Adoption of mobile technology for language learning: Teacher attitudes and challenges

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*Recent researchers have advocated mobile technology for education. The adoption of technology in language learning has advanced from Computer Assisted Language Learning (**CALL**) to Mobile Assisted Language Learning (**MALL**). This study examined the fundamental issues in deploying mobile technology mediated language learning, including teacher attitudes and challenges faced, for a feasible adoption approach. Six pre-service teachers were introduced to a mobile device, and asked to collaboratively design and implement **MALL**. Perceived usefulness, ease of use of the device, and their propensity to innovate the device were surveyed. Following adoption, an interview was conducted to address the challenges teachers faced. The results echoed literature findings on teacher adoption of other technologies and presented some new findings. For example, organizational effort should focus on providing knowledge and experience of mobile technology to teachers, or arranging a special design task for teacher participation. Using mobile technology in the classroom reveals pedagogical challenges such as balancing the attractiveness of the device with student engagement in the curriculum. Finally, this study also recommends a special supportive team to facilitate teacher adoption of mobile technology. Based on these preliminary results, this study hopes for better deployment of future mobile technology mediated language learning.*

Introduction

Chinnery (2006) and Zhao (2005) reported language-learning capacities in technology, including **PDA**s, multimedia cellular phones, **MP3** players, and **DVD** players.

These technologies have been explored and used for language learning due to their popularity. For example, researchers expect learners to use their mobile phones, simply because they own one (Hsu, Wang, & Comac, 2008). Mobile devices have become commonplace tools in a wide array of settings that may include teaching and learning alongside work and leisure, in both formal and informal settings. Stockwell (2008) predicted mobile learning in the next generation because of the prevalence of mobile devices among learners using technologies. If a mobile technology or device becomes popular, then it is worth exploring for possible application to language learning. Cook, Holley, and Andrew (2007) reported student attraction to cutting-edge technology, even if the device does not work perfectly for the intended task, because students felt instructors had attempted something novel. Given the success of podcasting (Abdous, Camarena, & Facer, 2009; Harris & Park, 2008; Rosell-Aguilar, 2007), this study explored the potential of mobile device in language learning.

Mobile assisted language learning (**MALL**) has significantly transformed language teaching and learning (Kukulska-Hulme, 2009). Researchers have exploited **MALL** in many fields of language learning such as vocabulary (Chen & Chung 2008; Levy & Kennedy, 2005; Lu, 2008), reading comprehension (Chen & Hsu 2008), writing proficiency (Morita, 2003), English listening skills (Edirisingha *et al.,* 2007), and pronunciation (Ducate & Lomicka, 2009). Most research in **MALL** has focused on how mobile technology can provide various language learning experiences. However, few studies have explored what language teachers can do to employ mobile technology in teaching.

Research has extensively explored teacher adoption of technologies. Kay (2007) formatively analyzed how pre-service teachers learn to use technology, Kessler (2007) explored formal and informal **CALL** preparation and teacher attitudes toward technology, Kessler and Plakans (2008) studied the relationship between teacher confidence with **CALL** and their innovative and integrated use of technology, and Chou (2005) examined the design of good institutional contexts for innovation in a technology-mediated learning environment. This line of research provides valuable suggestions for adopting technologies in education from various perspectives.

Because of the widespread ownership of mobile devices, mobile technology adoption may differ from other technologies. Most young generation teachers are skilled mobile users because of the prevalence of mobile devices. Therefore, the issue of teacher adoption of mobile technology in teaching should not focus on teacher knowledge about technology, but on using mobile technology as a tool for teaching and learning. This study explored how pre-service teachers utilize mobile a device for educational purposes, and focused on employing a mobile device in teaching English as a foreign language.

Under the topic of investigating pre-service teacher use of technologies, research concerning computer technologies has shown that the knowledge of and attitude toward the technology may determine the degree of teacher success in using technology following instructional technology teacher preparation (Atkins & Vasu, 2000; Kessler & Plakans, 2008; Milbrath & Kinzie, 2000). Based on the results of these related studies, the present study examined how pre-service teachers perceive and use mobile technology during the technology adoption process.

