

Chinese Language Teachers' Perceptions of Technology and Instructional Use of Technology: A Path Analysis

Abstract

This study examined internal and external factors affecting pedagogical use of technology among 47 K-12 Chinese-language teachers in the United States. Path analysis of the survey data was used to examine the relationships between the teachers' instructional use of technology, on the one hand, and on the other, their perceptions of three internal factors (i.e., technology's usefulness, its ease of use, and subjective norms) and one external factor (i.e., facilitating conditions). The results showed that these teachers' pedagogical use of technology could be predicted by two of the three internal factors (i.e., perceived usefulness and subjective norms) and by the external factor. Additionally, the external factor was found to have a significant influence on both perceived ease of use and subjective norms.

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Keywords: external factors, internal factors, language teachers, pedagogical use of ICT, technology acceptance

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Introduction

The growth of modern Information Communication Technology (ICT) has provided new and effective means of communication between teachers and students (Dawes, 2001). ICT enables learners to asynchronously and synchronously communicate directly with instructors, peers, or native speakers of their target languages all over the world (Warschauer, 1997). Through email, instant messages, chat rooms and other applications, ICT permits many-to-many communication, text-based interaction, and time- and place-independent exchange (Warschauer, 1997).

Since social interaction is a central component of language learning (Lantolf, 2006; Vygotsky, 1978), the potential benefits of ICT for language learning and teaching are beyond doubt (Blake, 2007). The use of ICT has consistently been shown to have positive effects on language skills, including listening (e.g., Ducate & Lomicka, 2009), speaking (e.g., Sun, 2009), reading (e.g., Lan, Sung, & Chang, 2007), and writing (e.g., Bloch, 2007). In addition to improvement of these skills, integrating ICT in language classrooms has been shown to increase learners' motivation to practice their target languages (Blake, 2009; Shang, 2007), their motivation (e.g., Shang, 2007), and their intercultural awareness (e.g., Lee, 2011). As Murphy-Judy and Youngs (2006) noted, "given the emphasis on communication and the opportunities for computer-assisted learning, technologies play an ever-increasing role in learning standards" (p. 45).

However, the affordances and potentials of using ICT cannot be fully realized unless teachers integrate it into their instructional design and use it to support students' learning (ISTE, 2007). Language teachers are now often required to learn how to integrate ICT into their courses, and to actively use it to promote their students' language learning and use; and professional

standards for language teachers and language-teacher preparation programs often set forth clear specifications for teachers' pedagogical integration of technology (ACTFL, 2013; NEALRC & CLASS, 2007; TESOL, 2010). For example, ACTFL's 2013 Program Standards for the Preparation of Foreign Language Teachers for K-12 and Secondary Certification Programs require that teacher preparation programs provide "opportunities for candidates to experience technology-enhanced instruction and to use technology in their own teaching" (p. 2). The Chinese Language Association of Secondary-elementary Schools in its Professional Standards for K-12 Chinese Teachers, holds that teachers should understand that "technology supports the teaching and learning of language and culture and provides tools, strategies and practices that motivate student interest and increase performance ... [and should] incorporate technology into lesson planning and instructional delivery" (NEALRC & CLASS, 2007, p. 9). Indeed, the need for language teachers to engage with technology is considered so urgent that they will find themselves at a disadvantage if they are not adequately proficient in computer-assisted language learning (Hubbard & Levy, 2006).

Yet, despite the aforementioned professional standards and expectations regarding teachers' professional competences, technology integration by language teachers (among others) has been far from satisfactory, and underuse or non-use of technology has been consistently reported (e.g., Grosse, 1993; Li & Walsh, 2011; Liu, Lin, Zhang, & Zheng, 2017; Yang & Huang, 2008). According to Rogers' (1995) Diffusion of Innovations Theory, decisions regarding the adoption of technology should take the adopters' attitudes into account. Inspired by Rogers' ideas, much subsequent work has shown that teachers' attitudes toward adopting technology are a critical factor in their acceptance of new technology as well as its actual use in their teaching (e.g., Becker, 2001; BECTA, 2004; Liu et al., 2017). These studies have identified a number of

factors that may affect teachers' use (and underuse or non-use) of technology. Yet, most such factors "do not directly influence technology uses in a linear fashion"; rather, their influence is "mediated or filtered by teachers' perception" (Zhao & Frank, 2003, p. 817). Hence teachers' perceptions of the factors related to technology usage are of vital importance to anyone seeking to explain the slow adoption of technology.

