Group discussion elicits interpersonal communication c. Individual presentation and group presentation require students to practice presentational communication
Teachers included as co-designers to adapt the design to their classroom	Teachers are invited to make decisions based on student language proficiency and class culture.
Adjust learning design based on cross-group observation and communication of needs as well as reflection on classroom dynamics	There are ongoing conversations between designers, teachers, and students in order to respond to student needs

technology-supported portfolio building, iterative drafts and formative peer evaluations, performances of understanding and knowledge celebration, and reflective summative feedback. The five phases are listed in Table 3.

Table 3. Fives phases of the present learning experience design

Order of Phases	Name of Phases
Phase one	Differentiated Inquiry-based Collaborative Learning
Phase two	Collaborative E-portfolio Project
Phase three	Peer review and revision
Phase four	Presentation, feedback and celebration
Phase five	Reflection and Improvement

As stated earlier, characters are presented in unique ways at six different learning stations in phase one. Learners are assigned to a particular station but are also encouraged to explore one or two additional stations if they have time. At each station, students are provided with differentiated ways to participate in the learning process. For example at the calligraphy practice station students do calligraphy while others do paper cutting and still others explore character games. Finally, students are able to choose different ways and different technologies to demonstrate and share their knowledge with their peers. For example, students can create a traditional poster, make a booklet, or use iPad apps to craft their project as long as their resultant artifacts align with the requirements of the station as outlined in the rubrics co-created by the teacher.

Roles and responsibilities

Role of the teachers. While the general idea for each learning station was designed beforehand, teachers are co-designers of the learning experience. Since all the learning stations are situated in the classroom, the teachers in charge in each classroom has an opportunity to work in concert with the designer in order make adjustment to the stations in order to best serve their specific students' needs and interests. Additionally, to ensure engagement and ownership participatory design principles have been implemented in order to ensure ongoing communication between learners, teachers and designers.

Role of the students. Students are co-constructors of knowledge in collaborative learning with the six research-based character-learning stations. Students are offered the opportunity to participate in the design and are invited to engage in democratic conversation with teachers to provide feedback to improve current and future versions of the curriculum.

Technology-Supported Intervention to Facilitate Chinese Character-Learning

The narrative-based multifaceted social constructivist Chinese character learning experience can be divided into five phases: differentiated inquiry-based collaborative learning; collaborative e-portfolio project creation; peer review and revision; presentation and celebration; and reflection and evaluation (for an illustration of the entire process, see Appendix B).

Phase One: Differentiated Inquiry-based Collaborative Learning. As mentioned above, the character learning experience is contextual and integrated into curriculum, and is introduced via the Chinese New Year story. With the Chinese New Year theme serving as the context, six learning stations are used to facilitate student character learning (see Table 4).

In phase one learners first read the Chinese New Year story as a class, new words are introduced in pinyin accompanied with character presentations for the most frequently used words. Learners are assigned to groups of five to explore characters from the Chinese New Year story perspective based on the tools and activities at their station. In experiencing multiple stations and by talking with other students, learners are exposed to multiple representations of knowledge about the same characters (Porcaro, 2011 Chita, Gravel, Serpa, & Rose, 2011/2012).

Table 4. Overview of Six Chinese Character Learning Stations

Stations	Approaches	Tools/ Technologies
Character evolution	Connections / technology/ (culture)	Video clips, presentational technology (e.g. spark video, show me, sock poppet, PPT, prezi, etc)
Animation of characters	Stroke animation/ technology	Online website, character training apps (monki Chinese classroom, Fun Chinese, etc.), presentational technologies (spark video, show me, sock puppet, pic collage, and etc.)
Calligraphy Practice	Handwriting (culture)	Brush, paper, ink, calligraphy apps
Typing Practice	Pinyin & Character Input technology	Interpersonal communication technology (wechat, instagram, groupme, twitter, etc), presentational technologies (same as above)
Radical and character games	Gaming/ technology	Character game app (Chinese writer, quizlet, etc.), character flashcards, Chinese character board game, presentational technologies (same as above)

