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Elementary In-Service Teachers' Beliefs and Uses of Technology in China: A Survey Study

Guofang Li & Xiaopeng Ni
Michigan State University

In the past decade, China has shown rapid improvement in technological infrastructure and network access within the K-12 system. While the technology-rich resources offer new possibilities and approaches to teaching and learning, the teacher is the key factor to effective utilization of technology. This study was conducted to investigate how Chinese elementary in-service teachers use new technologies in instruction, their beliefs toward technology, and the kind of support that they receive in using technology. Data was collected through a survey from a sample of 507 elementary in-service teachers and 2501 students in Shanghai, China. The data show that the in-service teachers held positive attitudes about the benefits of technology for teaching and learning and routinely used a variety of common computer applications in instruction. However, inconsistent with their beliefs, their technology use was limited to teacher-centered purposes, rather than student-centered activities. The findings also indicate that there is a strong correlation among teachers' attitudes toward technology, their frequency of using technology, and technological supports from school district. These findings suggest that the needs for Chinese in-service teachers are not functional computer skills, but more professional development in instructional design skills in technology integration that promote student-centered practices. The results have significant implications for teacher-education and professional development programs and policymakers to redirect their effort to improve in-service teachers' competence in pedagogical design that integrates content, technology, and student-centered learning.

Keywords: teacher beliefs and attitudes, technology integration, technology use, instruction, elementary teachers, China

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Guofang Li is an associate professor in the Department of Teacher Education at Michigan State University. Xiaopeng Ni is a research associate at Michigan State University. Please contact Guofang Li at liguo@msu.edu

INTRODUCTION

One of the most significant changes in K-12 education during last several decades is the increased activities of integrating technologies in teaching and learning. It is believed that technology has great potential to build enriched learning environments, transform teaching practices to prepare students for their digital future, and promote students' academic achievement (Mishra & Koehler, 2006; AACTE, 2008; U. S. Department of Education, 2007). Therefore, promoting technology integration initiatives in schools has become a pervasive phenomenon of many countries around the world. In the United States, for example, it is estimated that K-12 public schools invested more than $7.8 billion in technology equipments in the school year 2003 -04 excluding the related expenses on personnel and other service cost (Quality Education Data, 2004). By 2006, the ratio of students to computers in public schools in the US has reached 3.8 to 1 and nearly 100 percent of public schools in the United States had access to the Internet (NCES, 2006). In China, multimedia and computer network have been gradually introduced into the K-12 schools since the late 1990s (Song, Liang, Liu & Walls, 2005). By 2005, over 9 million computers were installed in the K-12 schools and more than 50,000 schools were connected via local networks; and funding for educational technology in the K-12 system reached approximately 20 billion RMB ($2.8 billion US), representing about 4% of the total educational funding in China (CERNET, 2008; Zeng, 2007).

However, despite the large investments in educational technology in the K-12 systems around the world, much research has found that optimal use of technology in instructional delivery is rare or when used, it is often not truly integrated with curriculum (Bauer & Kenton, 2005; Cuban, 2001; Cuban, Kirkpatrick, & Peck, 2001; Wozney, Venkatesh, & Abrami, 2006). For example, in the US, researchers discovered that though many elementary and secondary in-service teachers were "tech-savvy"—they were highly educated and skilled with technology and were innovative and adept at overcoming obstacles, they did not integrate technology on a consistent basis as either a teaching or learning tool (Bauer & Kenton, 2005; Cuban, Kirkpatrick, & Peck, 2001). For example, Shi and Bichelmeyer (2007) compared two ethnographic studies regarding in-service teachers' uses of computers in 1991 and 2004 to understand how the teachers' uses of computer have changed since the proliferation of computers in schools. They found modest progress in the teachers' computer use and continuing token integration of computers by teachers despite the tremendous increase in availability of computers in schools. For instance, similar to technology use in 1991, the in-service teachers who participated in the 2004 study were still using computers for primarily administrative (which was mandated by the school districts) and the primary use of computers for instructional purposes by teachers continued to be for word processing, though the amount of Internet research in class activities was increasing.

Similar "high access, low use" paradox (Cuban, 2001) was also observed in Chinese in-service teachers' technology use (Shi and Bichelmeyer, 2007; Yang, 2008; Zhang & Liu; 2006; Zhong & Shen, 2002). In another survey study on in-service teachers' technology use conducted in an economically developed region in eastern China, Wen Zhou, Zhejang Province, for example, Yang (2008) found that among the 378 K-12 teachers in both urban and rural schools, only 24.9% of the in-serivce teachers reported that they often or sometimes use multimedia technology in instruction. Further, the most frequent multimedia technology that was used was overhead projectors (61.1%) and multimedia computer technology was used less often, only 34.1%. In teaching preparations, only 40.7% of the teachers considered using multimedia technology in their lesson plans.

