

A study of the tablet computer's application in K-12 schools in China

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ABSTRACT

As an emerging mobile terminal, the tablet computer has begun to enter into the educational system. With the aim of having a better understanding of the application and people's perspectives on the new technology in K-12 schools in China, a survey was conducted to investigate the tablet computer's application, user's perspectives and requirements among K-12 students, teachers and educational administrators in developed areas in China. The findings of the study showed that K-12 students, teachers, and educational administrators, still need deeper understanding of the new technology's application in K-12 education. In addition, this study indicated that in order to introduce tablet computers into K-12 education in China and other developing areas, more attention should be paid to the comprehensive design of the whole educational system, including the design of the learning support system and instructional strategies, as well as the design and development of educational software and resources.

Keywords: *tablet computer; mobile learning; K-12 school; survey; educational eco-system*

INTRODUCTION

With the developing technology, the modes of learning have evolved from learning solely in the classroom to distance learning and the virtual classroom, and from being exclusive for the elite to being accessible to everyone (Nordin, Embi & Yunus 2010). Mobile learning has been defined as "learning that happens without being limited at a fixed location" and "learning that takes advantage of mobile technologies" (Sharples 2000, p. 183), such as PDAs, cellular phones, tablet computers, iPods or ultra notebook computers, which make learning more flexible so that students can learn from anywhere and at anytime. With mobile technology, the educational environment is becoming more ubiquitous and better in instant connectivity, personalization, and forming self-directed learning-communities (Kwon & Lee 2010).

For the advantages of flexibility and triggering learners' learning motivations, mobile learning has developed rapidly all over the world. According to a report from Ambient Insight (Adkins 2011), the worldwide mobile learning market reached \$3.2 billion in 2010, and will reach \$9.1 billion by 2015. The five-year compound annual growth rate (CAGR) is a robust 21.9%.

The concept of mobile learning was introduced in China in 2000 via Desmond Keegan's presentation *Distance Education, Digital Education, Mobile Learning* at the 40th anniversary of Shanghai Radio and Television University (Ye, Xu & Xu 2004). Since then, the offering of mobile learning services appears to be a new marketing strategy for mobile manufacturers to attract customers and to generate new revenue (Ye, Xu & Xu 2004; Sun 2008). Since 2010, China has

become one of the countries with the highest mobile learning growth rate (over 60%) (Adkins 2011). Ambient Insight (Adkins 2011) also predicted that by 2015, China would be the second largest buying country of mobile learning products after the US.

As one of many kinds of mobile devices, tablet computers received particular attention at the International Electronic Consumer Electronics Show (CES 2011, Las Vegas, USA) in February 2011. In May 2011, *Los Angeles Times* reported that a big change has been taking place across the computer industry since 2011 (Sarno 2011). The PC era, which began three decades ago, has been giving way to what Apple's late CEO Steve Jobs called "the post-PC era". The new era is all about mobile devices such as tablet computers and smartphones.

With the development of the Internet and theoretical studies on mobile learning, tablet computers have been proven to be very useful in education because of their portability, ease of note taking (EL-Gayar, Moran & Hawkes 2011), the convenient wireless access, and multiple applications (Ifenthaler & Schweinbenz 2013; Sullivan 2013). Many countries are also trying to introduce tablet computers into education. For example, in the US, the New York City public school system ordered more than 2,000 iPads (Hu 2011); Thailand signed a deal to purchase 400,000 tablet computers for primary schools (The Economics 2012); K-12 schools in developed areas in China have provided tablet computers for iPad-assisted trial courses (Shi 2011; Xinhuanet 2012).

The instructional design used to improve students' learning achievements, and the students' attitudes towards using mobile devices and mobile learning approaches (Chen, Kao & Sheu 2003), are important and challenging issues in mobile learning (Chu, Hwang & Tsai 2010; Hwang, Kuo, Yin & Chuang 2010). Laouris and Laouri (2006) also described the move to mobile learning as a change of mindset when designing and planning learning environments. According to educational ecological theory (Zhao & Frank 2003), four metaphorical equivalents are used to describe the issue of new technology use in school and the ecological issues: a) classrooms or schools as ecosystems; b) computer usage as living species; c) teachers as members of a keystone species; and d) external educational innovations as invasions of exotic species. Whether exotic species can survive in a new eco-system depends on whether they can be in symbolic coordination with the whole eco-system. In this sense, as an external educational innovation, whether a new technology can be accepted and really improve the efficiency of learning depends on its relationship with other elements in the whole eco-system of schools. Like many educational reform efforts, the introduction of technology in schools has been less than successful, because of the pressure that the innovations bring to teachers, students, administrators and other elements in the whole educational eco-system. In the trend that mobile learning is rapidly developing in China, more and more people have seen the educational potential of tablet computers. It is necessary to understand the dynamics of the elements in the educational system, in order to make corresponding adjustments based on the innovations the tablet computers have brought.