Instructions, learning materials and project ideas for each learning station are developed ahead of time based on the characters from the story. Students are assigned the group roles of leader, coordinator, monitor, questioner, recorder to ensure all participants have a specific responsibility within the learning task and to promote equal participation and simultaneous interaction for learner engagement (Kagan, 1994, Chita, Gravel, Serpa, & Rose, 2011/2012)—such structures maximize productive learning in small groups (Kagan, 1994, Novodvorsky & Weinstein, 2014). Teachers circulate to facilitate, assist, encourage, prod, question, and to ensure student involvement (Novodvorsky & Weinstein, 2014). At the end of the exploration, students are to create an individual representation or project about the content they have learned and how they learned it at their experience at each specific station.

Phase Two: Collaborative E-portfolio Project. Students return to their home groups of six with one member from each serving as an expert representing each learning station to share his or her learning experience and project. Rubrics are provided to guide students in peer evaluation and self-evaluation of their projects.

Next, students work in groups to conduct a web-quest to identify:

A. More information about all the six learning approaches
B. Additional Chinese character learning strategies,
C. The history of Chinese characters,
D. Add more examples for materials that have been used in each learning station.

Finally a culminating e-portfolio developed as a summative project. Students are required to work together to build e-portfolios on the topic of Chinese character learning with the knowledge they gained from their previous learning experience and the web quest. The e-portfolio also serves as a collaborative learning space enabling cooperation, peer support, and constant editing. E-portfolios can be used as procedural assessment tools that provide a variety of evidence to formatively and summatively document student learning (Ambrose, Martin, & Page Jr., 2014, Attia, 2010). Learners are encouraged to add to their e-portfolios throughout the course in order to document their group's experiences with characters.

Phase Three: Peer review and revision. Each student group then reviews the e-portfolios created by other groups--making critical formative comments based on the provided rubrics. In the process of peer review, students gain additional opportunities to interact with characters, gain insights into their own portfolio composition, and potentially enjoy an enhanced sense of agency.

After peer review each group discusses possible revisions to their portfolios based on feedback received from peer groups--deciding on an action plan to ensure equal participation in making the necessary revisions. Then, the whole group revises their portfolio and prepares for their portfolio presentations in front of the entire class.

Phase Four: Presentation, feedback and celebration. A range of options are provided in terms of format and modes of action and expression regarding portfolio presentations. This flexibility draws on the principles of Universal Design (Chita, Gravel, Serpa, & Rose, 2011; 2012; Edyburn & Gardner, 2009). The teacher can use the presentation and e-portfolio as a summative grade and offer constructive feedback for future revisions.

After the presentations, the teacher can facilitate the Chinese New Year celebration, which provides an authentic and culminating linguistic and cultural context to elicit oral production and character literacy in Chinese. The celebration can alternatively be adjusted according to the most closely related seasonal, historic, governmental, or cultural holiday; for example, if the temporal context is mid-autumn the celebration can be a Mid-Autumn Moon festival.

Phase Five: Reflection and Improvement. After the celebration, teachers and learners complete a brief questionnaire reflecting on the whole experience in terms of strengths and weakness in order to facilitate further improvement of the learning experience for future iterations of the learning experience design.

Pedagogical Considerations — Supporting Elements for Character Learning

As mentioned above, this is a multifaceted co-constructed knowledge process supported by multiple elements based on several theories,

technologies, and pedagogical considerations. The physical settings, technologies, and character learning tools are aspects of the design that ensure that the activities and content is scaffolded and introduced with pedagogical rationales--fostering productive learning in high-support learning environment (Gibbons, 2015).