The widespread "high access, low use" phenomenon suggests that simply increasing investments in technology and improving the availability of technology access is not enough for educational informationalization. Rather, understanding the role the teachers play—what and how they use technology in instruction and factors that affect their use—is central to the essential and ever challenging task of educational informationalization. Without understanding the key factor of teachers, technological resources will continue to be caught in the "high access, low use" status. Therefore, the purpose of this article is to understand Chinese elementary teachers' status of and attitudes towards technology use. We hope the findings of this study will serve to inform teacher practices and teacher professional development in technology integration in China and beyond. The study is guided by the following research questions:

1. How is technology used in instruction by elementary in-service teachers in China?
2. What are their beliefs and attitudes toward technology use?
3. How do the in-service teachers' beliefs and attitudes toward technology influence their technology use?
4. What kinds of support do they receive in terms of technology use?

FACTORS AFFECTING TEACHERS' TECHNOLOGY USE A LITERATURE REVIEW

Since the purpose of the article is to begin to understand Chinese elementary in-service teachers' status of and attitudes towards the technology that they use, this review will draw on research findings from the international contexts. In search for explanations of the "high access, low use" paradox, researchers around the world have pointed out a number of factors that affect teachers' technology integration in instruction. These include personal factors related to teacher beliefs and their teaching styles, and external or contextual factors related to the quality of professional development offered to teachers, the extent to which administrative and curricular support is available to teachers, the quality of teacher access to computer resources as well as the school culture of technology use (Chen, 2004; Cuban, Kirkpatrick, & Peck, 2001; Liu & Huo, 2007; Wozney, Venkatesh, & Abrami, 2006; Zhao & Frank, 2003).

In terms of teacher personal factors, it is found that teachers' attitudes to and understandings of technology use affect their technology use in instruction (Chen, 2004; Dudeney & Hockly, 2007; Liu & Huo, 2007; Parks et al, 2003; Park & Son, 2009; Wozney, Venkatesh, & Abrami, 2006; Zhao & Cziko, 2001). For example, if teachers perceive technology as a threat to their traditional teacher-centered methodology in which they have received years of training, they may resist the use of technology (Liu & Huo, 2007). Similarly if teachers adopt a "slow revolution" or a gradualist instrumentalist view of change, they will not resist the use of technology, but will use technology mostly for instructional preparation and communication (Cuban, Kirkpatrick, & Peck, 2001). In a study on the discrepancy between teacher beliefs and practices in technology integration in Taiwan, Chen (2004) found that reasons for the inconsistency include teachers' limited or improper theoretical understanding on constructive instruction and technology integration or know how to transfer theoretical concepts on technology integration into practice, e.g., how to design technology-based learning activities that would facilitate students' active knowledge construction; and teachers' other conflicting beliefs such as the conflict between the pressure to cover content due to the test-driven culture and the need to allow students to explore content through technology.

Teachers' technology use is also found to be related to their expectancy of success and perceived value of technology. Wozney, Venkatesh, & Abrami (2006) found that

teachers who believed that they had the skills to implement computers successfully and who valued the outcomes associated with integration were more likely to be at the high end of the "technology user" spectrum. In a similar study of English as a Foreign Language (EFL) teachers' technology use in classrooms in Korea, Park & Son (2009) revealed that internal factors such as teachers' limited computer skills, knowledge about computers and beliefs and perceptions of computer assisted language learning significantly affected teachers' decisions on the use of technology in teaching. In addition to teacher beliefs, Wozney, Venkatesh, & Abrami (2006) also found that teachers' personal use of computers outside of teaching activities was the most significant predictor of teacher use of technology in the classroom. That is, teachers' access to computers outside of teaching has a positive influence on their computer use in the classroom. Therefore, to understand teachers' practices in technology use in instruction, it is important to examine teachers' perceived value of technology and their self-efficacy in technology as wells as their use of technology outside of classroom.

Another personal factor is related to the relationship between teachers' pedagogical practices (such as teaching approaches) and technology use, though research on the relationship is not conclusive. In their study of 2,213 teachers' perceptions of technology implementation in elementary and secondary schools in the province of Quebec, Canada, Wozney, Venkatesh, & Abrami (2006) found that teachers who preferred more student-centered approaches are more likely to integrate computer technologies more frequently and report themselves as being at a more sophisticated stage of integrating computers in classrooms. In contrast to these findings, several studies (Chen, 2004; Dexter, Anderson, & Becker, 1999; Judson, 2006) have found disconnection between teachers' reported teaching styles and their technology use in classroom. In his study of 47 elementary and second teachers in the US, Dexter, Anderson, & Becker (1999) found that teachers who adopted more student-centered, progressive teaching practices did not regard technology as catalyst for change in their teaching practices. Similarly, Chen (2004) found high levels of agreement on constructivist concepts among the Taiwanese teachers studied, but the participants' instruction remained teacher-centered and lecture-based, and their technology use was to support such instruction. These contradictory findings from different countries and contexts suggest further research is needed to examine the relationship between teachers' pedagogical beliefs, practices, and technology use.

