Unpacking Chinese University Music Teachers' Technology Adoption: A Mixed- Method Approach

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Abstract

This study adopted a mixed-method approach to unpack Chinese university music teachers' technology adoption, on the basis of the technology acceptance model and the semi-structured interviews to obtain deep understandings of their usage experience. Results indicated Chinese university music teachers perceived positively on technology use in music education. Their intentions to use technology were significantly predicted by perceived usefulness and their attitudes. In addition, music teachers' attitudes towards using technology in teaching were significantly explained by perceived usefulness and ease of use. Perceived usefulness was explained by their perceptions of ease of use. This way, the technology acceptance model was approved as useful and valid in explaining Chinese university music teachers' technology adoption. The findings from the semi-structured interviews for music English teachers showed that technology adoption was useful in content delivery and teacher-student interactions, especially during the pandemic era. Despite its usefulness, music teachers admitted that online teaching was not as satisfactory as traditional hands-on tutoring. A lack of design thinking involving technology and difficulty in diverting from their accustomed teaching habit are two main challenges for them. Suggestions are provided to improve music teachers' design thinking and technology adoption.

Keywords : technology adoption, music teacher, China

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Introduction

Technology innovation brought about changes in teaching beliefs, pedagogy, and educational stakeholders' expectations (Huang et al., 2021; 2023). Despite its pervasiveness in education in the digital age, the use of technology among music teachers is insufficiently explored in existing literature. Scholars suggested that studies in technology adoption need to take specific teaching content and context into consideration given that teachers in different domains and cultural backgrounds may think differently (Srite, 2006; Teo et al., 2018). Following these suggestions, researchers have endeavored to unpack teachers' technology use in diverse domains. For example, foreign language teachers in China used technology to enrich language teaching materials and improve students' learning motivation and engagement (Huang et al., 2019; Gao & Zhang, 2020). Music teachers in the United States used technology more frequently than their students and they mainly used CD burning and notation software to teach music (Dorfman, 2008). Music teachers in Hong Kong suggested that when technology was carefully designed and adopted into music teaching and practice, it could improve students' motivation and the learning quality (Ho, 2004). Recent studies suggested that music teachers used online videos in classrooms to provide students with stimulating and relevant materials (Upitis et al., 2016), citing the use of social networking sites (e.g., YouTube) to engage learners (Dougherty & Andercheck, 2014) and illustrate music instruments and forms (Hwang & Ilari, 2019). Furthermore, technology enabled music teaching in and out of school (Kruse & Veblen, 2012), which is of great significance for music teachers, especially with respect to teaching during difficult times following the outbreak of Covid-19.

The success of integrating technology into music education lies in an underlying assumption that teachers are willing to adopt technology and that they are competent technology users as well. However, to date, few studies unpacked Chinese music teachers' attitudes toward using technologies and their intentions to integrate technology into music teaching. How they perceive technology use in music teaching, and whether they hold positive emotional attitudes toward technology use in enhancing students' learning compared with the traditional master-apprentice teaching model deserve researchers' investigation.

To understand these issues, this study adopted a mixed-method approach to understand Chinese university music teachers' technology adoption in music teaching. To be specific, a well-

designed survey based on technology acceptance model (TAM) proposed by Davis (1989) was conducted among 179 university music teachers in China, and among them, 3 were interviewed to reach a deep understanding of music teachers' technology use in teaching.

Research questions (RQ) guiding the current study are:

RQ1: Is the technology acceptance model valid in explaining Chinese university music teachers' technology adoption in music teaching?

RQ2: How do they perceive the use of technology in music teaching?

Literature Review

The formulation of hypotheses in the current study originated from the original technology acceptance model (TAM) developed by Davis (1989). TAM is well-known as a mostly used and valid theories in explaining technology users' intentions in diverse cultural contexts (Sing et al., 2022; Teo et al., 2018; Huang et al., 2019), such as North America (Venkatesh & Bala, 2008), Europe (Sánchez-Prieto, et al., 2019) and Asia (Huang et al., 2021). Be that as it may, the TAM was still criticized for its parsimony and limit in the explanatory ability (Venkatesh & Bala, 2008). Therefore, it was suggested scholars examine TAM in diverse settings, such as education (Teo et al., 2018).
In the TAM, the two main antecedents to users' attitudes and behavioral intentions are the perceived usefulness (PU) and the perceived ease of use (PEU). To be specific, PU measures people's understanding of technology in improving their productivity or effectiveness in the working setting. PEU indicates people's belief about whether and to what extent using technology is effortless or not difficult. These two main antecedents influence people's attitudes toward technology use (ATU), which examines individuals' likeness of using technology. The behavioral intention (BI) measures person's willingness to use technology and is directly influenced by PU and ATU (Davis, 1989). In addition, ATU is influenced by PU and PEU. PU is directly determined by its antecedent, namely, PEU. The TAM model is illustrated in Figure 1.

