Chapter 11
Information and Communication Technologies for Literacy Education in China

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11.1 Introduction

The rapid development of information and communication technologies (ICTs) has initiated a multitude of changes in schooling around the world. In particular, the impact of ICTs on literacy teaching and learning is immense due to the close connection between literacy and technology (Bruce 2003; Valmont 2003). Effective integration of technologies helps students become competent information technology users, information seekers, analyzers, evaluators, problem solvers, decision makers, creative and effective users of productivity tools, communicators, collaborators, publishers, producers, as well as informed, responsible, and contributing citizens (ISTE 2002).

In China the issue of technology integration to support student learning has attracted attention from the central government in recent years. Several mandates have been issued to address technology in education. Although the degree of integration varies from school to school and from teacher to teacher, various technologies have been used in many classrooms across the nation. In this paper, we first briefly review the history of technology use in literacy education in China. Next, we provide a synthesis of the current state of ICT use in China's literacy education based on an extensive literature review and critical analysis of academic journals and web resources related to ICTs. Finally, we conclude our paper with a discussion of the implication of ICT integration for Chinese literacy students and teachers and make recommendations for literacy researchers studying effective integration of ICT in Chinese literacy education.

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11.2   Historical Review of ICT Integration in Literacy Education in China

China had a late start in its effort to integrate technology into education due to its slow economic development and lack of resources in most of the twentieth century. Thus, technology integration in education is a rather recent phenomenon in China (Liu and Zhang 2006). Before the 1990s, educational technologies were rarely used and could only be observed in highly selective university settings. Common technologies for language and literacy teaching and learning, if schools could afford them, included TV programs, audio cassette tapes, radios, and overhead projectors. Computers were luxury items beyond the reach of most schools. In a very limited number of well-resourced city schools where computers were available, they were reserved for technology classes in labs where students were taught basic computer literacy skills as an isolated subject. The concept of integrating technologies into various subject areas was nonexistent.

Since the late 1990s, the Chinese government has recognized the importance of information technologies to the future development of the country and started to form an active agenda to promote ICTs in education. Information technology education became one of the major national educational priorities. In 2000, the Chinese Ministry of Education (MOE) issued a policy document entitled *Information Technology Curriculum Guide for Primary and Secondary Schools*. This ground-breaking document stipulated that primary and secondary schools should offer information technology courses. Most recently, the Chinese government published a strategic document, *Outline for National Mid- and Long-Term Education Reform and Development Plan* (MOE, 2010), that sets the direction for education for the upcoming decade (2010–2020). ICT in education is one of the key elements of the document.

The Chinese government put into motion an extensive curriculum reform in 2001. New curriculum standards were set for various subject areas, and content related to ICTs was added to the curriculum guides for each subject area. In particular, the new curriculum standards for Yuwen (Chinese language and literacy education) have for the first time included items specifically addressing ICTs for Chinese literacy teaching and learning (MOE 2001b, 2003). The curriculum guide for grades 1–9 (compulsory education) specifically highlights the importance of equipping future citizens with the knowledge and skills to use modern technologies to collect and process information (MOE 2001a). Detailed objectives include using computer programs for word recognition and typing Chinese characters (3rd–4th grades) and for collecting information and using libraries, the Internet, and other information channels for inquiry-based learning (5th–6th, 7th–9th grades). The high school Chinese literacy curriculum guide also includes objectives that require students to develop competence in locating and processing information through various media channels and in using computers for word processing, editing, interface design, developing personal websites, and making presentations. Both curriculum guides also make recommendations for teachers to utilize rich curriculum resources available on the Internet and to incorporate ICTs into the teaching of Chinese.