In addition to teacher personal factors, contextual factors such as teacher professional development in technology integration are also found to affect teachers' technology use. Inadequate teacher training is often cited as the most serious obstacles in helping teachers learn how to use technology in their instruction (Bauer & Kenton, 2005; Holmes, Vargas, Swan, Jennings, Meier, & Rubenfeld, 2002; Mitchem, D. Wells, & J. Wells, 2003). For example, Yang (2008) found that due to the lack of information technology experts or teachers, 46.3% of the 378 K-12 teachers in his study reported that no professional development on technology integration was offered in their schools in China. In addition to inadequate training, the kind of training teachers receive also matters. There is a consensus that the traditional application-driven workshops or summer "institutes" well removed from classroom practices are often not effective in helping teachers learn to integrate technology into the instruction. A large body of literature all concludes that effective PD must be sustained, content-focused, and collaborative to effect change in teacher practices in ways that ultimately improve student learning (Darling-Hammond & McLaughlin, 1995; Li & Protacio, 2010; Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009). A focus on a specific content area or a particular pedagogical strategy will enable teachers to take this new knowledge from the professional development and integrate it with their classroom practices. Therefore, teacher professional development in technology cannot just focus on technology applications; it

must connect with a specific curriculum and subject area and with specific attention to the pedagogical practices associated with the subject area. Since the effectiveness of technology integration is more rooted in pedagogical and design principles, rather than technology itself (Chen, 2004; Dudeney & Hockly, 2007; Liu, et al 2003; Parks et al, 2003; Zhao, 2003), teacher professional development must focus on not only how to use a particular hardware or software, but also on how it is used in alignment with more effective pedagogy, content, and context.

Other contextual reasons identified include inadequate technology support in hardware/software stability. Shi and Bichelmeyer (2007) summarized several factors that inhibited the teachers' technology integration in the high access, technology-rich environment among their 2004 participants in the US. These factors include the importance of hardware/software stability and technical support, the lack of effective training, lack of collegiality, lack of involvement in planning for technology integration, and lack of material support (e.g., teachers reported having to periodically spend their own money for peripheral devices and supplies such as computer cables, which discouraged them from using computers).

These findings suggest that in order to understand how technology is used by teachers, it is necessary to examine teacher beliefs and the varied external factors that may influence their technology uses and classroom practices. In this article, we chose to focus on a rather under-researched group of Chinese teachers', elementary in-serve teachers', technology use. We focus on these elementary teachers' practices in and attitudes towards technology use and the external factors such as technology support and professional development associated with their technology use. We also examine the relationship between teacher pedagogical beliefs and practices in technology use.

METHOD

THE SURVEY INSTRUMENTS

The purpose of this study is to understand how technology is used and perceived by in-service teachers in Chinese elementary schools. Data were collected through paper-pencil based surveys. Though our focus was on teacher use and beliefs, we believe that how students use technology is also inseparable from teacher practices. Therefore, in this study, we surveyed both teachers and students.

The teacher survey was adapted from the Teacher Technology Practices Survey designed by Zhao and Frank (2003). The adapted teacher survey instrument contained five main sections: instructional and professional uses of technology, teacher attitudes and perceived value towards technology, technology support, and professional development associated with technology. A total of 51 items were included and all items were Likert-scale, multiple choices or filling in the blanks. The first section concerns about technology use for general professional purposes and contains nine items about teachers' frequency of technology use as well as their experiences using computer in school. For example, in terms of teachers' frequency of use of different technologies (e.g., word processing, student-teacher forum, video/TV network, WWW, E-mail, blog etc) and frequency of use in different locations (e.g., school lab, classroom, and office), teachers were asked to rate on a five-point Likert Scale ("Never" 1, "Yearly" 2, "Monthly" 3, "Weekly" 4, and "Daily" 5). The second section focuses on the teachers' instructional use of technology and contains six items about what and how frequently teachers use technology in teaching. To understand teachers' instructional use of technology, teachers were asked to rate on the same 5 point Likert scale on their purposes of use such as "communication with parents", "teacher-student communications",

"classroom management", "record keeping", "preparation for instruction", "student-student communication", "student expression", "core curriculum skills development", "student inquiry", "remediation", "development of basic computer skills"). The third section consists of eight questions that address the teachers' attitudes toward computer technology, their perceived value towards technology in both their teaching and students' learning, and their perceptions of their school's technology climate or culture of use. Five questions (teachers' attitudes towards technology, perceived value of technology for teaching and teachers themselves and for students' learning, teachers' views of the value of computer use within the context of their school) used a six-point Likert Scale ("Strongly Disagree" 1 to "Strongly Agree" 6). In this section, three multiple choices questions were also included to understand teachers' perceptions of the advantages and disadvantages of technologies for teaching and factors that affect the learning success of students. The fourth section comprises of 13 items on hardware and software support and professional development for technology use that the teachers receive from their district or school. The last section, which has 15 items, concerns about the teachers' background information as well as their use of technology at home.