Research questions

This study addressed two research questions as follows:

1. Can using, designing, and implementing mobile technology enhance the attitude of

pre-service teachers toward that technology and the corresponding propensity to inno-vate pedagogically with that technology?

2. What challenges do pre-service teachers face during the process of learning, designing, and implementing mobile technology?

Attitude and propensity to innovate

Various fields and pedagogies have proven the benefits of technology; however, teachers may or may not accept technology due to personal factors (Teo, Lee, & Chai , 2008). Luan, Fung, Nawawi, and Hong (2005) pointed out that the likelihood of teachers using tech-nology effectively and successfully is highly related to their attitudes toward the technol-ogy. That is, no matter how sophisticated and powerful the technology is, the extent of its implementation depends on the positive attitude of teachers toward it (Huang & Liaw, 2005). Nichols (2008) argued that the success of technology facilitated learning depends on teacher acceptance. Perceived usefulness (**PU**) is defined as the degree to which a person believes using a particular technology will enhance his or her job performance (Davis, 1989; Teo *et al.,* 2008). People tend to use an application that they believe will boost their job performance. Perceived ease of use (**PEU**) refers to the degree to which a person believes that using a particular technology will be effortless (Davis, 1989; Teo *et al.,* 2008). These two variables are fundamental determinants of user acceptance and future use (Davis, 1989); therefore, they serve as factors in measuring attitude toward a technology in this study.

Further understanding of possible instructor implementation of a teaching and learning device refers to teacher "propensity" to innovate. Nambisan, Agarwal, and Tanniru (1999) described instructor propensity to innovate in educational technology. The three anteced-ents include technology cognizance (**TC**), ability to explore (**AE**), and intention to explore a technology (**IE**). Among these three, technology cognizance offers the key to understand teacher intention for innovative adoption of a technology in a teaching context. Technology cognizance relates to user knowledge of technology capabilities, its features, potential use, and costs and benefits (Chou, 2005). That is, users with a propensity to innovate typi-cally understand the technology, the tasks involved, and the environment within which the system will operate (Chou, 2005; Nambisan *et al.,* 1999). Understanding the power of teachers to develop innovative technology-supported pedagogy requires examining teacher propensity to innovate.

The above factors are viewed as neither stable nor intrinsic personal traits, but as a "learned" disposition evolving interactively as personal experience and knowledge change over time (Nambisan *et al.,* 1999). Therefore, this study examined these aforementioned mechanisms of "learning" in affecting teacher attitude and propensity to innovate for adopt-ing mobile technology.

Approach to adoption

Because of research findings that teachers need time to reflect on new learning and inte-grate this new knowledge into their practice through experimentation, and then reflect on these outcomes to make appropriate adjustments, a hands-on approach for using technol-ogy should be provided (Gooler, Kautzer, & Knuth, 2000; Rosenfeld & Martinez-Pons, 2005). In other words, after initial training regarding the features of a mobile device, teachers require an experimental practice period to tune their understanding of the device. Therefore,

this study assumed the necessity of appropriate hands-on experience, related reflection, and integration in a sample practice design.

Kay (2007) proposed two effective strategies to help pre-service teachers adopt a technology in their teaching: collaboration and using authentic tasks. Egbert, Paulus, and Nakamichi (2002) referred to these strategies as peer collaboration in situated learning contexts. Teachers learn best in a collaborative and authentic context by seeing methods used in actual classrooms, by trying out mobile techniques and receiving feedback on their efforts, and by observing and talking with fellow teachers (Egbert *et al.,* 2002). Granger, Morbey, Lotherington, Owston, and Wideman (2002) suggested supportive and collaborative relationships among teachers and a commitment to pedagogically sound implementation of mobile technology as highly useful factors for successful **ICT** implementation. By interacting with the environment, the tool, and other people, pre-service teachers can actively adopt a mobile device based on their prior experiences and existing knowledge structures.