11.3   Current State of ICT Integration in Literacy Education in China

Much progress has been made at the school and classroom level where Chinese literacy teachers actively integrate ICT to support teaching and learning. This section is a comprehensive review of the current state of ICT integration in literacy education in China, including the types of ICTs, various ICT applications and resources, as well as ICT-supported pedagogy in Chinese literacy education. We searched, reviewed, analyzed, categorized, and synthesized various periodical articles (journals and magazines) and website resources on the uses of ICTs over the past 10 years in literacy education in China. Our goals were to acquire a better understanding of the strategies, resources, and tools currently used for literacy education in China, to inform Chinese educators of available ICT tools and resources that can be used to improve Chinese learning and instruction, and to suggest to Chinese educators the most effective strategies for the use of ICTs in teaching literacy. At the same time, we were interested in identifying gaps in the existing literature on ICT integration in literacy education in China.

11.3.1   Data Sources

Our primary data source was the database *China Academic Journals* (中国知网) (2000–2010). We also reviewed popular education websites frequently used by educators in China. We chose these two data sources because they extensively capture and represent the current status of and trends in the development of ICTs in literacy education in China. We selected eight major journals at the national level to review: *China Educational Technology*/中国电化教育 (2000–2010), *E-education Research*/电化教育研究 (2000–2010), *Modern Educational Technology*/现代教育科学 (2004–2010), *Distance Education in China*/中国远程教育 (2001–2008), *China Information Technology Education*/中国信息技术教育 (2003–2010), *Modern Education Science (Middle School Teachers)*/现代教育科学 (中学教师) (2008–2009), *Modern Education Science (Primary School Teachers)*/现代教育科学 (小学教师) (2007–2010), and *Primary and Middle School Educational Technology*/中小学电教 (2007–2010). In addition, we reviewed some regional magazines, such as *Jilin Education*/吉林教育, *Monthly Journal for Principals*/校长月刊, and *Journal of Subject Education*/学科教育. From a myriad of journal and magazine articles, we selected, examined, and analyzed a large number of articles related to ICT use in K-12 literacy education, including Chinese reading, writing, literature, and character recognition. Altogether, we examined over 600 articles.

11.3.2   Analysis of Data

We went through a rigorous process of searching, selecting, classifying, coding, analyzing, and interpreting. First, we created research logs containing abstracts and additional information about the selected articles (e.g., key words, author, title, year, etc.). Then we went through the selected abstracts and articles to obtain preliminary information and to categorize the articles. As part of the coding process we assigned labels, highlighted key words, and wrote reflective notes as we coded the abstracts and articles.

Following the coding procedure, we created a database using a spreadsheet to help us organize the information we had coded. We created different sheets for different categories, classifying articles in two ways: by functions or purposes (e.g., reading, writing, literature, types of technology, technology integration, resources, tools, etc.) and by codes/keywords (e.g., motivation, interest, self-regulation, metacognition, self-control, interest, wiki, integration, etc.). We set up each sheet for a designated function, such as reading and writing. For each of the article entries, we entered the keywords, codes/labels, functions, author names, titles, journal titles, and dates. Subsequently, we identified major themes regarding ICT integration in Chinese literacy education. In addition, we explored online resources dedicated to teaching with ICTs. We identified and annotated a number of websites that were intended to assist teachers to integrate ICTs into their classroom instruction, including courseware, lesson plans, discussion forums, and resources for K-12 teaching.

11.3.3   Findings

Through our analysis we identified a number of themes that reflect the current state, trends, and impact of ICT integration in Chinese literacy education, including types, functions, and uses of ICT tools and resources; the role of ICT in literacy education in China; and current trends in ICT integration in literacy education in China. According to the articles we reviewed, a variety of ICTs have been widely used in various instructional contexts to teach reading, writing, and literature. Generally, these tools can be categorized into (a) standalone multimedia programs or courseware, (b) character encoding and input systems, (c) communication and collaboration tools, (d) mobile technology, (e) corpora, and (f) instructional delivery devices (e.g., LCD projectors and whiteboards). Below we focus on the first five types of technologies.