In exploring the complex conditions surrounding ICT integration (Zhao, Puge, Sheldon & Byers, 2002), researchers usually distinguish between external and internal factors in teachers' perceptions. How teachers translate their pedagogical perceptions and beliefs into classroom practices varies greatly alongside variations in their perceptions of both the external and the internal factors affecting educators' technology adoption. While many studies (e.g., Hew & Brush, 2007; Teo, 2011) have examined such factors, few have focused on language teachers, and fewer still on teachers of Chinese. By examining the external and internal technology-adoption factors perceived by a group of K-12 Chinese-language teachers in the United States, the present study aims to identify the key factors influencing such teachers' pedagogical use, or non-use, of ICT in their classrooms, as well as the relationships among those factors – in particular, if/how external factors influence internal ones.

Literature Review

The first two sections of our literature review focus on why teachers use or do not use technology in light of external (or first-order) and internal (or second-order) factors: a framework widely used in the literature on teachers' technology adoption (e.g., Brickner, 1995; Ertmer, 1999). The third section reviews work on language teachers' actual technology-adoption behaviors.

External Factors

External factors, also termed extrinsic factors (see Ertmer, 1999), cover a broad range of demands that teachers adjust their teaching practices to, and/or teach with, technology, as well as the presence/absence and quality of technological support and technical infrastructure. It is important to note, however, that the changes teachers make due to these factors will not necessarily change their *perceptions*, either of technology itself or of its pedagogical use.

External factors have often been included in examinations of technology adoption. For example, in the Unified Theory of Acceptance and Use of Technology (UTAUT) formulated by Venkatesh et al. (2003), external factors are conceptualized as *facilitating conditions*, defined as “the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system” (p. 453). In Ajzen and Fishbein’s (1980) Theory of Planned Behavior (TPB), a similar construct called *perceived behavioral control* relates to individuals’ beliefs in the existence/nonexistence of factors that facilitate/impede their performance of particular behaviors. Many technology-integration barriers examined in previous literature, such as hardware support and management (Yang & Huang, 2008), access to technological resources (Egbert, Paulus, & Nakamichi, 2002; Li, 2014), and difficulty with equipment deployment (Yang & Huang, 2008) can be classified as external factors.

Collectively, UTAUT’s external factors – i.e., facilitating conditions – have been identified as a “direct determinant of usage behavior”, and as having significant effects on usage when examined together with age and gender (Venkatesh et al., 2003, p. 467). Unlike Venkatesh’s study, which collected data from four organizations, a follow-up study by Teo (2011) focused on educators from elementary and secondary schools. Through Structural Equation Modeling (SEM) analysis, Teo found that facilitating conditions significantly influenced the participants’ behavioral intention to use technology. Moreover, facilitating

conditions were found to have an indirect influence on behavioral intention via an internal factor, perceived ease of use (Teo, 2010, 2011). Similarly, Venkatesh and Davis (2000) found that facilitating conditions exerted a mediation effect on intention via effort expectancy, a similar concept to perceived ease of use. Such findings about external factors are not especially surprising, in that teachers tend to use technology if they receive adequate personal and technological support (Fuller, 2000; Yang & Huang, 2008).

Internal Factors

Unlike external factors, which are objective aspects of a person's environment, internal factors are subjective: intrinsic factors that teachers perceive in relation to behavioral intention of technology use or technological practice in reality. Previous studies have identified three major internal constructs, including perceived usefulness, perceived ease of use, and subjective norm, that are significant predictors of people's intention to use technology (Jeyaraj, Rottman & Lacity, 2006).