Physical Environment

Physical environment for learning can influence the way teachers and students feel, think, behave and interact with each other (Novodvorsky & Weinstein, 2014). Well-designed physical learning environments provide security and shelter, foster social contact, demonstrate symbolic identification, and facilitate learning activities in a pleasing atmosphere (Steele, 1973, cited from Novodvorsky & Weinstein, 2014). The learning environment for Chinese character learning should display authentic Chinese cultural products and language signs. In the context of Chinese New year celebration, students can notice, co-create, explore, and interact with Chinese characters in a classroom filled with Chinese New Year decorations, such as lanterns, red couplets, traditional paper cutting, and Chinese character crafts. It is important for western learners to notice and feel comfortable seeing signs in Chinese characters while transiting from pinyin to characters. Chinese word walls with beginning characters and classroom survival phrases should be prominent on the classroom walls. Finally, seats should be put in clusters to facilitate group activity and discussion.

Technology Supports

There are many websites and mobile device apps and games designed to support Chinese character learning. Often these apps are designed with specific approaches to character learning. These include a focus on stroke order, handwriting practice, character recognition, and character history among others. The apps chosen for each station should reflect the best in current designs available for the devices accessible to the students and understood by the teacher. Students are provided with instructions and manuals concerning when and how to use apps at each station.

Chinese Character-specific Supports

Character-related supports include Chinese traditional games, starting character activities, class notes, color-coded character badges, gradual replacement of pinyin, and Chinese names in Characters among others. Class notes are required to document group-learning progress and students are encouraged to keep learning journals that include reflections on characters and character learning. These supports are important as pinyin, initially used for most written assignments and classroom representations is gradually replaced by characters based on students' progress in character learning—with the goal of achieving a smooth transition from pinyin to characters.

Limitations and Future Directions

This learning experience design is based on the first author's previous teaching experience, collaboration with colleagues, review of empirical literature, and instructional design experiences. The design has been successfully piloted in the classroom with formative feedback received from both teachers and learners for iterative design improvement. However, no data of any kind was systematically collected. Therefore, formal research is needed and, as of the writing of this manuscript, in progress. The first author is implementing and collecting data on implementations of this experience in two different high school classrooms in the US Midwest to evaluate the design's efficacy, pedagogical value, and feasibility in similar classroom settings. Additionally, this design requires a certain facility with technology, constructivism, and project-based learning.

Conclusion

This learning experience design for Chinese character acquisition is intended to support western-learners of the Chinese during their transition from pinyin to Characters via research-based facilitators enhanced by collaborative learning approaches and technology applications. During the process of designing and piloting the experiences, constant adjustments and revisions were made due to the participatory orientation of the first author.

The creation of multiple pathways into and through the process of decoding, recognizing, and creating characters accommodates learners with different interests, abilities, and strengths. The co-construction of knowledge via the portfolio and peer review process promotes increased exposure to content, positive interdependence, and individual accountability within their learning community. Additionally the thematic embedding of the experience within a culturally relevant event serves to contextualize character knowledge that might otherwise be seen as abstract and disconnected. These and other strategies described herein represent a multifaceted approach to supporting western learners along their path to developing written literacy in Chinese. By drawing on learning theories empirical research and emerging technologies we can design curricula and learning experiences that afford learners heterogeneous, hierarchical, multimodal interactions with challenging content.