11.3.3.1   Multimedia Programs and Courseware

Standalone courseware refers to multimedia programs integrated with texts, graphics, audio, and animations, created with popular presentation tools—Microsoft PowerPoint or interactive web development software, such as Adobe

Flash. The multimedia-based courseware is often used to stimulate students' interest in language learning, to enhance reading comprehension, and to support interpretation of literature. Some of the exemplary uses of multimedia programs include displaying the procedures for writing Chinese characters, illustrating literary concepts, creating a simulated environment by representing real-world situations or problems, and evoking students' emotional responses by representing the environment or culture depicted in stories, prose, or poems (Li 2009; Xu 2010; Zhong 2008).

11.3.3.2   Chinese Character Encoding and Inputting Systems

Character encoding and input systems are essential communication tools in this digital age because they are required for information retrieval, word processing, and composing emails. Therefore, computer literacy skills related to inputting relevant information in a specific written language form have become basic literacy skills (Liu and Zhang 2006). While Chinese computer inputting is taught in schools as a basic communication skill, character encoding and input systems also have been used as an instructional method to teach young learners pinyin and the phonetic input method, to assist learners in the recognition of Chinese characters, and to facilitate learners in beginning to write stories at an early stage before they can write many characters. Research shows that with a combined method of teaching pinyin and character recognition using a computer input system, students significantly shorten the time needed to develop a good command of pinyin while mastering more characters, compared with the conventional teaching method without a computer input system (Gui 2009; Liu and Zhang 2006; Xing 2008).

It is important to note that many methods have been devised for inputting Chinese characters on computers. In general, three major inputting systems are in use: phonetic- or pinyin-based, structure-based, and hybrid (combined phonetic- and structure-based) methods. Among the three major types of input methods, the phonetic-based methods are most popular among school children because these methods are easy to use and do not require much training.

The phonetic-based input methods utilize standard pinyin. In addition, these methods are subcategorized into Quanpin (全拼/full spelling), Shuangpin (双拼/double spelling), and Jianpin (简拼/simple spelling). Quanpin involves inputting the full string of pinyin letters that represent a Chinese character when typing the character, for example typing "zhang" for 张. This method can be used by anyone who has knowledge of pinyin, which includes first graders. Shuangpin simplifies the input process by using only two predetermined letter keys to represent the whole string of pinyin, for example "vh" for zhang/张 (v for zh and h for ang). Users of Shuangpin need to study the predetermined rules that specify which letter key represents which letter or letter strings before they can use this method efficiently. Jianpin allows users to input just the first letter in the pinyin string to come up with the corresponding character. This method produces a list of

homophones, so users have to decide which character is the exact one they want. Current popular phonetic-based input methods include Sougou Pinyin (搜狗拼音), Google Pinyin (谷歌拼音), QQ Pinyin (QQ 拼音), and Microsoft Pinyin (微软拼音).

Structure-based input methods assign specific keys to represent different structure components or strokes of Chinese characters. Compared with phonetic-based methods, they are more difficult to master, but one can input a character without knowing its pronunciation. Some well-known structure-based input methods include the Wubi method (五笔字型输入法) and the Zheng Ma method (郑码输入法).

Hybrid input methods combine the phonetic approach with the structure-based approach. These methods draw on learners' knowledge of both pinyin and character formation. One of the most common hybrid input methods used in China is the Renzhi Ma method (认知码). Using this method, the structure of the character, such as 树/shu/, can be divided into three roots: 木/mu/, 又/you/, and 寸/cun/, all of which are characters themselves (i.e., simple characters in a grammatical sense). Based on the pinyin of these three roots, 树/shu/ is encoded as "myc," the initials of the syllables of the three roots. Therefore, by typing the three parts, m, y and c, the character 树/shu/ is inputted into the computer (Liu and Zhang 2006). This method helps students decode and encode Chinese characters and understand their meanings at a deeper level, which in turn helps them retain the information in their long-term memory.

Additionally, voice recognition systems are used to improve the writing skills of students with writing disabilities (Hu 2007). For those students with writing difficulties, voice recognition software allows them to tell stories verbally and concentrate on the content. Further information on input systems can be found at http://seba.studentenweb.org/thesis/im.php.