Perceived Usefulness. Perceived usefulness, a key factor in the Technology Acceptance Model (TAM) proposed by Davis (1986), refers to "the degree to which an individual believes that using a particular system would enhance his or her job performance" (p. 82). This construct has since been examined many times. Davis, Bagozzi and Warshaw (1989), for example, conducted a longitudinal study of 107 users' intentions to use a specific system, and found not only that perceived usefulness had a strong impact on such intentions, but that it accounted for more than half of the variance in their intentions 14 weeks later. A review study by Jeyaraj and others (2006) reported that perceived usefulness was the most frequently used independent variable in studies that involved predicting information technology adoption by individuals. The same review study found that, as well as being the most popular variable, perceived usefulness

was one of the most effective predictors of technology adoption: being reported as significant in 26 out of 29 cases. Aydin (2013) reported that the majority of the 157 EFL teachers perceived computers as a valuable tool for teaching and learning. However, other studies examining language teachers' perceptions of the usefulness of technology and their intention to use it are rare.

Perceived Ease of Use. Various, potentially conflicting conceptualizations of perceived ease of use have been proposed. While Davis (1986) defined it as “the degree to which an individual believes that using a particular system would be free of physical and mental effort” (p. 82), others operationalized it simply as computer competence (e.g., Albirini, 2006).

Previous research has shown that teachers' lack of computer competence is a major factor in their non-adoption of technology in their teaching (Albirini, 2006; Al-Oteawi, 2002; Na, 1993; Pelgrum, 2001). For example, Albirini (2006) reported that although Syrian EFL teachers had positive attitudes toward computers, they reported little to no ability to use them for their teaching. A more recent study by Li (2014) showed that, while teachers had a certain degree of knowledge about using technology, they did not feel confident about using it in their teaching. This may be a key reason for the slow adoption of technology among language teachers.

Perceived ease of use has also been one of the most commonly adopted predictors in studies examining people's intention to use technology (Jeyaraj et al., 2006). Though not as powerful as perceived usefulness, it was also found to be a significant predictor of intention (e.g., Davis, Bagozzi & Warshaw, 1989; Teo, 2010, 2011).

Subjective Norms. Subjective norms were proposed by Ajzen in his Theory of Reasoned Behavior (TRA) and later adopted in TPB. They are defined as “the perceived social pressure to perform or not to perform the behavior” (Ajzen, 1991, p. 188). Much like subjective norms in

TRA and TPB, the UTAUT model's social influence factor refers to how an individual perceives respected others' beliefs in certain technology (Venkatesh et al., 2003).

Studies of subjective norms have usually shown that they are significant predictors of individuals' intention to use technology (Jeyaraj et al., 2006). Yet, some studies have found instead that subjective norms had "no effect on intentions" (Davis et al., 1989, p. 982). Based on an investigation of language teachers in China, Li (2014) highlighted the importance of sociocultural context to technology adoption, and that support from school principals was an important factor in technology use. However, additional studies examining the influence of subjective norms on language teachers' intentions to use technology, and/or their actual technology-related behavior, are difficult to find.

Language Teachers' Technology Adoption

Language teachers have been consistently reported as slow to adopt computers and unlikely to use them productively in language teaching (Li & Walsh, 2011; Yang & Huang, 2008). Yang and Huang (2008), for example, found that technology-mediated English teaching behaviors in middle- and high schools in Taiwan were on a modest level, with most teachers using technology only to prepare their teaching material. Li and Walsh (2011) examined 400 middle- and high-school EFL teachers' use of technology in Beijing and found that, despite these teachers having an adequate level of computer literacy and their schools providing access to computer technology, computer use remained peripheral to their teaching. Specifically, most teachers only used PowerPoint to present information. A follow-up study by Li (2014) reported similar results: i.e., that Chinese EFL teachers only used technology occasionally to engage their students and meet their pedagogical needs.

A number of theoretical models, including the aforementioned TRA, TPB, TAM and UTAUT, have aimed to account for teachers' technology adoption, or the lack thereof. In such models, teachers' technology-adoption behavior is generally a dependent factor predicted by internal and external variables of the types discussed above. Yet, this can elide the differences between an individual's intention to perform a behavior and his or her actual performance of it. For example, Fishbein and Ajzen (2010, p. 300) pointed out that while their TPB can account for 50-60% of the variance in intentions to perform a given behavior, its ability to explain the behavior itself is markedly less (30-40%). Indeed, teachers' intentions to use technology in instruction do not often correspond with their actual technology behavior in the classroom (e.g., Basturkmen, 2012). Ertmer, Gopalakrishnan, and Ross (2001) also reported that teachers' *enacted* beliefs in technology (i.e., actual classroom technology practice) did not align with their *espoused* beliefs in technology (i.e., attitudes and intentions). Therefore, in contrast to previous models that have focused primarily on teachers' intentions to use technology, the present study uses language teachers' actual technology practices in their classrooms as the dependent variable, and aims to discover whether the internal and external factors described above can predict such actual practices.