The student survey was designed to understand students' technology use, attitudes, and confidence levels with technology use and it contained 15 items of multiple choices questions in total. Questions include "How many hours on average do you use computer at home or in your free time each week?" "How many hours on average do you use computer at school each week?" "For how many years did you learn computer?" "How often do you have the homework for which you need to search online to do well?"

THE RESEARCH CONTEXT

This study took place in Shanghai, China. We chose Shanghai as the research site because it is a leader in Chinese education movements and a pioneer in the Educational Informatization process in China. As early as 1999, Shanghai Education Bureau put forth the "21st Century K-12 EFL Reform Action Guidelines" that called for student-centered pedagogy (以学生为本) that promotes "learning for application" (学以致用) to meet the needs of modernization. In terms of Educational Informatization, by 2005, all K-12 schools in Shanghai had local network with Internet connections and offered an information technology course, which means that they had achieved the basic component of the "Xiao-xiao-tong 校校通" (School-to School Connection) project. In addition, 160,000 computers had been installed in the schools and the ratio of students to computers was 10:1 in elementary schools, 8:1 in middle schools, and 6:1 in high schools, and the ratio of teachers to computers in K-12 schools was 3:1 (Shanghai Educational Committee, 2005). Currently, Shanghai school districts are continuing to improve their information resource development and innovative use of information technology in classrooms. Therefore, Shanghai is an ideal site to understand how technology is used in its basic education.

SAMPLE AND PROCEDURE

Teacher and student surveys were distributed via paper formats to 1200 in-service teachers and 4600 students (3-5th graders) in 20 elementary schools in Shanghai in fall 2007 and spring 2008. The schools were randomly selected through the assistance of our local research partner who was familiar with the school system. A total of 522 teacher surveys and 2605 student surveys were returned. Among the returned 522 teacher surveys, 15 were invalid; and among the 2605 student surveys, 104 copies were invalid.

All the invalid surveys were excluded from the analysis. Therefore, the analysis was based on the N = 507 (42.3%) completed, valid teacher surveys and N = 2501(54.4%) completed, valid student surveys. The teacher participants represent all subject areas such as language, math, science, music, art, social science, etc. Approximately 98% of the teacher participants have a home computer with Internet access. Among the student sample, there are equal numbers of male and female students.

DATA ANALYSIS

The 507 valid teacher surveys and 2501 valid student surveys were entered into the SPSS (Statistical Program for Social Sciences) 15.0.1 database. In order to enter survey data into the SPSS, for the close-ended question items, a numerical code for each answer was assigned. We first use descriptive analysis to provide analytical profiles and patterns. Frequency tables showing frequency and valid percent of answers for each question item were generated. Valid percent represents the percentage of only the non-missing cases falling into each category. The valid percent was chosen in this study since the valid percent provides a more accurate distribution of the valid cases and the missing values are excluded in this study. In addition, to understand the relationship between teacher attitudes and use of technology, correlation analyses of variables such as teachers' attitudes toward computer technology, their perceptions of the value of technology to their teaching and students' learning, frequency of instructional use of technology and professional use of technology were conducted. To understand the relationship between teachers' teaching styles and their use of technology, correlation analyses of variables such as teacher beliefs of the compatibility of teaching styles and technology, teacher-centered technology use, student-centered technology use were conducted.

FINDINGS

In this section, the findings are organized according to the foci of this analysis: elementary in-service teachers' technology use, their perceived value toward technology, technology support and professional development they receive in technology use. In order to better understand teachers' technology use in classrooms, we also include results from student survey on students' technology readiness and use.

IN-SERVICE TEACHERS' TECHNOLOGY USE

Teachers' most frequent activities on computers for educational and professional purposes included word processing, Internet browsing, and e-mail. More than two-third of the teachers used Word applications and the Internet on a daily basis. And more than 76% of teachers used e-mail weekly. Approximately 30% of participants reported that they used blogs weekly. In addition, the teachers reported that daily, 78.5% of them used computers in the office, 68% used computers in the classroom, and 7.9% used their school computer labs. The percentage of teacher responses regarding their technology use wass displayed in Table 1.