11.3.3.3 Communication and Collaboration Tools

Communication tools include email, instant messaging (e.g., MSN), chat rooms, and software applications that allow users to make simultaneous voice calls over the internet (e.g., Skype). E-mail allows students to exchange information and supports their development of writing skills, whereas synchronous communication tools, including instant messaging and chat rooms such as MSN and Skype, can be used to support collaborative reading and writing tasks.

In addition, emerging online collaborative applications, such as bulletin boards and wikis, have provided educators with additional tools to guide students in collaborative learning activities. For instance, several articles discussed wikis as an effective collaborative software application to support collaborative writing (e.g., Jiang and Xue 2006; Lu 2009; Ye and Zhou 2007). The teacher can use collaborative technologies to guide writing on an interesting topic and provide prompt feedback. Students can make revisions based on the teacher's feedback and ask further questions or seek clarification in a timely manner (Xia and Sun 2010).

Learning management systems, such as Blackboard and Moodle, are specifically designed to provide a platform for interactive and collaborative learning. These systems are now used to create comprehensive courses to teach reading, writing, and literature. Yu and Xu (2009) illustrated that utilizing the collaborative platform and interactive features afforded by Moodle not only allowed students to publish their work, but also engaged them in social interaction and peer review processes, including sharing information and resources and providing comments and feedback to each other.

Some popular and emerging social network tools have quickly found their way into Chinese literacy education, for instance QQ and Qzone developed by Tacent Inc. QQ combines all the common communication tools into a single system. It consists of a communication space, instant message, BBS for information sharing and group discussions, chat rooms for one-to-one or group chatting, email for communication, an album for sharing pictures, and a dropbox for uploading, downloading, storing, and sharing files. With its popularity and user-friendly features, QQ has quickly gained the attention of many educators. Some educators have taken advantage of the various features of QQ to support Chinese literacy education, for instance, to carry out discussions on a given topic, brainstorm ideas for a composition, or conduct a collaborative writing task. Some educators use Qzone, another product created by Tacent, to encourage students to use the blog function to write journals. Qzone gives students the freedom to write what they want to write without having to worry about being criticized by teachers or laughed at by peers. Students can create their "zone" according to their interest and needs. In this sense, Qzone offers a vehicle for self-expression and creativity and helps promote self-image and self-confidence, especially for those students who are introverted or emotionally troubled (Li 2010).

11.3.3.4   Mobile Technology

China has witnessed the rapid development and widespread use of mobile technology, such as mobile phones, digital PDAs, and Pocket PCs. Mobile technology is characterized by being small, light, easy to carry, and convenient to communicate through voice or text messages. With a wireless internet connection, users can search for resources and share information conveniently. These technological affordances have caught the attention of Chinese educators. Ji and Bai (2009) explored how this new technology could be integrated into teaching language and literature. Given its affordances, mobile technology allows learners to receive instruction anytime and anywhere. They illustrated the various ways a teacher used mobile technology in a junior middle school Chinese class: to provide materials for previewing a lesson, to deliver pictures or graphics to help students establish mental representations of a text and to evoke their emotional responses, to provide instant feedback to students' reading and writing tasks, and to provide online resources to help students complete a writing task or after school exercises. Mobile technology also enables students to study an object closely. For example,

when students study a particular breed of birds and its characteristics, they can search for information about those birds, listen to their twittering through an MP3 file, and watch a video clip of their behaviors and habitats delivered by the mobile devices. Mobile technology is used to help students develop observation abilities and descriptive writing skills.