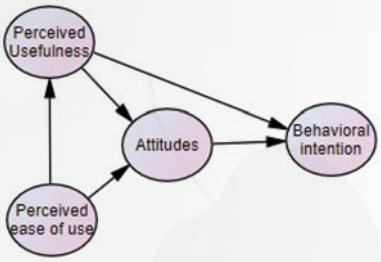

Figure 1 The technology acceptance model

Note. From "*MIS Quarterly,"* by F. D. Davis, 1989, *13*(3), 319–340 (https://doi.org/10.2307/249008).

The above description of the TAM gives rise to the proposed hypotheses:

H1: PU significantly influences ATU.

H2: PU significantly influences BI.

H3: PEU significantly influences PU.

H4: PEU significantly influences ATU.

H5: ATU significantly influences BI.

Methodology

This study used a mixed-method approach to analyze the data collected from a questionnaire survey and semi-structured interviews. This approach starts with an analysis of quantitative data collected from a survey questionnaire, followed by qualitative interviews informed by survey results. The qualitative inquiry helps understand results that arise in the initial quantitative phase. The mixed-method approach can increase people's confidence in findings and provide sufficient evidence while reducing possible shortcomings in an otherwise single research approach (Creswell & Plano Clark, 2011; Tashakkori & Creswell, 2008).

Participants and research procedure

Participants in the quantitative study were 179 university music teachers. Data for the quantitative study were gathered by using the convenience sampling technique, with assistance from teachers who work in Chinese universities. Before they filled in the online questionnaire, the author informed them of the aim of the study as well as their voluntariness of participating.

For the survey questionnaire, participants spent an average of 8 minutes filling out the questionnaire. Among the participants who are university music teachers in China, most of them were female teachers and their ages were averagely at 35.23 years old (SD = 9.37). As for music teaching experience using technology, they had averagely 5.55 years' teaching experience. In addition, most Chinese university music teachers in this study were lectures (44.10%), very few are associate professors (19.6%) and professors (3.9%). Please refer to Table 1 for details of participants' demographic information.

Table 1 Summary of demographic information (N = 179)

	Categories	Number/Mean	Percentage
Gender	Male	67	37.43%
	Female	112	62.57%
Profession	Lecturer	79	44.10%
	Associate Professor	35	19.60%
	Professor	7	3.90%
	Not provided	58	32.40%
Age	Range: 18~66	35.23 (SD =9.37)	
Yeas of teaching	Range: 0~40	9.996 (SD = 8.60)	
Years of teaching using technology	Range: 0~30	5.55 (SD = 5.56)	

After filling in the survey questionnaire, 3 music teachers who are friends of the researcher were interviewed. They were from different Chinese universities. Considering their rich teaching experience and good reputation in music education in the Chinese context, the author intentionally invited them to provide their understanding of using technology in music teaching. Based on their consent, interviews were recorded for further analysis. Pseudonyms (Han, Wang and Huo) were used to ensure anonymity. Han and Huo are from specialized music education colleges in Beijing and Shanghai, China, respectively, and Wang is from a comprehensive university

in Qingdao, China. They were well informed of the purpose of the study, they were willing to provide deep thoughts about using technology in teaching music. Given the fact that the interviewees were geographically distant from the researcher, telephone interviews with an average length of 40 minutes were conducted.

Instrument and data analyses

The As mentioned above, the author used an online questionnaire to collect data among university music teachers in China. The design of the questionnaire was based on TAM, to be specific, the first part inquired into participants' demographic information (age, gender, university type, etc.), and the second part of the questionnaire included key constructions with measurement items in the TAM (Figure 1). These items were adapted from diverse sources where their reliability and validity were tested: PU (4 items); PEU (4 items); ATU (4 items); BI (4 items). All the items were all measured at a 7-point Likert scale.

Data analyses were performed by using SPSS 24.0, one of key instruments for data analyses in the education and social science field. To ensure the validity and the reliability of the factors of the TAM, the author examined the Kaiser-Meyer-Olkin (KMO), with the value being at .946 (sig. = .000), indicating the appropriateness of conducting factor analyses. In addition, these constructs were significantly correlated, indicating good validity of the items (Table 2). The reliabilities of the constructs also suggested a satisfying level, with values of the Cronbach's alphas being above .9 (please see Table 2 for the details).