Using authentic tasks also refers to contextualized technology knowledge. Research in the computer field has shown that while fundamental skills are necessary for technology literacy, teachers may not need to develop advanced skills to be successful **CALL** practitioners (Hubbard, 2008). Peters (2006) identified the need to prepare teachers to use technology effectively in the classroom rather than prepare them to be technical or technology experts. Teachers need sufficient background and familiarity with language teaching technology solutions, rather than simply expanding their technology knowledge in general (Hegelheimer, 2006; Hubbard, 2008; Kessler & Plakans, 2008; Levy & Stockwell, 2006). That is, **CALL** teacher preparation may benefit from a focus on developing contextualized confidence within certain teaching domains or types of technology, rather than expecting teachers to develop a high level of confidence in technology across domains (Kessler & Plakans, 2008). When teacher experiences are situated in authentic teaching problems and experiences, teachers will learn about and implement technology more successfully in their future classrooms (Kim & Hannafin, 2008). Therefore, teachers in this study were provided with a real context for performing authentic tasks.

Research design

The current research attempts to explore pre-service teacher adoption of mobile technology into teaching by focusing on how teacher perceptions form and change over time with their adoption field experience. This study proposes a sequence of actions for participating teachers to incorporate mobile technology into their teaching, and analyzes their attitudes toward that technology and pedagogical adoption, while challenging the design task.

Procedure

This research design involves two phases. Phase one introduces a mobile device to participating pre-service teachers. Following a briefing about the technical specifications and operations of the device, the pre-service teachers were questioned on their attitude toward the device, and their propensity to innovate the device. Phase two is a two-month trial period for pre-service teachers to familiarize themselves with the device and to design, implement, and carry out a learning practice for the device at the end of this phase. These teachers were required to adopt the mobile technology into their **EFL** curriculum collaboratively in a real

context and were later surveyed again about their attitude toward and their propensity to innovate the device. In so doing, this study intended to investigate how teacher attitude and propensity to innovate vary during the proposed deployment process. Following adoption, the teachers were interviewed about the challenges they faced in implementing a mobile device, and underwent a semi-structured interview to provide qualitative information.

Guidelines for teacher adoption

Because these teachers majored in English education, they were reminded to develop their materials based on the hypotheses about ideal conditions for second language acquisition. This work provided two aspects of design guidance to help participating teachers build their conceptual understanding of adopting technology. The first aspect is human-centric, emphasizing the importance of use and activity rather than technologies. A framework proposed by Fischer and Konomi (2007) served as the guiding principle for designing a technology in education: (1) *Who* is using the device? (2) *What* are they doing? (3) *Where* are they doing it? (4) *When* are they able to do it? (5) *Why* are they doing it? (6) *How* do they do it?

The second aspect concerns innovative adoption of technology in education. Some definitions and frameworks include for example, Hughes (2005) who identified a technology as transformation (innovation) to possibly change student-learning routines, including content, cognitive processes, and problem solving or teacher instructional practices and roles in the classroom. In the context of education, the vision to transform involves using technology (1) to redraw the physical boundaries of the classroom, (2) to enable more teamwork, (3) to allow learning to be a continuous time-independent process, and (4) to enable multi-level, multi-speed knowledge creation (Leidner & Jarvenpaa, 1995). Design guidance helps participating teachers think of a technology beyond its technological characteristics, and focus more on what type of pedagogical value the mobile technology can create.

Participants

Six female pre-service teachers volunteered for this study, and were fairly compensated for their time and effort. The limited number of participants was due to the limited availability of devices and funding support, and the nature of a collaborative task design for language learning practice. The ensuing statistical results may be criticized for their validity. However, since this research is the first of its type, its value is to provide a sound rationale and reasoning to support the adoption process in this study. Therefore, the statistical results are preliminary in providing a direction for further research to more deeply and comprehensively investigate future educational technology.

A questionnaire was administered to the participating teachers to collect their demographic information and their related experience. The questionnaire was composed of two parts: personal data and experience of the ICT tool related to the mobile device. The participants had just finished a one-year service in elementary school as English teachers, and received passing grades in a CALL course during their senior year.