This study aimed at exploring the potential problems faced by three groups of people, how they understood and applied tablet computers in education. The three groups consisted of students, teachers, and educational administrators, who are three critical stakeholders in the educational eco-system in K-12 schools. This study also aimed at providing practical guidelines to schools and families, who would be tablet computers' potential users. A related purpose of this study was to explore the implications of introducing tablet computers into K-12 education in developing countries. By sharing the findings of this study, useful information can be gained that will facilitate the adoption of tablet computers in K-12 education in the developing areas in China and other developing countries where tablet computers are not yet widely used.

The research questions in this study included, (1) What were students', teachers', and educational administrators' attitudes towards tablet computer's application in education? (2) How

did students, teachers, and educational administrators use tablet computers? (3) What did students, teachers, and educational administrators need for using tablet computers in education?

METHOD

Participants

Random number generator was used to select three groups of participants through local public educational system in developed areas in China. The local public educational system granted permission to the researchers to send them the link of the anonymous online survey via email or instant messaging. The participants were students, teachers, and educational administrators in K-12 schools in developed areas in China, where the advanced economic conditions and sufficient educational funds from local governments have made tablet computers popular in K-12 learning and work.

Students

A total of 114 K-12 students participated in this study. Among the 114 students, 83.3% grew up in most developed areas in China (e. g. Beijing, Guangzhou and Shenzhen). A total of 90.4% of the students were secondary or high school students, while 9.6% were elementary school students.

Teachers

Forty-seven K-12 teachers from developed areas in China were involved in this study. Among them, 68.1% taught social sciences, and 31.9% taught sciences.

Educational administrators

A total of 68 educational administrators, who were principals and curriculum supervisors in K-12 schools from the developed areas in Beijing and Shandong, participated in this study.

Procedure

This study sought to identify students, teachers, and educational administrators' perspectives of tablet computers, together with tablet computers' application among the three groups of users.

All the participants volunteered for this study, and they completed the online anonymous survey. A group of 6 Chinese experts in instructional technology engaged in three rounds of discussion to arrive at the consensus on the survey structure and questions. The survey questions for the three groups of participants, who were students, teachers and educational administrators, varied slightly based on the specific characteristics and the requirements of the three groups of tablet computer users. All three surveys contained close-ended questions about the participants' understanding of tablet computers, such as the acceptance of the device, their preferences comparing tablet computers with other equipment, and the role of tablet computers to support learning and work. The second part of close-ended questions focused on participants' application of tablet computers, including the frequency and the average time used per week, as well as the locations and most frequently used functions. The last part of close-ended questions asked the users about their requirements of introducing tablet computers into their learning, teaching and work.

RESULTS

Attitudes towards tablet computers

Based on the results of the survey, most of the participants among each group had heard of tablet computers. They also held positive attitudes towards introducing them into learning and work.

As presented in Table 1, among the 114 students, 93.0% indicated that they had heard of tablet computers, and 66% agreed that tablet computers can better support their learning compared with other equipment. In addition, 54.4% stated that the tablet computer would be an important learning tool, and 79% stated that it would increase their learning interests.

Table 1: Students' attitudes towards tablet computers

Students' attitudes	Percentage		
	Agree	Neutral	Disagree
I've heard of tablet computers.	93%	2.6%	4.4%
Tablet computers can help me with my study better than other devices.	57.9%	29.8%	12.3%
I don't know how tablet computers can support learning.	27.5%	24.6%	57.9%
Tablet computers will become an important tool to supporting learning.	54.4%	43.8%	1.8%
Tablet computers will increase my interest.	69.3%	26.3%	4.4%
Tablet computers will distract learning.	6.1%	43%	50.9%

Note. Total=47, Neutral = neither agree nor disagree

Table 2 presents findings from the teachers' survey. Nearly 80% of the teachers had heard of tablet computers, and 57.4% knew their advantages in instruction, but nearly half of the teachers didn't know their application into teaching and learning. Moreover, among the 47 teachers involved in this study, fewer than 20% indicated they had confidence in introducing tablet computers into instruction (see Table 2). More than half were not sure whether tablet computers could be important tools to support teaching and learning, or more suitable for students learning at home than in classroom. Up to 53.2% expressed hesitation about applying tablet computers in their instruction. The teachers' hesitation was strongly related to their poor knowledge about tablet computers and their instructional functions.