Instructionally, most teachers used computers for teaching preparation and classroom teaching (such as making lesson plans and PPTs and downloading material such as pictures). More than 80% teachers used computer for teaching preparation and 50% teachers used computers for classroom management on weekly basis. About 57% of them reported that they used technology in daily lesson preparation, and 38.6% reported using computers for classroom management, 34.8% for core curriculum skills development, and 22.2% for development of basic computer skills. However, only 6.5% reported using

computers for student to student communication, 5.2% for student inquiry, and 6% for student expression. A comparative analysis of teachers' patterns of technology use (Table 2) showed that teachers were more likely to use technology for teacher-centered purposes (M = 3.76) than student-centered activities (M = 2.59). The frequency of teacher-centered usage was computed as an average of four items (classroom management/ incentives, record keeping, preparation for instruction, core curriculum skills development). The frequency of student-centered usage was computed as an average of five items (remediation, teacher-student communication, student to student communication, student inquiry, student expression).

Table 1: *Frequency of Technology Use by Teachers (N=507)*

Please indicate how much you use each of the following technologies for *educational or professional purposes*	Never(1)	Yearly	Monthly	Weekly	Daily(5)
Word processing	.8%	1.8%	4.9%	25.0%	67.5%
Student-teacher forum (BBS)	27.3%	18.7%	23.5%	19.7%	7.2%
Video/TV network	9.9%	15.0%	18.1%	29.4%	22.3%
World Wide Web	3.6%	3.8%	3.0%	14.0%	74.1%
E-mail	3.8%	5.4%	13.9%	35.7%	39.7%
Blog	40.8%	11.4%	16.2%	17.8%	10.7%
Computers in your school's lab	26.5%	35.0%	16.0%	10.9%	7.9%
Computers in your classroom	7.5%	2.8%	3.2%	16.6%	68.0%
Computers in the offices	9.1%	1.4%	3.0%	6.3%	78.5%

Table 2: *Comparison of Elementary Teachers' Technology Use Patterns*

	N	Minimum	Maximum	Mean	Std. Deviation
Student-centered usage	465	1.00	5.00	2.60	.99
Teacher-centered usage	479	1.00	5.00	3.67	.91
Valid N (listwise)	455				

IN-SERVICE TEACHERS' PERCIEVED VALUE OF AND ATTITUDES TOWARD TECHNOLOGY

In general, the teachers had positive attitudes toward the role of technology in their instruction. As Table 3 demonstrated, most teachers had a favorable perceived value toward technology. 78.4% agreed that computers could help them "connect the curriculum to real world tasks" and 78.3% agreed that computers could "be more productive." 77.7% and 78.3% of them agreed that computers could help them teach innovatively and model an idea or activity respectively. And 68.1% and 71.1% of them agreed that computers coul help them integrate different aspects of the curriculum and direct students' learning respectively.

Table 3: *Teachers' Perceptions of the Effects of Technology on their Teaching (Strongly Disagree =1; Strongly Agree = 6; N=507)*

Computers can help me...	1	2	3	4	5	6	Mean	SD
Integrate different aspects of the curriculum	.8	1.4	3.4	26.3	42.6	25.5	4.85	.94
Teach innovatively	1.4	.8	4.2	22.9	44.0	26.7	4.87	.97
Direct student learning	1.4	.8	5.0	21.8	46.3	24.8	4.85	.97
Model an idea or activity	1.6	.8	3.2	17.1	42.1	35.2	5.03	.99
Connect the curriculum to real world tasks	1.4	.4	2.6	17.2	43.0	35.4	5.06	.94
Be more productive	1.4	.6	3.0	16.7	43.7	34.6	5.05	.95

The teachers also had a positive attitude towards the impact of technology on students' learning. As illustrated in Table 4, over 70% of the teachers thought that computers could help students develop new ways of thinking and critical thinking abilities. Over 80% of the teachers agreed that computers could help students be more productive. And over 90% of them thought that computers could help students gather and organize information, explore a topic, and be more creative.

Table 4: *Teachers' Perceptions of the Effects of Technology on Student Learning (Strongly Disagree =1; Strongly Agree = 6; N=507)*

Computers can help students …	1	2	3	4	5	6	Mean	SD
Develop new ways of thinking	2.2	3.8	6.8	26.7	41.1	19.4	4.59	1.12
Think critically	2.4	6.4	15.2	31.4	31.4	13.2	4.23	1.19
Gather and organize information	1.4	1.0	2.6	13.7	41.6	39.8	5.12	.97
Explore a topic	1.4	1.6	3.2	15.8	44.2	33.8	5.01	1.00
Be more creative	2.6	2.0	6.2	24.0	40.6	24.6	4.72	1.12
Be more productive	1.8	2.2	4.2	23.8	45.0	23.0	4.77	1.04

TECHNOLOGY SUPPORT

The percentages of teacher responses regarding their beliefs about technology support they received in their school district were displayed in Table 5. As the data suggested, half of the teachers held a negative opinion toward the school involvement and support for implementing hardware and software. About 38.9% of the teachers reported that the district provided enough hardware; 41% reported that it provided enough software; and 39.5% believed that it provided a reliable server. In terms of technical support for software and hardware use, about 49.2% of the teachers thought that the district provided good or excellent technical support for hardware use and 33% thought that technical support for hardware was good or excellent. The data suggested that only 27.6% of the teachers were included in decisions about software purchase.