The average daily hours spent on the computer after school for these six teachers were all greater than two hours. Three of them spent more than three hours. Their time spent using MSN or Instant Messaging exceeded two hours. The survey results confirmed the literature that students today are experienced ICT users and very experienced in instant messaging. Five of these six teachers did not have any prior experience with PDAs, but all

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had a fair knowledge of electronic dictionaries. This result may be because **PDA**s are still expensive products for students without many required functionalities, and the electronic dictionary is a necessity for pre-service teachers in the **ESL** field. The teachers had owned mobile phones for over three years, and used them frequently. Mobile phone features, such as voice and **SMS** were the most common types used, while listening to music and watching videos were next. The exception was the enabling Internet feature, which was seldom used due to high cost. The acquired information revealed these teachers were thoroughly experienced with the communicative functions of a mobile device in speaking, listening, and messaging in reading and writing. They were also familiar with watching videos and listening to music on a portable device—experiences that should assist them to operate a mobile device and design the practice required in this study.

The mobile device in this study

The mobile technology used in this study is a mobile device promoted by a local operator in Taiwan, shown in Figure 1. The device has dimensions of 120 × 70 × 20 mm and five features: (1) mobile **MSN** with full keyboard input, (2) **POP**3 email, (3) Internet Browsing + **RSS** news feeds, (4) **MP**3 player, and (5) basic mobile phone functions of voice and **SMS**. The vendor contends the major appeal is to young people, with most of them using instant messaging frequently to contact classmates and friends. The mobile device is portable, and claimed to have an enhanced keypad function, adequate display, and basic voice function.

Figure 1. Mobile device used in this study

The participating teachers were given operator instruction manuals on how to operate the device. They were asked to try as many functions of the device as they felt able to during this project.

Instrument development

Attitude

Several research papers have developed questionnaires to measure attitudes toward computers, the Internet, mobile phones, and **PDA**s respectively (Corlett *et al.,* 2005; Francis *et al.,*

2000; Liu, 2007; Selwyn, 1997; Thornton & Houser, 2005; Teo *et al.,* 2008; Tsai *et al.,* 2001). Among these questionnaire factors, the most closely related to this study are the categories of perceived usefulness and perceived ease of use because pre-service teachers need to evaluate how the tool they use in their daily life can be adopted for enhancing student English proficiency.

Selwyn (1997) and Teo *et al.* (2008) measured attitude toward computers using **PU** and **PEU** factors, Tsai *et al.* (2001) examined the topic of the Internet, and Corlett *et al.* (2005) surveyed wireless enabled **PDA**. We refer to these inventories because the device in this study comprises the characteristics of computers and the Internet (**MSN** and email) and **PDA**s (Hand-held). Because **PU** is a mobile device, the question "…do more interesting and imaginative work" in Selwyn (1997, p. 41) and in Tsai *et al.* (2001, p. 45) is adopted by replacing the word "computer" in Selwyn or "the Internet" in Tsai *et al.* with the name of the new product in this study. The question "The Internet helps me acquire relevant information I need" (Tsai *et al.,* 2001, p. 45) is changed to "The device helps me communicate with people and access relevant information." This modification reflects that the features of the device are mobile voice and **MSN** for communicating with people, and email and **RSS** for accessing relevant information. The general questions in Selwyn (1997) and Teo *et al.* (2008) about computers were all adopted because they are not restricted to the characteristics of technology addressed in the inventory, for example, the idea of enhancing effectiveness, increasing productivity. The added question to reflect the device features is "I can use the device to do the job anywhere, anytime" because of the portability and connectivity of the device. The statement about enlarging the scope and contribution to human life and advancing society in Tsai *et al.*'s Internet, and organizing or enhancing presentation of work in Selwyn's computer, were removed because the mobile device in this study is not designed for those types of functionalities.