11.3.3.5 Learner Corpora

Corpora is a term that originated in the field of applied linguistics. It refers to a large-scale database that automatically collects and processes a corpus of natural language and analyzes rules, patterns, syntax, semantics, and so on (Wei et al. 2008). The purpose of corpora is to automatically analyze, index, and store natural language in a computer system, so users can easily retrieve information from a large database by various searching techniques. Chinese educators have been using corpora to serve instructional purposes. Different kinds of learner corpora have been built, such as a reading corpus for elementary school students, an ancient Chinese corpus, a famous writers' corpus, (e.g., Wei 2008; Wei et al. 2008). These corpora have become rich resources for both students and teachers. Students can refer to exemplary writings and engage in guided language tasks, such as examining a specific language pattern in a language context and exploring various language devices employed by a particular writer. Teachers can draw resources from the corpora to help them prepare their Chinese lesson plans and integrate them in their instruction (Wei 2008; Wei et al. 2008).

11.3.3.6 Online Resources for Teachers

In addition to ICTs, there are numerous teaching websites and networks that provide a wealth of teaching resources, forums, and tools for Chinese language teachers to share lesson plans, instructional strategies, and teaching experiences aimed at improving the quality of Chinese literacy instruction. We have identified several major web resources specifically related to Chinese literacy and literature, including

- Primary School Chinese Teaching Resources (小学语文教学资源网)
  http://xiaoxue.ruiwen.com/
- Middle School Chinese Teaching Resources (中学语文教学资源网)
  http://www.ruiwen.com
- Chinese Language and Literature Network (中学语文网中网)
  http://www.ykyz.net/yuwen
- Chinese Language Network (中华语文网)
  http://www.zhyww.cn

These web resources provide thousands of instructional courseware or multimedia programs, video clips, articles, and lesson plans on teaching Chinese, as well as

quizzes and tests. In addition, these sites offer support centers, various forums or channels on different topics and content areas, and many other links to additional resources.

The Docin Network (豆丁网 http://www.docin.com/) claims it has the largest collection of Chinese articles on various topics, including PowerPoint files, Courseware, and many other formats of files (e.g., doc, xls, ppt, txt, pdf, jpg, rtf, mpp, vsd, pps, pot, wps). The Docin Network offers resources ranging from fiction, art, fashion, psychology, physical education, and general education to science and technology, engineering, and computer science. A noticeable feature of this site is teachers can freely share lesson plans by uploading and downloading materials. Since the Docin Network has a wide coverage of topics, it is fairly easy to find materials related to literacy education. For example, when typing "multimedia" (in Chinese), we found articles like "Smart Uses of Multimedia Programs in Elementary School Chinese Classes" ("多媒体技术在小学语文课堂的妙用"), and "Principles and Methods of Using Information and Communication Technology in Elementary School Chinese Teaching" ("小学语文教学使用信息技术的原则和方法"). Teachers also have the option of selecting resources by file type, such as doc, pdf, or ppt. Docin fully illustrates the notion of communities of practice that build, share, and use databases and knowledge.

11.4 Roles of ICTs in Chinese Literacy Education

The literature reveals that ICTs play important roles in supporting Chinese literacy education in China in terms of cultivating students' motivation, interest, and affective development, promoting skills development, and supporting self-regulated, independent literacy learning.

11.4.1 Motivation, Interest, and Affective Development

A large number of articles discuss how to use ICTs to motivate students' interest in learning language, reading, writing, and literature. For example, Zhong (2008) described how a teacher used multimedia programs to enhance teaching Chinese characters. When teaching the concept *water* to young learners, the teacher played a video clip with music in the background, showing a winding stream, the magnificent Yangtze River, the vast ocean, and the peaceful West Lake. This video clip immediately grabbed the attention of the elementary school students. While they enjoyed the beautiful scenery, the students were completely immersed in the simulated natural environment. It evoked the students' feelings and understandings about water and the relationship between water and their day-to-day life. At this point, the teacher paused the video clip and began to explain the concept of *water* and the formation and characteristics of the character *water* (水). The multimedia

program created a visual effect for the learners and presented a vivid image in their minds to help them retain the information in their long term memory. The students not only learned how to recognize and read the character *water*, but they also understood the deep connotations associated with the concept *water*. Therefore, ICTs make learning Chinese fun and interesting (Yang 2007).