Table 5: *Teachers' Perceptions about Technology Support (N=507)*

Please rate the district in terms of the following:	Poor	Fair	Neutral	Good	Excellent	Mean	SD
Providing technical support for hardware use	4.0	5.3	41.5	35.6	13.6	3.49	.933
Providing a reliable server	6.1	9.9	44.5	31.0	8.5	3.26	.963
Providing enough hardware	4.5	7.5	49.2	29.4	9.5	3.32	.909
Providing enough software	2.9	5.9	50.2	32.4	8.6	3.38	.836
Engaging teachers in decisions about software purchases	7.0	15.5	49.9	20.0	7.6	3.06	.967
Providing professional development for software use	3.3	7.6	56.1	24.8	8.2	3.27	.843

PROFESSIONAL DEVELOPMENT IN TECHNOLOGY

The percentages of teacher responses regarding their beliefs about professional development in technology were displayed in Table 6. Approximately 35.1% of the teachers thought that their professional development in technology helped improve their teaching style and 23.5% reported it as "Don't know." Therefore, the majority of teachers were either unfavorable or unsure about if their technology professional development helped change their teaching style. About 51% of the teachers reported that more than 50% of their technology professional development connected with the content they taught. In terms of the relationship between their professional development and student learning, teachers were even less positive: 45.7% teachers believed that their professional development helped them improve students' engagement in learning while 25.4% thought that it helped them improve student achievement.

Table 6: *Teachers' Views on the Relationship between Technology Professional Development and Teaching and Learning (N=507)*

Approximately what percentage of your technology professional development helped you improve:	0%	25%	50%	75%	100%	Don't Know	Mean	SD
Your teaching style	4.7	37.7	19.3	10.1	4.7	23.5	2.64	1.00
The content you taught	2.4	27.6	32.7	11.0	7.3	18.9	2.92	.97
Students' engagement in learning	2.6	29.4	25.6	11.4	8.7	22.3	2.93	1.05
Student achievement	7.9	27.6	19.5	11.0	4.9	29.0	2.68	1.08

In terms of the benefits of the professional development on their technology use, 58.4% of the teachers thought that the professional development helped them learn technology skills such as word processing and PowerPoint; 31.9% thought that it was helpful for them to learn how to teach technology skills to their students; and 29.4% thought it is helpful to learn to coach other teachers. About 46.3% thought that the professional development helped them learn how to integrate technologies into the curriculum.

INFLUENCE OF IN-SERVICE TEACHERS' ATTITUDES AND SCHOOL SUPPORT ON TEACHERS' USE OF TECHNOLOGY

To understand the impact of teachers' attitudes and schools support toward technology on teachers' frequency of technology use, a correlation analysis was conducted. The results indicated that there was a strong correlation between teachers' attitudes toward technology (i.e., attitudes toward computer technology, their perceptions of the value of technology to their teaching and students' learning, and their perceptions of school technology climate) and the frequency of their technology use for instruction and for general professional purposes in school. According to the correlations in Table 7, teachers' attitudes toward computer technology was strongly correlated to their frequency of technology use in instruction (r = .43, p = .01) and their use of technology for professional purposes (r = .36, p = .01). The results also indicated a strong correlation between perceived effectiveness of school support, either hardware support or software support, and teachers' frequency of technology use for instruction and for professional purposes in school. Teachers' attitudes toward computer technology was also strongly correlated to the school climate for technology use (r = .26, p = .01), hardware support from school district (r = .14, p = .01), and software support from school district (r = .16, p = .01). Teachers' perceptions of the value of technology to their teaching was strongly correlated to their perceptions of the values of technology to their students' learning (r = .65, p = .01) and also strongly correlated to their perceptions of the school technology climate (r = .39, p = .01).

Table 7: *Correlations among Teachers' Attitudes, Frequency of Technology Use, School Climate of Technology Use, and Technology Support*

	Att. to tech	Percept. for teaching	Percept. for student	Freq. of use	Purposes of use	Percept of tech climate	Hard. support	Soft. support
Attitudes to tech		.407(**)	.337(**)	.360(**)	.428(**)	.263(**)	.138(*)	.156(**)
Percept of tech for teaching			.649(**)	.214(**)	.262(**)	.282(**)	.128(**)	
Percept of tech for students				.125(**)	.213(**)	.390(**)	.092(*)	
Frequency of use					.421(**)	.116(*)	.170(**)	.145(**)
Purposes of use						.170(**)	.205(**)	.189(**)
Perception of tech climate							.309(**)	.296(**)
Hardware Support								.788(**)
Software Support								

** Correlation is significant at the 0.01 level (2-tailed).;
* Correlation is significant at the 0.05 level (2-tailed).

Our data also showed that there was a strong correlation between teacher beliefs about compatibility of his/her teaching style and technology and teacher-centered use of technology (r = .419, p = .01) as well as student-centered use of technology (r = .373, p = .01) (see Table 8). That is, when teachers had more positive attitudes toward technology, they were more likely to use technology more not only for teaching preparation but also

for student-centered activities. This finding on teacher beliefs contradicted with teachers' actual practices of technology use described above.