Tsai *et al.* (2001) and Selwyn (1997) used the subscale of perceived control in their attitude measurement of the **PEU** factor, and this subscale was adopted in the **PEU** of this study, because their questions, "I need an experienced person nearby when I use a computer" in Selwyn or "I can use the Internet independently, without the assistance of others" in Tsai *et al.* indicate ease of use. The question "I could probably teach myself most of the things I need to know about the Internet" in Tsai *et al.* (2001, p. 45) and Selwyn (1997, p. 41), which assumes the user might possess enough understanding of the Internet and accessible supplementary information, is removed because such knowledge and support is not available for a mobile device. The four questions of Teo *et al.* (2008) about computers are general ones which are all adopted in this study.

Propensity to innovate

Evaluation of teacher "propensity" to innovate includes technology cognizance (**TC**), ability to explore (**AE**), and intention to explore a technology (**IE**) (Chou, 2005; Nambisan *et al.,* 1999). Nambisan *et al.* (1999) developed an inventory for fostering information technology innovation in business enterprises, and Chou (2005) rephrased that inventory for educational use. Their instruments survey general, not specific, technology. This study modified and devised a new set of instruments to measure teacher **TC** as explained in the previous section.

Interview

The interview used a semi-structured focus group method to elicit the views and experiences of participating pre-service teachers, to generate multiple interactions among all participants in the group, and to enhance data quality. The method is expected to provide participants with in-depth reflection of their experience, to better understand their perceptions during group discussion. The complete interviews were transcribed verbatim and thematic content analysis was used to analyze the answers to the research questions.

Designed lesson with mobile device adoption

The six pre-service teachers were required to adopt the mobile device in their English teaching of thirty 6th graders. The teachers designed a lesson with task-based instruction for adoption of the mobile technology. The learning content included lexical items and sentence structures, based on the 9-year Integrated Curriculum Guidelines created by the Ministry of Education in Taiwan. Three phases of task-based instruction were designed by these participating teachers. The first and third ones included classroom pre- and post- field learning, and the second one was a task-based field learning approach. The aim of the design was to begin with classroom preparation, followed by an authentic language task in the field. The synthesis work was conducted in the classroom, which included presenting and sharing what the students had learned during the task. These three phases combined two modes of instruction (face-to-face and **MALL**).

After finishing the lesson design, the participating teachers held a two-day summer camp for 30 students to complete the proposed process of mobile technology adoption. Students formed in groups of three with a mobile device to communicate with the teachers. The pre-task phase included learning language skills required for the task, spatial orientation to the field, and use of the mobile device. The task phase set a problem-solving task, which required students to solve a burglary case in an authentic context. Because students needed to move around to accomplish the task, they used the mobile device to communicate. The post-task phase helped students review and compare what they had learned during the task. For accomplishing the task, students needed to access and understand various formats of English clues stored in the mobile device or through language communicative means supported by the device. Students needed to demonstrate their four skills of English using the mobile device for most interactions. These included using **MSN** to respond, writing short messages to report, listening or reading instructions, and talking to others on the phone. The improvement between pre- and post- tests of student English proficiency provides evidence for the successful mobile learning project.

Results

The first result is teacher attitude toward the device following introduction of the mobile device and after a two-month project, respectively. Table 1 shows the summary report using a Likert scale from 1 to 5 (from strongly disagree to strongly agree).

Table 1: Teacher attitude toward the study device

	Question	After introduction		After two-month project	
	Perceived Usefulness (PU)	Mean (Std)	Mean		Mean
1	The device allows me to do more interesting and imaginative work	3.83(0.41)		4.00(0.00)	
2	The device helps me communicate with people	4.17(0.41)		4.67(0.52)	
3	The device helps me access relevant information	4.00(0.63)	3.61	4.33(0.52)	3.92
4	I can use the device to do a job anywhere, anytime	3.33(0.82)		4.00(1.10)	
5	Using the device enhances my effectiveness	3.50(0.55)		3.17(0.75)	
6	Using the device increases my productivity	2.83(0.75)		3.33(1.21)	
	Perceived Ease of Use (PEU)				
1	I need an experienced person nearby when I use the device	2.83(1.17)		3.50(0.55)	
2	I can use the device independently, without the assistance of others	3.17(0.75)		4.50(0.55)	
3	My interaction with the device is clear and understandable.	2.83(0.41)	3.17	3.50(1.22)	4.08
4	I find it easy to get the device to do what I want it to do.	3.17(0.98)		4.17(0.41)	
5	Interacting with the device does not require a lot of mental effort.	3.50(0.84)		4.50(0.55)	
6	I find the device easy to use.	3.50(0.84)		4.33(0.52)	