Table 2: Teachers' attitudes towards tablet computers

Teachers' attitudes	Percentage		
	Agree	Neutral	Disagree
I've heard of tablet computers.	78.7%	6.4%	14.9%
I know the advantages of tablet computers in instruction.	57.4%	21.3%	21.3%
I feel confused about using tablet computers in instruction.	53.2%	29.8%	17.1%
Tablet computers will become an important tool in instruction.	44.7%	55.3%	0
It's more convenient for students to use tablet computers after class or at home than in classroom.	23.4%	68.1%	8.5%

Note. Total=47, Neutral = neither agree nor disagree

Compared with teachers, educational administrators had more positive attitudes towards tablet computers' effects in education. As demonstrated in Table 3, among the 68 administrators who participated in this study, 92.6% had heard of tablet computers; nearly 78% agreed that they would be important learning tools in future. Additionally, 76.5% believed great innovations would happen in teaching and learning after tablet computers' introduction into classroom learning. However, despite 61.8% of the educational administrators expressed their willingness to introduce tablet computers into learning support, 33.8% expressed their hesitation, and 47.1% were not sure whether it would be suitable to introduce tablet computers into education in large scale.

Table 3: Educational administrator's attitudes towards tablet computers

Educational administrators' attitudes	Percentage		
	Agree	Neutral	Disagree
I've heard of tablet computers.	92.6%	5.9%	1.5%
I believe the tablet computer would be an important learning tool for students in the future.	77.9%	20.6%	1.5%
Tablet computers would bring significant changes to both teaching and learning.	76.5%	23.5%	0
I am willing to make an attempt to introduce tablet computers to support students' learning in my school.	61.8%	33.8%	4.4%
I think it is the right time for tablet computers to enter into education in large scale.	48.5%	47.1%	4.4%

Note. Total=68, Neutral = neither agree nor disagree

The application of tablet computers

The students' survey showed that tablet computers were not universally used in students' learning and daily lives. Table 4 showed that only 29.8% had their own tablet computers, and more than 60% had never used tablet computers or "occasionally used" them. Most students used tablet computers mainly at home (see Table 5) and only for entertainment, not for learning (see Table 6).

Table 4: The frequency of students using tablet computers

Frequency	Percentage
Never	26.3%
Occasionally, several times a month	35.1%
Often, several times a week	17.5%
Every day	13.2%
Other	7.9%

Note. Other=open-ended responses, total=114

Table 5: Locations of students using tablet computers

Location	Percentage
Never	26.3%
In class	14.9%
After class	8.8%
At home	36.8%
Anywhere	13.2%

Note. Total=114

Table 6: Popular uses of tablet computers among students

Uses	Percentage
Never	26.3%
Entertainment (playing games, listening to music, watching TV series)	34.2%
Learning (material searching, e-book reading, note taking, etc.)	19.3%
Management (time management, process management, etc.)	0.9%
Social activities (instant communication, online social networking)	6.1%
Other uses (open-ended responses)	13.2%

Note. Total=114

Teachers' application of tablet computers in instruction was not universal either. This was reflected in the finding that only 36.2% of the teachers reported they had the experience of using them, and only 27.2% had the experience of observing or participating in classroom learning activities with the support of tablet computers.

In the educational administrators' survey, only 25.0% had adjusted their schools' learning support system to prepare for introducing tablet computers into education, and only 26.5% claimed they had instructional practices about tablet computers in their schools.

Needs regarding tablet computers

The students' survey reflected that the students strongly desired making tablet computers play a greater role in learning, and also reflected that students needed guidance to understand their functions, as well as the applications in learning.

Table 7: Students' needs regarding tablet computers

Students' needs	Percentage		
	Agree	Neutral	Disagree
More knowledge about tablet computers	65.8%	15.8%	18.4%
Ways of tablet computers helping my study	64.9%	18.4%	16.7%
More learning resources	84.2%	11.4%)	4.4%
More learning software	86%	8.8%	5.3%

Note. Total=114, neutral = neither agree or disagree

As shown in Table 7, 86% of students expressed their desire for more learning apps, and 84.2% required access to more learning resources through tablet computers. In addition, 65.8% claimed they needed more knowledge about tablet computers, and 64.9% expressed they needed to know how to improve their learning efficiency with tablet computers.

The teachers were concerned about how to facilitate instruction with tablet computers. They also desired more guidance on how to increase their instructional efficiency with tablet computers. Table 8 showed that 91.5% expected that tablet computers can provide various functions to support instruction, and more learning resources can be get access to through tablet computer; 89.4% desired corresponding instructional strategies; 95.8% claimed they needed to know the learning activities which can be implemented with the support of tablet computers, and 93.6% desired technical support.