Table 8: *The Relationship between Teacher Compatibility Belief and their Orientation of Technology Use*

	Compatibility belief	Student-centered usage	Teacher-centered usage
Compatibility belief		.373(**)	.419(**)
Student-centered usage	.373(**)		.514(**)
Teacher-centered usage	.419(**)	.514(**)	

** Correlation is significant at the 0.01 level (2-tailed).

ELEMENTARY STUDENTS' READINESS IN TECHNOLOGY

Our survey on students shows that most students have mastered the basic skills in technology use. About 87% of the students report that they have learned to use computer for more than one year (See Table 9). As Table 10 indicates, most of the students (89.1%) have mastered basic computer skills in using Windows and Word processing; 81.2% of them are able to use multimedia software such as video and audio players and PowerPoint; and 74.6% of them are able to the Internet. In addition, more than 70% students indicate that they like using the Internet, and 95% of them think that the Internet is helpful for their academic studies. Around 80% of students report that they have used the search function and the Internet to help them do their homework.

Table 9: *Students' Years of Learning Computer (N=2501)*

	0 Year	1 Year	2 Year	More than 3 Years
Students' years of learning computer	13.1%	30.7%	24.5%	31.5%

Table 10: *Students' view on their technological skills (N=2501)*

Computer Skills	Very well	Average	Beginner	A little
Basic Skills	33.9%	55.2%	8.3%	2.6%
Multimedia Skills	34.3%	46.9%	13.4%	5.4%
Internet skills	30.5%	44.1%	22.2%	3.1%

ELEMENTARY STUDENTS' ACCESS TO TECHNOLOGY

On average, most elementary students used computer less than 4 hours at either home or school each week. Only 3% and 1% of students reported that they used computer more than 10 hours weekly at home and school (see Table 11). While 82% of the students reported that they usually accessed to computer and the Internet at home, only 8% of students reported that they usually had computer or Internet access at school. It seems, for

elementary students in China, home is a main environment for computer and Internet access while schools still do not provide sufficient access for those kids.

Table 11: *Students' time of using computers (N=2501)*

Location	less than 4 hours	4 to 10 hours	more than 10 hours
At home	79.1	17.9	3.0
At school	95.1	3.8	1.1

DISCUSSION

The data in this study suggested that Chinese elementary in-service teachers possessed high levels of proficiency in information technology and used computer technology, such as Word processing, e-mail, and the Internet on a regular basis. The findings also indicated a great majority of in-service teachers held positive attitudes toward technology. They believed that technology could help them connect the curriculum to real world tasks and make their teaching more productive. The results also indicated that the in-service teachers' attitudes toward technology are correlated to their frequency of using technology and technological support from school district. That is, in-service teachers' more positive attitudes regarding technology and technology support from school district leads to more frequent use of technology for their professional work. School culture of technology use is also significantly correlated to teachers' frequency of technology use, and teachers' perceptions of the value of technology to their teaching and to students' learning. That is, if school culture of technology use is more supportive, teachers are more likely to value technology's roles in the teaching and learning process.

However, consistent to previous studies (e.g., Chen, 2004; Dexter, Anderson, & Becker, 1999; Judson, 2006), this study revealed a disconnection between in-service teachers' reported beliefs and attitudes and their technology use in classroom. Although the teachers held positive attitudes toward technology and perceived technology to be valuable to students' learning, they used technology more for teacher-centered purposes and activities such as preparation of instruction, creating lesson plan, downloading materials, and make PowerPoint presentation and instructional activities that using computer as students' tool for exploration and expression were rare. Therefore, technology was primarily used as a teacher's instructional delivery tool, not a student's learning tool. While the in-service teachers used the computer and projector to present segments of the lessons (such as PowerPoint or Flash), students were rarely engaged in any technology use for key content learning. Instructional activities that using computer as students' tool for exploration and expression were rare—less than 7% of the teachers used technology for student-student communication, student inquiry or student expression. Students' data further confirmed low use of technology for student-centered purposes. The data indicate that the main place for students' access to the computer was home, not the school as we expected. Students' attitudes toward technology were favorable. Most of them reported that they like the Internet-based activities and believe the Internet was helpful for their studies. In fact, most of them had been tried to use the search function to help them complete their homework. However, most students used computers less than 4 hours each week in school. The findings suggest that in Chinese elementary schools, technology is still primarily used as a teacher's tool, rather than a student's tool.