The results show that the six teachers improved in all items of Perceived Usefulness (**PU**) except for the fifth item of enhancing effectiveness. The average **PU** improved from 3.61 to 3.92. As to Perceived Ease of Use (**PEU**), improvement is clear without any exception of these six items, and the average mean improved from 3.17 to 4.08.

This study speculates that such a difference between **PU** and **PEU** may be because the technology used in this study was a new mobile device on the market, and that device should pass a usability test and provide satisfactory ease of use. Subsequently, based on the designed educational practice and required performance, the device supports satisfactory ease of use.

Table 2 shows teacher propensity to innovate the mobile device at the period following the introduction and after the two-month project. The teacher **TC** factor does improve from an average of 3.13 to 3.63, and supports the argument that a collaborative and authentic design practice positively affects teacher perceived technology knowledge. Among these five items, only the second one, "cost of deploying the mobile device," received negative responses, showing these pre-service teachers have little knowledge of the expense in deploying technology mediated learning. This might be because the project budget was not a concern for these teachers. As to other items, the first item of "knowing the features

of the mobile device" showed the greatest improvement, as teachers spent two months exploring the device and adopting it into learning practice.

Table 2: Report of TC propensity to innovate on the Likert scale from 1 to 5 (from strongly disagree to strongly agree)

	Question	Pre-Mean (Std)		Post-Mean (Std)	
	Technology cognizance				
1	I understand the features of the device	3.17(0.75)		4.00(0.63)	
2	I am aware of the cost of deploying the device	2.33(1.03)		2.67(0.52)	
3	I know the types of benefits that can be gained from deploying the device	3.33(0.82)	3.13	3.33(1.21)	3.63
4	I know the extent of benefits that can be gained from deploying the device	3.33(0.52)		4.00(0.63)	
5	I know the type of teaching activities in which the device can be deployed	3.50(0.84)		4.17(0.41)	

Interview

The interview results reveal three adoption issues acknowledged by the pre-service teachers. The first issue is the role of the mobile device. Because a mobile device had been perceived as a living tool for these participants, the stereotypical image of a mobile device and the corresponding learning value needed to be changed. At the beginning of the practice design, a teacher expressed that she thought the device was not suitable for this project because a language-learning device needed recording and electronic dictionary functions. Because the device did not have the above two functions, it was considered unsuitable for language learning. This comment not only reflects a stereotype by pre-service teachers of what the functions of a language learning device should be, but also suggests that the stereotypical image of a mobile device may hinder its acceptance and potential adoption. Another stereotypical image was of the specific device used in this study. An interviewee mentioned that she learned about the device manufactured by a foreign company. This increased her willingness to use the device for foreign language teaching. When asked for clarification, she explained, "Whenever I use the Internet to browse websites and read news, I think of myself as having an international mindset and being more willing to communicate in a foreign language." This statement suggests that a foreign-made device might stimulate student emotional motivation to learn a foreign language. The changing role of a mobile device also affected the lesson enactment. The pre-service teacher pointed out the novelty for students to regard the mobile device as an instructional classroom tool. Students were eager to play with the device and liked the idea of using cutting-edge technology (Cook *et al.*, 2007) in the classroom. This pitfall implies a pedagogical challenge in adopting a mobile technology and reveals a needed balance between attractiveness of the device and the corresponding curriculum. Students attended to the lesson because the mobile device attracted them; meanwhile, they need to engage in learning content instead of exclusively playing with the device.