Multimedia affordances are used not only to motivate students' interest in studying literacy, but also to support their affective and cognitive development. Emotions and cognition go hand in hand in reading comprehension and literature appreciation. A large number of articles examined how ICTs can be used to provoke senses, feelings, and the imagination, and to present simulated environments depicted by texts to help students experience and understand literature. For example, Xu (2010) demonstrated how she used multimedia programs to stimulate learners' imaginations and evoke their feelings when she taught reading comprehension on a lesson titled "Chinese International Rescue Team is Terrific!" This text described how Chinese rescue workers in a foreign country worked hard to rescue people from a natural disaster. The vivid pictures moved the students to tears as their teacher read aloud the text. The use of pictures created an atmosphere in which silence speaks more than words.

11.4.2   Skills Development

ICTs have been used to support the teaching of Chinese characters. At the elementary level multimedia programs have been used to teach character recognition and writing. Animations have been designed and used to explain the formation of Chinese characters from historical and etymological perspectives. For example, the image of *water* (水/shui/) represented by streams, rivers, lakes, and oceans, can be designed to be gradually transformed into the Chinese character for water through animation created with authoring software, such as Adobe Flash (Zhong 2008). The animation can be followed by demonstrating the process of character writing, showing how the strokes of *water* (水/shui/) are written and explaining the stroke writing sequence of that character (Bian and Wang 2005).

Chinese input systems, an increasingly important type of ICT for learning Chinese, enable young students to recognize characters and to develop into independent writers more effectively and efficiently. With the knowledge of pinyin and the help of an input system, young children can compose stories on computers even when they do not know how to actually write many of the characters they want to use in their stories (Liu and Zhang 2006). According to Gui (2009), it is much easier to recognize Chinese characters than to write them. If students know a character but cannot write it, they can type pinyin for that character and select a suitable character from among a list of characters produced by the typing output. Chinese input systems help to increase the number of characters students can recognize and memorize within a limited period of time, compared with the traditional teaching method that does not involve the use of a Chinese input system. Liu and Zhang

(2006) noted that normally many Chinese children cannot write much when they first start their formal schooling. However, with the help of a computer and the Shuangpin (double spelling) input method, these young learners are able to write what they want to say using the computer, and they learn to write essays within a year. In addition, some students who were already trained to recognize about 1,000 characters before their formal schooling can write stories on computers after a few weeks' training (Zhou 1999).

A great number of articles also share ideas on how technology can be used to develop students' knowledge and skills important to learning a language and understanding literature, including making observations, thinking critically, using imagination, and expressing creativity. For example, Li (2009), who was also a teacher, found that many of her students were unable to make careful observations of people, things, or scenes in real life or to form connections between things they observed in their own life experiences, so she took advantage of multimedia technology to develop students' observation skills. In teaching young children to write an essay on "A Small Lovely Animal," she first demonstrated how to describe a white rabbit by using a multimedia program. The program showed the rabbit in an instructionally logical order, first showing the entire white rabbit and then gradually moving to different parts of the rabbit, zooming in and out from different angles and perspectives (Li 2009). Students could choose to pause at a specific point in the program or to replay the program. With the help of the multimedia program, she engaged the students in the writing task of describing the small white rabbit clearly and vividly, and in a logical and sequential order.