Research Questions

Previous studies have shown that internal and external factors may affect language teachers' technology adoption. However, the studies reviewed above have largely dealt with teachers as an undifferentiated bloc with regard to the subjects they teach, despite foreign-language teachers' distinct needs and challenges (e.g., Li, 2014). To help fill this research gap, the present study examines how various internal and external factors influenced a group of U.S.-based K-12 Chinese-language teachers' instructional use of ICT. In addition to that central

question, we are interested in how these teachers perceived the interrelationships of the internal and external factors drawn from two popular technology-adoption models (i.e., TAM and UTAUT). Based on the findings of some previous studies (e.g., Davis et al., 1989; Teo, 2010, 2011), we constructed a conceptual path model to examine the impact of internal (i.e., perceived usefulness, perceived ease of use, subjective norms) and external factors (i.e., facilitating conditions) on instructional use of technology, as well as the possible influence of facilitating conditions on the three internal factors. Figure 1 is a path diagram of the conceptual model.

(Insert Figure 1 here)

The following research questions guide this study:

1. Do facilitating conditions, considered as an external factor, significantly influence Chinese-language teachers' pedagogical use of technology?
2. Do internal factors, including perceived usefulness, perceived ease of use, and subjective norms, significantly influence Chinese-language teachers' pedagogical use of technology?
3. Do internal factors mediate the effect of external ones on the technology behaviors of Chinese-language teachers?

Methods

This study employed a quantitative approach. Data were collected through a questionnaire that asked the participating teachers about their perceptions of various internal and external factors, as well as about their pedagogical use of technology in Chinese-language classrooms.

Participants

We recruited a sample of 47 teacher-education students enrolled in a university certification program in the Midwestern United States. All were native speaker of Chinese and ranged in age from 21 to 40, with most (66%) being between 21 and 25. The majority of the respondents were female ($n = 39$); approximately half of them had master's degrees, and the remaining half, bachelor's degrees. Their previous academic backgrounds were mixed, and included Chinese Language Arts, Teaching English to Speakers of Other Language, Business, and Biology, among other subjects. All the participants were placed in K-12 schools, where they taught full time while taking online courses to fulfill the requirement of the certification program.

Procedure

A questionnaire used in previous studies of teachers of other subjects (e.g., Teo, 2011) was revised to suit the present study's focus on language teachers. The revised version was administered to the participants through Qualtrics, a web-based tool that has affordances for conducting survey research online (see the Instruments section, below, for details).

Instruments

Demographic information. Individual background information collected in this study included respondents' name, age (range), gender, and educational background.

All the survey items were presented in Chinese, and responded to via a five-point Likert scale, with "1" indicating strong disagreement and "5", strong agreement.

Facilitating conditions. Five survey items designed to measure facilitating conditions were adopted from Teo (2011). A sample survey item for this component was, "The school offered positive environment for me to use technology." The Cronbach's alpha for the group of facilitating-conditions items was .86.

Perceived usefulness. To measure this internal factor, we adapted 10 survey items from Teo (2011) covering teachers' beliefs about whether the use of technology could enhance teaching and learning. A sample survey item was, "Information technology can improve students' interest in learning." The Cronbach's alpha for the set of perceived usefulness items was .91.

Perceived ease of use. For this internal factor, eight survey items adapted from Teo (2011) were used to capture teachers' beliefs about how easy technology is to use. A sample survey item was, "I think it is easy to use information technology." The Cronbach's alpha for this group of items was .83.

Subjective norms. To measure this internal factor – the pressure to use technology that teachers feel coming from others – we edited eight survey items, and two of the items were adapted from Teo (2011). A sample survey item was, "My friends think that I should use information technology." The Cronbach's alpha for the subjective-norms items was .91.