Table 2 Correlations and reliabilities of the constructs

	PU	PEU	ATU	BI	Cronbach's alpha
PU	1				.931
PEU	.646**				.914
ATU	.839**	.624**			.961
BI	.892**	.658**	.908**		.967

To examine the hypotheses in the research model, the author conducted linear regression analyses and results were presented in the following sections.

The semi-structured interviews were also conducted in Chinese based on an interview protocol. Example questions are: What technological tools do you use in music teaching? How do you understand their usefulness in music teaching? How do you cope with difficulties, if any?

Interview data were initially transcribed word-by-word to texts by the researcher, later sent to the research assistant (co-analyst) to review, and finally submitted to the interviewees to check before being finalized into the draft. This process formed the basis for a triangulation of data sources to ensure data accuracy (Denzin & Lincoln, 1994). The draft was then subject to a coding process that involved open coding, axial coding and selective coding suggested by grounded theory, which provides a systematic procedure for researchers to identify codes and categories and build their connections to generate themes (Urquhart, 2013).

Results and Discussion

Descriptive analyses

Besides university music teachers' demographic information demonstrated in Table 1, results suggested that the means of the constructs varied from 5.79 to 5.98 (SD from 1.28 to 1.39), indicating participants' positive responses to these constructs. To be specific, Chinese university music teachers had the highest grade/score in the perceived usefulness construct, followed by attitudes, behavioral intention, and perceived ease of use. The data was normally distributed, given the skewness and kurtosis were from -1.39 to -.1.08 and 0.96 to 1.75, respectively. Table 3 demonstrated results of descriptive analyses of the constructs.

Table 3 Results of the descriptive analyses

Constructs	Min	Max	Mean	SD	Skewness	Kurtosis
Perceived usefulness	1.00	7.00	5.9804	1.27736	-1.296	1.303
Perceived ease of use	1.00	7.00	5.7863	1.30608	-1.081	0.965
Attitudes towards technology	1.00	7.00	5.9302	1.33477	-1.391	1.749
Behavioral intention	1.00	7.00	5.8561	1.39443	-1.276	1.264

Factor loadings

To further ensure the validity of the measurement items, the researcher conducted exploratory factor loadings. Results Table 4 suggested, factor loadings were all above .6, indicating the significance of items in indicating their factors (Hair et al., 2010). The total variance explained by the four factors was 81.374%.

Table 4 Results of the factor analyses

Factors	Standardized factor loadings			
PU_1	0.846			
PU_2	0.859			
PU_3	0.850			
PU_4	0.869			
PEU_1		0.672		
PEU_2		0.741		
PEU_3		0.779		
PEU_4		0.569		
ATU_1			0.848	
ATU_2			0.879	
ATU_3			0.924	
ATU_4			0.911	
BI_1				0.901
BI_2				0.909
BI_3				0.929
BI_4				0.940

Results of the hypotheses

Table 5 below indicated the results of the hypotheses, and they were all supported. Music teachers' technology using intentions were significantly influenced by their perceptions of usefulness and their attitudes (H2 and H5). Attitudes were predicted by their perceptions of usefulness and ease of use (H1 and H4). Moreover, perceived ease of use significantly predicted their perceptions of usefulness (H3).

Table 5 Results of hypotheses

Hypotheses		Standardized Beta	Sig	Results
H1	PU⟶ATU	0.839	.000	Supported
H2	PU⟶BI	0.892	.000	Supported
H3	PEU⟶PU	0.646	.000	Supported
H4	PEU⟶ATU	0.646	.000	Supported
H5	ATU⟶BI	0.908	.000	Supported

Music teachers' understandings of technology-integrated teaching

To further understand teachers' technology adoption in music teaching, data from the semi-structured interviews were transcribed word-by-word for coding. Themes were further generated and presented in the following parts.

Theme 1: Usefulness and ease of use in information delivery

Music teachers agreed on the usefulness of technology-integrated teaching, especially in terms of delivering teaching and learning content, arousing students' attention, and providing feedback.

...Technology is quite useful in teaching music. When I find new music tracks and pieces, I send them to my students through WeChat and QQ... my students often record their performance and send me video clips. This is more convenient and easier than using express delivery to send tapes...When schools are closed because of Covid, technology use is indeed useful... (From Han)

...I often teach night classe to students who are interested in music, for example, English majors. When I teach them theoretical knowledge of music, they feel it's boring and difficult to understand, but whenever I display music through computer, I see their eyes sparkle; they seem to follow me better... (From Wang)

...The screenshot function of online teaching tools was very helpful. When I found my students had a wrong finger position, I would take a screenshot and send the picture to him/her, and point out the mistake... (From Huo)

Theme 2: Barriers of technology-assisted music teaching

Music teachers believed technology use, to some extent, brings benefits and convenience, but limitations still exist and thus, they do not believe online teaching will replace the traditional

face-to-face hands-on tutoring.