At a more advanced level, ICTs have been used to teach abstract concepts, especially when students do not have experience with the subject being studied. Multimedia programs have often been used to address difficult concepts and to convey specific moods depicted by poems and prose, especially ancient poems characterized by concise and vivid language and the use of images, similes, metaphors, and other literary devices (Zheng et al. 2008). A famous ancient poem about Mt. Lu vividly presents a picture of the majestic mountains through the lines, "hen kan cheng ling ce cheng feng, yuanchu gaodi ge bu tong" ("横看成岭侧成峰, 远近高低各不同"). These lines mean "When the mountains are seen from one side, they are mountain ranges, and when seen from the other side, they are peaks; they show different heights when they are viewed from different distances." A teacher used pictures to help her students visualize the mountains and the poetic imagery. By viewing pictures of Mt. Lu taken from different perspectives, students closely examined the shapes of the mountains and pondered on the poetic words used by the poet. As another example, when teaching a lesson on the poem "Waterfalls," a teacher used a multimedia program to present to her students a simulated environment depicting the scene of a roaring waterfall rushing down 10,000-foot high mountains and layers upon layers of waves surging onto the shore while the wind blows over a pine forest. This simulated environment stimulated her students' imagination about waterfalls, evoked their emotional responses, and allowed them to gain a better understanding of the rhetorical devices used in the poem.

11.4.3 Self-regulated Learning

Rich web resources allow teachers to create open-ended learning environments that encourage inquiry, problem solving, and self-regulated learning activities. Wang (2006) illustrated the design of an open learning environment using web resources to promote self-regulated learning. During instruction of the lesson "Taiwan Butterfly Valley," students would first read the text to acquire a preliminary understanding of the fascinating butterflies. Then the teacher would prompt the students with questions, such as "In what ways do you find Butterfly Valley fascinating?" The students would be asked to search for, underline, and read the sentences describing the magnificent views of the butterflies. Next, they would be further prompted to search for relevant information from web resources, including articles, pictures, and animation to help them further experience the views described in the texts. Wu (2002) discussed how web resources could be integrated with texts to foster reading comprehension. In order to engage students in self-monitoring and self-regulated learning processes, Wu suggested providing students with question prompts to guide them in the inquiry process of searching, selecting, classifying, and reorganizing relevant information in order to generate solutions to problems. For instance, when teaching the lesson "We Only Have One Earth" related to environmental protection, the following question prompts could be provided: "Why should we pay attention to environmental protection? How do we deal with emissions and waste in the chemical industry? In agriculture, which chemical fertilizers and pesticides will cause pollution to soil and water?" Students can use the question prompts as a guide while browsing websites and resources to gain relevant information and to formulate answers to the questions. After the web searching activities, students are asked to discuss the issues with their group members and to generate reports on environmental protection.

11.5 Trends in ICT Integration in Literacy Education in China

In order to understand the trends in ICT integration in literacy education in China, we grouped the selected articles into two periods: 2000–2005 and 2006–2010, and we performed a general analysis of those articles. Comparing the 2000–2005 period with the 2006–2010 period, we observed that there was a significant increase in the number of articles on ICTs in Chinese literacy in recent years, with 16% of the articles published in 2000–2005 compared with 84% published in 2006–2010.

We also found that there were more articles discussing the teaching of reading (116 articles, 48%) and writing (96 articles, 40%) than the teaching of literature (28 articles, 12%). Within the reading instruction category, 13% of the articles were on teaching character recognition. Regarding teaching literature, more articles focused on teaching ancient poems than on contemporary literature. This could be due to the fact that ancient poems are difficult to decode and understand because archaic

Chinese was more succinct, comprehensive, and profound than modern Chinese. More articles were published on the use of ICTs to motivate students, stimulate their interest, develop cognitive and metacognitive skills, and evoke their emotions, imagination, and creativity than on how to teach difficult concepts and literary devices. We expect that articles in the latter categories will increase in the next 5–10 years as teachers continue to explore pedagogical uses of ICTs and deepen their understanding of the roles of ICTs in literacy education. Furthermore, we have also noticed an increase in the number of articles discussing the changing role of teachers over the past 10 years.

11.6   Discussion and Implications

According to the Ministry of Education's *Guidelines for Curriculum Reform of Basic Education* (2001a) educators should fully take advantage of ICTs and promote technology integration in curriculum. Our literature review shows that ICTs play important roles in supporting motivation, cognition, metacognition, and skill development (e.g., imagination, self-expression, creativity) and in promoting information sharing, idea exchange, and collaborative learning in students' reading and writing. Our findings indicate numerous opportunities and possibilities for ICTs to improve the teaching and learning of Chinese literacy.