The second issue is the technicality of a mobile device. The participating teachers mentioned that because they were not technicians, they could only adopt the mobile device as

it was. Although the pre-teachers were familiar with standard mobile device operations, they faced certain technical challenges for instruction. For instance, one of the participating teachers felt frustrated because technical difficulties, such as the narrow bandwidth of a wireless network, sometimes hampered content delivery. Mobile device connectivity also played an important factor in student performance of a task. Students attempting to operate mobile devices on their own and encountering operation difficulties, necessitated teachers to become troubleshooters, which often interrupted the lesson flow.

The third issue is the pedagogical potential of a mobile device. All six teachers admitted that after acquiring the mobile device, they did not have any idea how to adopt the device into language teaching, and to them, there was no such thing as pedagogical potential in the device. One teacher said, "I thought mobile learning should be 'high-tech' stuff. Because I was not able to do anything about hardware or software, I could not see any pedagogical potential of the mobile device." Another teacher added that after some discussion, they designed a language lesson for the participating students and simultaneously tried to find how the mobile device could facilitate learning the lesson. They found that the mobile device afforded multi-faceted interaction between teacher and students, instead of face-to-face only. They employed the mobile device in their lesson to create various interaction opportunities for students.

In addition to expressing concerns about the mobile device, the issue of workload and collaborative teamwork also emerged during the interview. During the two-month preparation and pilot activity, the participating pre-service teachers held two meetings each week for seven weeks, with each of the 14 meetings being approximately two hours. The meetings evolved from familiarity with the device, field survey, lesson planning, and activity design and creation, to in-house testing and revision, defining the work plan, field testing, and a two-day pilot testing with 20 volunteers. Participating teachers also spent considerable leisure time discussing ideas and receiving assurance for each step of the activities. During the interview, they all expressed that the workload was much greater than what they had expected at the beginning of the project. This comment raises concerns about predicting the workload of a **MALL** practice, especially for a mobile device, because these pre-service teachers had already finished their one-year practicum training, and should have had reasonable experience in evaluating the workload required to design and implement a language learning practice. All of them appreciated collaboration during the adoption process. One teacher mentioned that she would have given up if she had had to finish the job on her own. These comments suggest that the use of a mobile device in **MALL** may not be an affordable task for most novice teachers, and collaboration among teachers may be the solution.

Discussion

For the pre-service teachers in this study, using mobile technology seemed to be a common activity. This study investigated the extent to which teachers could use a mobile device in their teaching, utilizing two evaluation phases to answer two research questions for adopting a mobile technology: teacher attitude and propensity to innovate with that technology, and challenges faced during the adoption. Although teachers showed some concerns about the adoption in the interview, the quantitative results showed improved teacher attitudes and propensity to innovate along with the proposed design practice. With regard to mobile devices, a similar study on the Personal Digital Assistant (**PDA**) was conducted with contrasting results. Wishart (2008) asked foreign language teacher trainees to explore   **13**

the potential of a **PDA** to support their learning and teaching during their training program. These teachers attended the workshop and were provided technical support. However, neither design practice nor implementation was required for these teachers. The results showed that teacher trainees did not feel comfortable exploring **PDA** functionality, were not yet confident in their pedagogical identities, and felt they could not disrupt established practice with novel technology. These negative responses did not emerge in the present study. Based on the results, a collaborative and authentic design task in this study seems to provide pre-service teachers with necessary confidence. The mobile device in this study was also much more familiar to most people than the **PDA**. Technical familiarity may also affect teacher perception of technology adoption. Yildirim (2000) found that teachers who used computers more tended to develop positive attitudes that promote further use of the computer in their daily teaching tasks.

The proposed adoption approach seemed successful according to the general improvement in teacher **PU**, **PEU**, and **TC** toward the mobile device after the two-month project. Given the challenges teachers expressed they faced in the interview, hands-on experience, collaboration, and authentic tasks helped them encounter the challenges of the mobile device. Although the mobile technology of the device might not be new for these pre-service teachers such as in other technologies, the results of this study support the adoption approach proposed in other studies. For instance, Gressard and Loyd (1985) found that a staff development program providing hands-on experience with microcomputers lowered anxiety and enhanced confidence.