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Appendix A

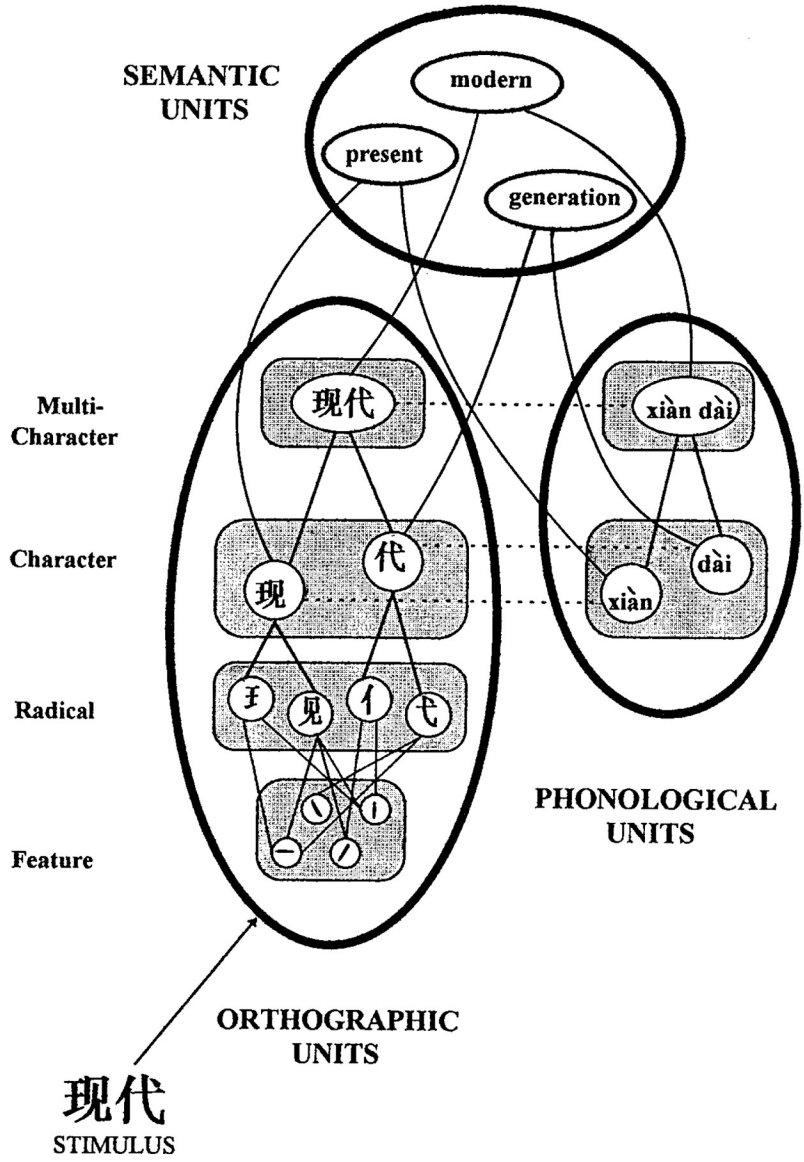

Figure 1: A Multilevel activation framework conceptualizing the lexical processing of Chinese Words (Taft, M., Zhu, X., & Peng, D, 1999)

Appendix B

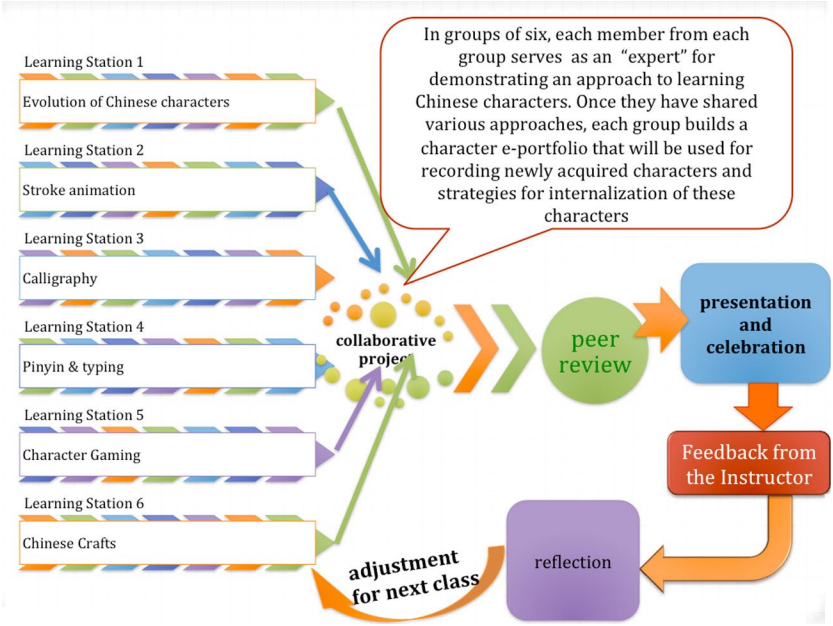

Figure 2: Technology-Supported Learning Experience to Facilitate Chinese Character-Learning