Technology behavior. The research team developed an additional 10 survey items to assess the respondents' technology-related pedagogical behavior. A sample survey item was, "I always use information technology to present teaching content in the classroom." The Cronbach's alpha for these technology-behavior items was .89.

Data Analysis

Given that the purpose of this study was to investigate the relationships among an external factor (facilitating conditions), three internal factors (perceived usefulness, perceived ease of use, and subjective norms) and teachers' self-reported behavior, the data were analyzed within a SEM methodological framework (Kline, 2005). Specifically, composite scores were first computed for all the questionnaire items that represented each individual factor. Path analysis

was then applied to assess the statistical significance of the coefficients of all the paths between the five variables.

Results

Descriptive Statistics and Bivariate Correlations

As shown in Table 1, the means of the five variables ranged from 3.40 to 4.23, indicating that the participants' overall response to each of those variables was positive. The standard deviation ranged from .57 to .78, reflecting that the responses were narrowly spread. All items had a skewness or kurtosis value that was less than the cutoff of $|2|$, implying the univariate normality of the distribution of the data.

(Insert Table 1 here)

Pearson correlation analysis was conducted to establish the bivariate relationships among the variables. As can be seen in Table 2, the correlation coefficients ranged from .23 to .57. Except for the correlation between facilitating conditions and perceived usefulness, which was positive but not statistically significant ($r = .23, p = .119$), all correlation coefficients were both positive and significant. More specifically, the correlation between perceived ease of use and facilitating conditions was $.56, p < .001$, and between facilitating conditions and subjective norm, $.48, p < .001$. Among the three internal factors, perceived ease of use was significantly correlated with perceived usefulness ($r = .31, p < .05$), while perceived usefulness was significantly correlated with subjective norms ($r = .57, p < .001$). The correlation between perceived ease of use and subjective norms was significant as well ($r = .41, p < .01$). Lastly, the dependent variable (technology behavior) was found to be significantly correlated with all four of the other variables: $r = .50, p < .001$ for facilitating conditions; $r = .46, p < .01$ for perceived ease of use; $r = .53, p < .001$ for subjective norms; and $r = .51, p < .001$ for perceived usefulness.

(Insert Table 2 here)

Path Analysis

The proposed path model was tested using Stata 13.0. The resulting goodness-of-model-fit indices were $\chi^2(2) = 2.44$, $p = .30$; SRMR = .043; CFI = 0.994; and RMSEA = .068.

According to the cut-off values discussed in Kline (2005), this indicates a very good model fit.

The results of significance testing for all the path coefficients are shown in Table 3. Five path coefficients were found to be statistically significant. Figure 2 provides a graphic representation of the final model with the significant paths and their standardized path coefficients.

(Insert Table 3 here)

(Insert Figure 2 here)

As Table 3 indicates, the external factor (i.e., facilitating conditions) had a significantly positive influence on the sampled Chinese-language teachers' use of technology ($\beta = .28$, $p < .05$), after all three internal factors were controlled for. Two of the internal factors – perceived usefulness and subjective norms – also had significant, positive, and unique impacts on teachers' use of technology: $\beta = .32$, $p < .05$, and $\beta = .17$, $p < .05$, respectively. However, teachers' use of technology in this study was not significantly predicted by perceived ease of use ($\beta = .15$, $p = .27$), after the two other two internal factors and the external factor were controlled for. Together, the four other variables accounted for approximately 44% of the variance in the participants' pedagogical use of technology.

Mediation Analysis

The external factor, facilitating conditions, was found to have a significantly positive effect on two internal factors: $\beta = .56$, $p < .001$ with perceived ease of use, and $\beta = .48$, $p < .001$

with subjective norms. However, the external factor did not significantly predict perceived usefulness, $\beta = .23$, $p = .09$.

From Figure 2, it can be seen that the external factor also had an indirect effect on the participants' technology use when subjective norms acted as a mediator variable. The indirect effect on technology use of facilitating conditions via subjective norms was .082.