Therefore, different from the "high access, low use" paradox observed in other studies (Bauer and Kenton, 2005; Cuban, Kirkpatrick, & Peck, 2001; Shi & Bichelmeyer, 2007; Wozney, Venkatesh, & Abrami, 2006; Zhang & Liu, 2006; Zhong & Shen, 2002), our study showed high access but high use for teacher-centered purposes. We believe that the Chinese in-service teachers' technology use orientation might be influenced by the traditional teacher-centered Chinese education culture in which classrooms are primarily dominated by teacher, text, and test. According to Li, et al. (2011), despite the continuous effort to reform the educational systems, the curriculum in teacher education in China has been overwhelmingly focused on academic subject knowledge with little attention to professional knowledge such as Putonghua proficiency or use of audio-visual equipment or teaching methods (including lesson planning and time management); Instruction in school is overwhelmingly exam-driven and teachers still teach to the test. In this test culture, it is not surprising that new technologies are often used for delivering materials but not to enrich students' learning experience -- as teaching accessories to support a predominantly teacher-driven class with minimum interaction between students and technology (Zhong & Shen, 2002).

In addition to the test-driven culture, lack of effective teacher professional development that supports in-service teachers' technology integration also influences teachers' technology use in instruction. As the data suggests, the Chinese elementary in-service teachers were negative about their districts' support in providing stable hardware and software or effective professional development in technology use. Most in-service teachers found most of the technology professional development irrelevant to their curriculum, content, or student engagement and learning. These perceptions suggest that the existing technology infrastructure and associated professional development for these teachers were not ideal or effective. More stable software and hardware support and training in pedagogical design to integrate technology into the curriculum and student-centered activities are needed.

CONCLUSION

These findings from the Shanghai in-service teachers suggest there needs a paradigm change in teachers' use of technology—it must be transitioned from a teaching tool to a student learning tool. To facilitate such a paradigm shift, improving in-service teachers' pedagogical design competence and providing corresponding training on technology integration are a must. First, schools cannot just purchase popular hardware or software; they have to promote teachers' competence in instructional design to achieve optimum outcome that balances technology, content curriculum, and pedagogy. We believe that technology and design are interwoven with each other. Technology, as a vehicle for enriched resources, authentic contexts, and powerful tools, provides support for engaging environments and innovative learning activities; on the other hand, design provides new directions for technology to be activated and integrated into regular teaching and learning. Therefore, as Zhang and Shen (2002) suggest, pedagogical innovations should start at the design level to involve curriculum writers, practitioners, teachers and students in the process of awareness raising, programming and classroom implementation. Through improving in-service teachers' competence in pedagogical design and providing corresponding professional development, we believe a new way of teaching and learning using new technologies will be seen in China's basic education system.

Second, we believe that exploring the learning potentials that exist at the intersection among subject matters, technology integration, and student-centered learning is very important. Schools/districts should organize workshops to support in-service teachers on how to promote student-centered learning where technology is used as a learning tool and

a student-centered knowledge construction tool. Effective professional development plays an important role in supporting such technology integration. Traditional professional development primarily focusing on technological operation is not enough today; teachers need more exposure to pedagogically appropriate technology use that promotes student-centered learning. In his analysis of 174 case studies of innovative pedagogical practices using technology from 28 participating countries, Kozma (2003) concludes that when teachers go beyond these basic practices and use technology to also plan and prepare instruction and collaborate with outside actors, and to allow students to also use technology to conduct research projects, analyze data, solve problems, design products, and assess their own work, students are more likely to develop problem solving, information management, collaboration, and communication skills that are needed for the 21st century. Therefore, in addition to the instructional design skills, to better integrate technology to promote student learning, teachers must change their traditional role from knowledge transmitters and information gatekeepers to facilitators, guides and co-learners. As Zhong and Shen (2002) argue, pedagogical changes would only take place with a changed perception of the process of learning and teaching. Thus, in order for technology to have a real impact on student learning, the issue is not whether technology is used by teachers, but is how it is used and designed in alignment with more effective pedagogy, content, and context that is centered on students as explorers, producers, cognitive apprentices, and sometimes teachers (Jones, Valdez, Nowakowski, & Rasmussen, 1995).

Finally, since the culture of technology use in schools is perceived to influence the in-service teachers' technology use, teacher professional development on technology integration also needs to promote a supportive culture of technology use through forming teacher learning communities in which teachers from the same or different schools or grade levels or subject areas can meet on a regular basis for the purposes of learning, joint lesson planning, and problem solving (Desimone, 2008; Wei et al., 2009). This kind of learning communities provides a broader base for understanding of and support for technology integration in instruction and fosters a better culture of technology use at the school level which in turn will help in-service teachers' use of technology in their classrooms.

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