The integration of ICTs into Chinese literacy teaching not only shows the impact of technology on learning and instruction in China, but more importantly, also reflects new perspectives on learning and instruction. We argue that ICTs promote Chinese teachers' reconsideration of their role in literacy education. Many articles indicate that the role of teachers in literacy classes should change from lecturing to supporting, from teacher-centered instruction to student-centered learning, from the paradigm "The teacher asked me to learn" to the paradigm "I want to learn" (Lin and Ouyang 2007; Zhang 2003). Wen (2006) contended that students should take ownership of their own learning and actively construct and build knowledge while teachers should be mentors, guides, and facilitators.

According to our observations and analysis, the role of ICTs in literacy education has gone beyond being a tool to support the learning and teaching of Chinese literacy. ICTs have caused a transformation in teachers' beliefs about learning and instruction and motivated teachers to break away from the traditional instructional approach and seek innovative teaching approaches to guide learners in self-directed and self-regulated learning. Some of the new pedagogical concepts that have been increasingly discussed in recent literature include development of metacognition (e.g., Ding et al. 2009), self-regulated and self-monitored reading and writing activities (e.g., Wang 2006), knowledge acquisition and transfer of skills (e.g., Sun 2008), integration of Chinese literacy and other subjects, and interactive and collaborative learning (e.g., Hu and Bei 2008). We are inclined to say that the development of ICTs have become one of the determining factors promoting a paradigm shift in learning and instruction in China's literacy classrooms. This paradigm shift meets the

needs of the society and is consistent with fundamental changes in instructional supersystems as China rapidly moves away from an agricultural and industrial society into a digital/information society, in which employees are required to be able to solve problems, work in teams, communicate, take initiative, and bring diverse perspectives to their work (Reigeluth 1999).

While there is no lack of articles on a variety of topics on the use of ICTs in literacy education in China, our literature review revealed some gaps in research on ICT integration in literacy education. The majority of articles were short write-ups, one to six pages long, of experience sharing or issue discussions. Few articles reported data-based empirical studies. Although it is exciting to see the rapid infusion of ICTs into Chinese literacy education and the rising number of articles covering a wide range of topics related to literacy education, most of the articles were piecemeal descriptions of the uses of isolated tools: using ICTs to design a specific lesson or learning environment, integrating ICTs with specific instructional strategies, or discussing the use and benefits of a particular learning management system. There is a lack of research on systemic change and ICT infusion on a large scale in China's literacy education reform. To bring about systemic changes in Chinese literacy education, researchers, learning scientists, educational psychologists, and teachers must work together to promote empirical research grounded in learning theories and instructional design principles. In addition, it is critical that educational researchers studying Chinese literacy teaching and learning receive training in research methodologies, so they will be able to design and conduct empirical research or design-based research to produce greater insight into how to further improve literacy education in China.

In conclusion, we would like to make a number of recommendations for Chinese literacy educators based on the critical analysis and discussion of the literature on Chinese literacy in China. First, while it is important to use ICTs to teach basic literacy skills, it is even more important for educators to focus on developing students' higher-order thinking skills, such as reasoning, information searching, selecting and evaluating, self-monitoring and self-regulation, inquiry, collaborative learning, and problem solving. Second, ICTs should be used to motivate students and engage them in meaningful learning situations that will encourage them to apply their literacy skills in their day-to-day life to solve real-world problems. Third, ICT training should be an essential component of teacher professional development programs. Not only should teachers learn how to use ICT tools, but most importantly they also should understand the constructivist epistemological paradigm of learning and instruction. Professional development programs should emphasize the transformative power and pedagogical value of ICTs by integrating specific instructional approaches, models, and best practices with the use of ICTs. Furthermore, professional development programs should encourage Chinese literacy educators to be involved in classroom-based design research and should help them develop design research skills for the purpose of improving literacy education in their specific instructional settings.

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