Discussion

The External Factor

In answer to our first research question, the results of path analysis indicated that facilitating conditions had a significantly positive influence on Chinese-language teachers' pedagogical use of technology, over and above that of the two internal factors that also influenced it (i.e., perceived ease of use and subjective norms). This finding is consistent with those of previous studies (e.g., Becker, 2001; BECTA, 2004), that external factors such as technology facilities, technicians' support, administrative attitude, financial support, and training opportunities were key factors of teachers' instructional use of technology.

In addition to this direct effect, the present study found that facilitating conditions had indirect effects on the sampled Chinese-language teachers' technology use, through the mediation of one internal factor, subjective norms. This finding is fairly unsurprising, insofar as the existence of external support – such as training – would tend to enable teachers to see the value of instructional technology, and therefore result in their more frequent use of it. The same finding also corroborates the results of some previous studies in which the participants were non-language teachers (e.g., Teo, 2011; Yang & Huang, 2008).

The positive impact of the external factor suggests that adequate facilities, technical training, and other relevant forms of support are foundational to Chinese-language teachers' use

of technology in their teaching. This has clear implications for school and school-district leaders who are seeking to promote technology integration in K-12 world-language education.

Internal Factors

To answer our second research question, pertaining to the impact of the internal factors on technology-related behaviors, three path coefficients were examined. The results showed that two of the internal factors (i.e., perceived usefulness and subjective norms) had significantly positive influences on Chinese-language teachers' pedagogical use of technology, whereas the third internal factor (perceived ease of use) did not. With regard to perceived usefulness, our results are in line with those of Teo (2010, 2011), who found perceived usefulness to be a significant predictor of pre-service teachers' intention to use technology in Singapore. Other studies also reported that perceived usefulness had a positive impact on pre-service teachers' intention to use technology (e.g., Li, 2014; Sadaf, Newby, & Ertmer, 2012), or that a lack of perceived usefulness could hinder technology adoption (Albirini, 2006; Yang & Huang, 2008). Our study thus extends the findings from the literature on student teachers by focusing on their self-reported actual use of technology rather than their intention to use it in the future.

Subjective norms were also found to be a significant factor impacting on Chinese-language teachers' technology use, which was again in line with the literature (e.g., Jeyaraj et al., 2006; Li, 2014). This is unsurprising, in that Chinese-language teachers generally work in heavily regulated environments where their in-class technology use is strongly recommended or even mandatory. In addition, our participants were in the early stages of teaching of Chinese in the United States, during which they were also receiving online training in various teacher professional standards as part of their aim of achieving certification. Thus, it would not be unexpected if they chose to use technology as a way of demonstrating that they met the

expectations of their certification program. Overall, it is reasonable to suppose that outside pressure strengthened the participants' technology-adoption behavior.

In contrast to their subjective norms and their perceptions that technology was useful, the sampled teachers' perceptions that technology was easy to use had no significant effect on their self-reported technology-adoption behavior. This finding was inconsistent with those of some previous studies, such as Teo's (2010, 2011), in which Singapore-based pre-service teachers' perceived ease of use significantly predicted their intention to adopt technology. This discrepancy might be related to the fact that many of the Chinese-language teachers in the current sample did not consider technology to be easy to use. As shown in Table 1, among the three internal factors, our participants' perceptions of usefulness were the highest on a five-point scale ($M = 4.23$, $SD = .57$), and their perceptions of ease of use the lowest ($M = 3.39$, $SD = .36$). The gap between these two internal factors may suggest that the teachers in this study generally felt that, while technology was useful in their teaching, it was not necessarily easy to use. In other words, despite the challenges to their use of technology that they perceived, the participants chose to use it anyway, possibly due to a combination of their belief in its utility (i.e., perceived usefulness) and the aforementioned pressures attributable to their school environments/principals and their certification program (i.e., subjective norms). From a teacher-education perspective, it does not seem desirable for Chinese-language teachers to be "pushed" to use technology despite their personal reservations about it; rather, schools introducing technology into the classroom should provide more professional development to increase such teachers' technological proficiency and confidence.