...True understanding (fingering, movement, the shape of mouth) is better achieved by master-apprentice mentoring... I can tell my students if their fingering and shape of mouth are good. I teach wind music and need to correct students' playing movement. It is very difficult to correct them when they are far away from me. Students can only infer or guess what you mean. For example, if I tell them that their lips are too tight when they flute, they can only try to feel how to loosen...(From Han)

...I teach folk instrument performance, erhu performance. It is a two stringed bowed instrument with a lower register than jinghu. I often ask my students to record their performance and send it to me. If I find a good one, I will share with other students by using the screen sharing function of the Tencent Meeting software. But the audio quality of the computer is not satisfying to music majors, which, to some extent, impacts their understandings of the performance. So, I ask my students to prepare good-quality sound equipment if affordable... (From Huo)

Theme 3: Insufficient knowledge about technology-integrated teaching design

...Although I like using technology in my teaching, which is what my university clearly requires teachers to do, I feel incompetent sometimes, because I did not receive music-teaching-related technology training to improve my music teaching. There are many training lectures, but I do not think I have learned practical skills to integrate technology in my teaching plan... (From Wang)

...I prefer hands-on tutoring if conditions (time and space) permit. The charm of music lies in its emotional expression (sometimes like a storm, and sometimes like a gentle sheep), which requires professional techniques. Technology is helpful for most people who listen to music, but considering my reputation, I won't rely on using technology to teach, and I am not specialized in using these tools... (From Han)

Discussion

This study researched on Chinese university music teachers' technology adoption. Chinese music teachers held positive attitudes toward technology use, and they perceived using technology is useful in music teaching. Intentions of using technology were significantly related

to their attitudes towards technology and perceptions of usefulness regarding technology adoption in music teaching.

Results indicated that all the proposed relationships in the research model were supported. Chinese music teachers perceived that the usefulness of technology and ease of use in music teaching significantly impacted their attitudes, and it further influenced intentions to adopt technology in music teaching. This showed that music teachers' attitudes toward technology played an important mediating role in teachers' technology adoption, which echoes previous studies in diverse subject areas such as English language teaching (Teo et al., 2018) and math teaching (Sing et al., 2022). Perceived ease of use significantly predicted usefulness, indicating when teachers believed that using technological tools was not confusing or complicated, they would be more likely to form a perception of usefulness (Davis, 1989; Venkatesh & Bala, 2008). In line with studies in the technology adoption literature (e.g., Sing et al., 2022; Huang & Teo, 2020), perceived usefulness explained music teachers' technology using intentions. This indicates PU plays a vital role in music teachers' technology adoption intentions, especially for online teaching during quarantine. This is true when innovations have pervasive advantages in enhancing music teaching and learning (Haning, 2016).

The current study has both theoretical contribution and educational implications. The study empirically approved the power of the TAM in explaining music teachers' technology adoption in the Chinese context. Interview findings accentuate music teachers' understanding of their technology integration in terms of its usefulness, compatibility, limitations, and teachers' worries concerning technological pedagogical and content knowledge (Huang, et al., 2021, 2023; Mishra & Koehler, 2006) as well as design thinking (Tsai & Chai, 2012).

To overcome the above-mentioned challenges and difficulties, teachers should take measures to obtain technological knowledge and skills to design teaching activities by integrating technology. The hands-on practice and tutoring are effective and deserve people's respect but because online teaching has increasingly become a norm in education around the world as well as students' digital nativity and preferences for using technology, teacher training institutions are advised to design targeted training programs to facilitate pre-service as well as front-line music teachers' pedagogical design with technology. Apart from increasing learning opportunities and providing content in training programs, trainers should provide practical examples and

explanations to improve teachers' thinking of using technology in music teaching and strengthen their teaching beliefs of using technology (Ertmer, 1999).

Conclusion and Recommendations

The current study examined university music teachers' perceptions of using technological tools to teach music. Results of the quantitative study indicated Chinese university music teachers' intentions to apply technology was associated with perceived usefulness, ease of use, and their attitudes towards technology use in music teaching. Interviews provided deep insights regarding music teachers' perceptions of using technology in music teaching.

Even though the number of music teachers in universities is not as large as that of teachers in other domains (e.g., math, English), the sample size still falls short of getting a full picture of music teachers' technology adoption. Also, the study did not extend any variable from the TAM, it may to some extent decrease the explain ability of the TAM. In addition, as the qualitative study only involved a limited number of interviewees, the findings should not be overgeneralized. Future research can enlarge the sample size and solicit opinions from students, the faculty, and teacher-trainers to broaden people's understanding of technology use in music teaching.

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