The results of this study support the claim of Richards (2005) that by providing a practical project for teachers during their **ICT** training, *designers* of technology facilitated learning practice rather than *transmitters* of skills or information through add-on technology. This also tackles an issue addressed by Kessler (2007), who found a generally positive attitude in **ESL** teachers toward technology, but a significantly less positive attitude about using technology for specific teaching tasks. Organizations deploying a mobile technology should prioritize providing technology knowledge and experience to teachers, or arrange a special design task for teachers to participate in as did this study.

Because teachers were familiar with mobile technology, the technical difficulties for these teachers were not so much about operation, but connectivity. Connectivity difficulties did not affect the general attitudes of teachers toward the mobile device because they attributed connectivity failure to the telecommunication company, not to the mobile device. However, if connectivity is frequently a problem, teacher willingness to adopt mobile technology will decrease. Therefore, school administrators should attend to the wireless network bandwidth and connectivity, so teachers can proceed with fluent mobile assisted language learning. In this study, pre-service teachers encountered difficulty in planning their lessons to include mobile technology. Given their training in English teaching, they found it easier to plan a language lesson first, and then infuse mobile technology into their lesson. This adoption process fits the claim by Chinnery (2006) that technologies are not in and of themselves instructors; rather, they are instructional tools.

Several researchers have pointed out that modern developments of innovative technologies have provided new possibilities to teaching professions, but have simultaneously placed more demands on teachers to learn how to use these mobile technologies in their teaching (Dooly, 2009; Robinson & Latchem, 2003). Teachers in this study expressed similar feelings regarding their workload in the interview. The heavy workload might also be the

reason why they responded negatively to the question of "using the device will enhance

my effectiveness" in the survey. The workload in the current project did not significantly affect adoption of the mobile device. However, this factor may influence adoption of mobile technology for regular classroom teachers because they need to carry on daily teaching. A special supportive team may be needed to facilitate teacher adoption of mobile technology.

Conclusion

This study examined the fundamental issues faced in deploying mobile technology mediated language learning. The attitude and cognizance of teachers in the process of transforming a mobile device into a teaching or learning tool are important in explaining their adoption of mobile technology. The preliminary evaluation conducted in this study included the evaluation of six pre-service teachers, who were introduced to a mobile device, and asked to collaboratively design and implement a **MALL**. Perceived usefulness and ease of use of the device and their propensity to innovate the device were surveyed. An interview following the evaluation addressed the challenges teachers faced. The results show that direct adoption of a mobile device improved teachers perceived **PU**, **PEU**, and **TC**. However, teachers still encountered some challenges such as the changing role of the mobile device, technical difficulties, pedagogical potential, and workload. The findings indicate that a successful adoption approach should consist of hand-on experience, collaboration, and authentic tasks. The study also shows the need to address concerns if teachers are to adopt mobile technology in the future.

This study provides preliminary results in gaining better understanding of teacher adoption of mobile technology. The above results are limited to the context of the study: an over-the-market device, a specific group of teachers, and an approach to adoption. This study is not without problems, but the one sample investigated provides a reference for other contexts to adopt and implement a mobile technology.

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Appendix

Questionnaire

Questions were answered on a scale of 1–5, indicating Strongly disagree / Disagree / Neither disagree nor agree / Agree / Strongly Agree.

Q1. The device can allow me to do more interesting and imaginative work.
Q2. The device helps me communicate with people.
Q3. The device helps me access relevant information.
Q4. I can use the device to do the job anywhere anytime.
Q5. Using the device will enhance my effectiveness.
Q6. Using the device will increase my productivity.
Q7. I need an experienced person nearby when I use the device.
Q8. I can use the device independently, without the assistance of others.
Q9. My interaction with the device is clear and understandable.
Q10. I find it easy to get the device to do what I want it to do.
Q11. Interacting with the device does not require a lot of mental effort.
Q12. I find the device easy to use.
Q13. I understand the features of the new device.
Q14. I am aware of the cost of deploying the new device.
Q15. I know the types of benefits that can be gained from deploying the new device.
Q16. I know the extent of benefits that can be gained from by deploying the new device.
Q17. I know the type of teaching activities in which the new device can be deployed.