The Effects of External Factors on Internal Factors

In answer to our third research question, the results of path analysis showed that the external factor (i.e., facilitating conditions) had a significantly positive impact on perceived ease of use and subjective norms; on the other hand, a significant impact on perceived usefulness did not surface. This implies that language teachers may feel more confident and more influenced in favor of using technology if they are given a certain amount of external facilitation, even though such facilitation will not necessarily change their perceptions of whether technology is useful in their teaching. From a teacher-education perspective, these findings highlight that schools should provide technology-related training and support for teachers, particularly those in the initial stages of their teaching careers, and during such training provide specific models of how technology could be useful for teaching purposes.

Conclusion

This study of a group of K-12 Chinese teachers in the United States explored the relationships between and among their perceptions of the external and internal factors affecting their pedagogical technology use, and their self-reported pedagogical use of technology. Its key findings are as follows. First, facilitating conditions had a significant direct impact on the teachers' technology use, in addition to such conditions' medium indirect effect on technology use via three internal factors. Second, perceived usefulness and subjective norms were both significant predictors of these Chinese-language teachers' technology use. And third, facilitating conditions significantly influenced these teachers' perceived ease of use and subjective norms. These findings highlight the importance of facilitating conditions to technology integration, as well as the complex interrelationships of the external and internal factors we studied.

The findings of this study have some important implications for teacher educators, policymakers and school administrators in schools, especially those concerned with language

subjects. When implementing technology in school environments, better facilitating conditions – such as easy access to technical support, abundant resources and technology-related pedagogical training – should be provided for language teachers, to enhance their perceptions of the usefulness and ease of use of technology, as this is likely to lead to fundamental improvement in their instructional-technology integration. Moreover, teacher educators and professional-training specialists need to give greater consideration to academic subject content when designing courses and training aimed at facilitating technology integration. In other words, instead of providing one-size-fits-all technology training aimed at transmitting knowledge of how to operate hardware or software, professional teaching and training need to relate much more closely to the academic content of what is going to be taught, if the trainees' perceptions of the usefulness and ease of use of technology are to improve.

Several limitations of this research should be noted. Although path analysis of the present research model indicates a good model fit, adding some teacher-specific constructs, such as teachers' pedagogical beliefs, would tend to enhance our understanding of teachers' technology acceptance. Second, our sample size was comparatively small for SEM analysis, according to Kline (2005). To cope with the small sample size, an average score for each factor was used to reduce the number of parameters (i.e., 5), which resulted in the ratio of sample size (i.e., 47 in this study) to parameters being close to the suggested ratio of 10:1 (Bentler & Chou, 1987). Conducting more sophisticated statistical analyses such as SEM will yield considerably greater explanatory power if sample sizes are larger. Third, this study relied on teachers' self-reported data, which may not necessarily converge with their actual classroom behavior of technology use. Future research could consider using classroom observation to more accurately capture teachers' technology adoption in classrooms. Finally, the subjects of this study were limited to

teachers of Chinese as a foreign language in a particular region of the U.S., which is likely to limit the generalizability of its results. Future research on the same topic could usefully include samples of more people from more cultural and regional groups to increase the reliability and validity of their results.

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Table 1.

Descriptive Statistics

Variables	Mean	SD	Skewness	Kurtosis
Facilitating Conditions	3.74	.78	-.59	.04
Perceived Ease of Use	3.40	.61	-.36	-.10
Subjective Norm	3.96	.57	.12	-.10
Perceived Usefulness	4.23	.57	-.40	.07
Technology Behavior	3.64	.64	.13	.06

Table 2.

Correlations Matrix

	Facilitating Condition	Perceived Ease of Use	Subjective Norm	Perceived Usefulness	Technology Behavior
Facilitating Condition	1				
Perceived Ease of Use	.56***	1			
Subjective Norm	.48***	.41**	1		
Perceived Usefulness	.23	.31*	.57***	1	
Technology Behavior	.50***	.46**	.52***	.51***	1

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 3.