Table 8: Teachers' needs regarding tablet computers

Teachers' needs	Percentage		
	Agree	Neutral	Disagree
Diverse digital tools which could be used in tablet computers to support my teaching practice and students' learning activities	91.5%	8.5%	0
Knowledge about instructional mode and strategies regarding tablet computers	89.4%	8.5%	2.1%
More learning resources which could used in tablet computers	91.5%	8.5%	0
Knowledge about the role tablet computers play in teaching practice	91.5%	8.5%	0%
Knowledge about the role tablet computer can play in students' learning	91.5%	4.3%	4.3%
Knowledge about the learning activities regarding tablet computers	95.8%	4.3%	0
Technical support in the maintenance and updating of tablet computers	93.6%	2.1%	4.3%

Note. Total=47, neutral = neither agree or disagree

Nearly 90% of the educational administrators expressed their desire for systematic design approaches to integrate tablet computers into their schools' education, and 73.8% expected to understand the benefits and challenges of making such a revolution.

DISCUSSION

In this study, the aim was to find the perspectives and requirements of tablet computers for teaching and learning among 3 different groups of users: students, teachers and educational administrators. The findings reveal that much more work is required to be able to apply tablet computers in education in current China.

Although mobile learning has received great attention in the educational innovation of K-12 schools in China, and the schools in developed areas have made a great investment in introducing mobile learning devices into classroom instruction, much more works is required to popularizing mobile leaning in China. First of all, the popularity of tablet computers is still low. Only a few students in developed areas had their own tablet computers; most schools were not

equipped with tablet computers, and few educational activities were implemented with their support. Second, the users in the educational system, including the students, teachers and educational administrators, lacked a deep and comprehensive understanding about the application of tablet computers in education. The findings also revealed that although students agreed that tablet computers could be used to improve their learning and showed interests in it, they lacked the desired understanding of tablet computers' educational effects, but used them as the tools for entertainment. In addition, the teachers and educational administrators also lacked desired understanding of tablet computer's application in teaching and learning. These superficial understandings at first caused them to hesitate in judging tablet computers' educational potential, and then affected their decision about whether to introduce tablet computers into education.

When a new technology is introduced into an educational eco-system, other elements in the whole system, such as students, teachers and educational administrators, all face the pressure of adapting to these changes. In this sense, simply equipping and delivering devices to students and teachers is not enough. Similarly, the One Child per Laptop (OCPL) project has received criticism for only simply giving underprivileged children laptops, but not providing teachers' training and ongoing support (Warschauer & Ames 2010). Nevertheless, it is of great necessity to make corresponding adjustment to help teachers, students and educational administrators adapt to the changes. According to the finding of this study, students, teachers, and educational administrators need educational resources and tools designed and developed specifically for using tablet computers in education, and it is an important guarantee that tablet computers support teaching and learning.

Moreover, what teachers are concerned with most is how tablet computers improve their instructional effect and students' learning efficiency. New instructional strategies are also required to facilitate teachers to improve their instructional effect with the support of tablet computers, and it is also what the future work should focus on. In sum, the design and development of educational resources and tools for tablet computers, the design and training of the instructional strategies of using tablet computers in teaching and learning, are the adjustment should be made to the changes tablet computers, the new technology, has made in the whole educational eco-system.

However, a potential limitation to this study was that due to the difficulty of sampling, there were limitations on the numbers and the geographic diversity of the samples. Compared with the large group of tablet computer users all over China, the sample size for this study was small, and only from some of the developed areas. An additional limitation to this study was that the participants' applications and understandings among different tablet computers, such as iPad, Android Tablet, eBook Reader, etc, was not examined. Recognizing the potential limitations, in future work, more effort should be paid on expanding the sample size, in order to increase the validity and reliability of the study. Moreover, the future study would pay more focus on examining the comparative benefits of different tablet computers, in order to provide lessons for K-12 users to make appropriate choices.

As mentioned previously, when a new technology is introduced into a new educational system, many innovations may be brought about to other elements in the whole system. If the innovations and the impacts they have brought cannot be treated well, the future of the new technology's existence in the educational system would not be optimistic. In current China and other developing countries, many schools have invested millions of dollars for purchased devices for the "technological innovation", but it is a common problem that little attention has been paid on the adjustment of other elements in the educational system, such as the training, software update and corresponding strategies implementation. As a result, the students and teachers still prefer the "old technology" in teaching and learning due to their superficial understanding of the new technology, as well as the impact caused by the introduction of it. That is why in many schools in

China, the practical application is still not deep or wide. In the process of mobile learning being introduced into education in China and other developing countries, the same problem will be faced as with other new technologies, and it will be an inevitable process that many discomforts and impacts will occur. Therefore, it should be noted that "technology innovation" requires more work than merely purchasing the new devices for the school, and the adjustment on the other aspects in order to improve users' understanding and application skills are more important and worth more effort.

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