Parameter Estimates of Path Analysis

Causal path	Standardized coefficients	Standard Error	<i>t</i> statistics
Behavior←Facilitating Condition	.28*	.14	2.06
Behavior←Perceived Usefulness	.32*	.14	2.34
Behavior←Subjective norm	.17*	.08	2.11
Behavior←Perceived ease of use	.15	.14	1.10
Perceived ease of use←Facilitating condition	.56***	.09	6.16
Subjective norm←Facilitating condition	.48***	.11	4.54
Perceived usefulness←Facilitating condition	.23	.14	1.69

* $p < .05$; *** $p < .001$

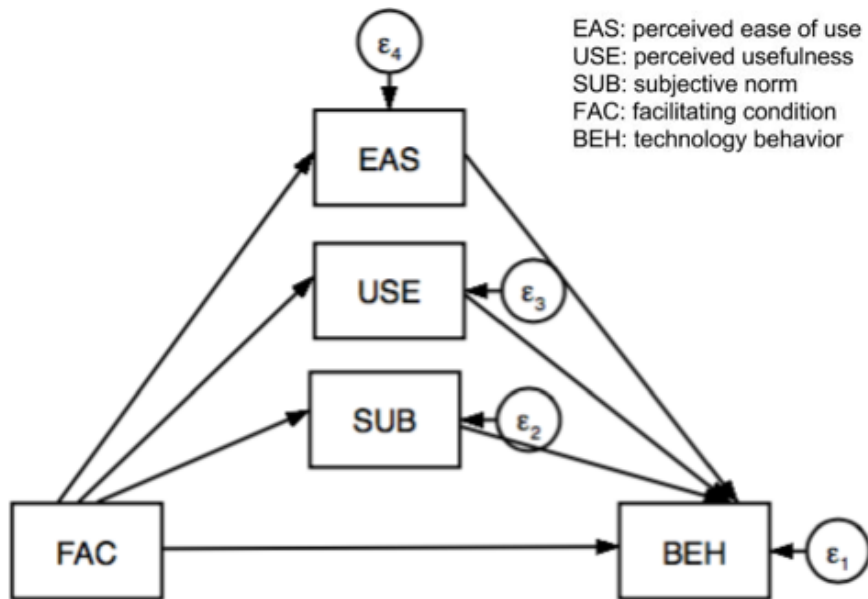


Figure 1. Proposed Research Model

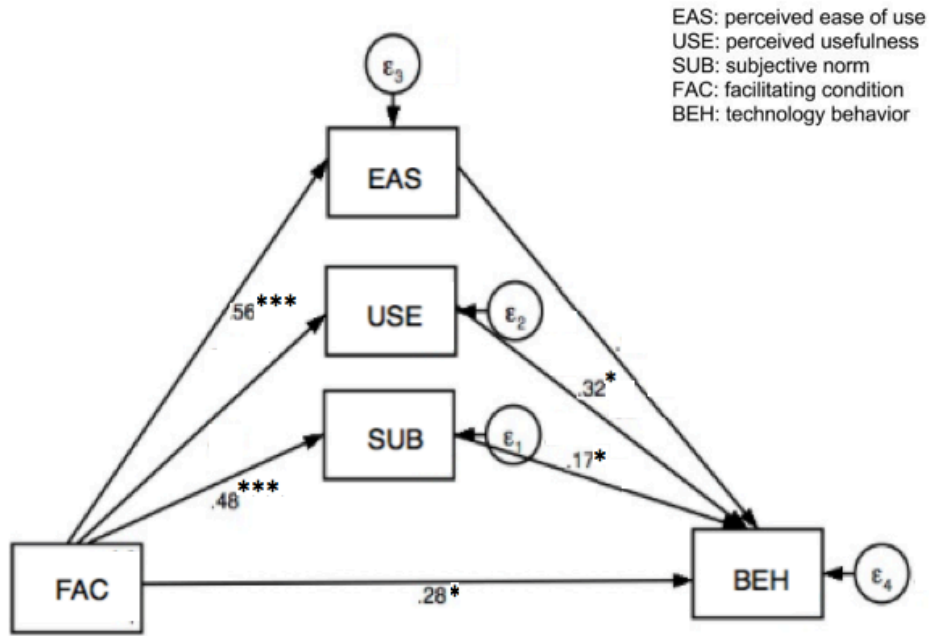


Figure 2. Final Model of Path Analysis with Standardized Path Coefficients

Note. Non-significant coefficients are not included.

* $p < .05$ *** $p < .001$