DEVELOPMENT OF A MODEL TO INCREASE TECHNOLOGY USE FOR MUSIC INSTRUCTORS IN SICHUAN PROVINCE, CHINA*

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Abstract

The use of technology for music instruction is an essential aspect of the development of creative and innovative music professionals. Nevertheless, the use of technology for music teaching in China is still developing in many areas. This study intended to develop a model to increase technology use by music instructors in Sichuan province. It utilized a sequential exploratory mixed methods design to develop a model and was based on two theories, TPACK and UTAUT. The study was based on the following objectives: 1)To explore the type of technological, content, and pedagogical knowledge of university music instructors and their intention to use technology 2) To determine the current levels of technological, pedagogical, and content knowledge and the intent to use technology of music instructors in universities in Sichuan province, 3) To find the relationship between university music instructors' content, pedagogical, and technological knowledge, and their intention to use technology 4) To develop a model to increase technology use for music instructors in Sichuan Province, China. Respondents were 412 music instructors from four universities in Sichuan province. Perceived pedagogical and content knowledge levels were high and technological knowledge was moderate. Instructors' intent to use technology was also high. Regression analysis revealed that there was a statistically significant relationship between instructors' levels of technological, content, and pedagogical knowledge and intent to use technology. The multiple regression results indicated that as $R^2 = .45$, where TPACK accounted for 45.5% of the variance related to intent to use technology. A final model was developed and validated by experts.

Keywords: Music Instructors, Technology, Tpack, Utaut.

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Introduction

The 49th Statistical Report on The Development of the Internet in China released by CNNIC shows that in March 2020, China had 904 million internet users, and the internet popularization rate reached 64.5% (CNNIC, 2022). The number of online education users has reached 423 million, accounting for 46.8% of the total internet users, among which student users have reached up to 265 million. In this technological environment, higher education in China has updated education technology. It is a trend in education development that educators are integrated into the information age (China Department of Education, 2022). Technology integration can supplement traditional face-to-face teaching and an extension of conventional and after-class classes. Technology can enhance the teaching content and act as a bridge between teachers and students. The Chinese Ministry of Education encourages higher education to use technology for teaching and has issued the project "Innovative Technology Classroom" (China Department of Education, 2022). It has also launched the "Modern Distance Education Project," "Network Curriculum in the New Century," "Excellent Course," "The Chinese University of Video Public Class," "China University Video Open Course," and undergraduate teaching evaluation. These policies promote the universities in the digital campus, the network teaching platform, the construction of digital teaching resources, and network courses. “The National Program for Medium and Long-Term Education Reform and Development (2010-2020)” clearly identifies the revolutionary impact and role of technology in education and, for the first time, puts forward the concept of "The Deep Integration of Technology and Education" (The Ministry of National Education, 2021).

Nonetheless, there still exists issues of technology use for teaching in music education. The researcher found that music teachers in Sichuan Province, China, rarely use technology to integrate into teaching and only use it in specific lectures or for special teaching needs. Additionally, instructors are accustomed to using the traditional teaching mode previously established. According to the interviews with school administrators, the instructors have inherent thinking; they do not have the initiative to use technology as a commonly used classroom tool. They do not want to spend too much time making changes, even though their institution provides hardware facilities related to technology. In music education, integrating technology in the classroom can encourage students to participate in teaching practice actively, and students have a great interest in the particular classroom form with technology integration (Wash, 2019). However, some music colleges with technology facilities in the Sichuan province only regarded technology equipment as a "possibly" helpful tool (Wang, 2021). Therefore, this study aims to develop a model that will help increase technology use in higher education music teaching.

The following research objectives guide this study: 1) To explore the type of technological, content, and pedagogical knowledge of university music instructors and factors related to their intention to use technology, 2) To determine the current levels of technological, pedagogical, and content knowledge and the intent to use the technology

of music instructors in universities in Sichuan province, 3) To find the relationship between university music instructors' content, pedagogical, and technological knowledge, and their intention to use technology and 4) To develop a model to increase technology use for music instructors in Sichuan Province, China.

Research Objectives

The study was based on the following objectives:

1)To explore the technological, content, and pedagogical knowledge of university music instructors and their intention to use technology

2) To determine the current levels of technological, pedagogical, and content knowledge and the intent to use the technology of music instructors in universities in Sichuan province,

3) To find the relationship between university music instructors' content, pedagogical, and technological knowledge, and their intention to use technology

4) To develop a model to increase technology use for music instructors in Sichuan Province, China.

Literature Review

Integrating any new technology into the education system and promoting the effective development of education is a highly complex and gradual process. The teaching system is exceptionally complex; people cannot fully control the various factors and predict the impact of new technology. When using technology in teaching, teachers will encounter various obstacles and difficulties, leading to teachers' unwillingness to use technology in the classroom. In a study by Agnew (2009), it was found that teachers were unsure how to implement technology; Teachers were unsure whether using technology in music classrooms was helpful for teaching. Still, teachers' attitudes and self-efficacy toward using technology in education are positive.

The introduction of technology into college teaching in China began at the end of the 20th century (Xie, 2007). More than 50% of universities have popularized integration technology in teaching. Nonetheless, far as music teaching is concerned, art colleges attach more importance to the renewal of teaching methods than comprehensive university music colleges (Zhou, 2002). In 2020, the prevalence rate of multimedia music equipment in professional art colleges was 100%. In non-art comprehensive colleges with music education courses, it was 81.4% (Education Department of Sichuan Province, 2020). Additionally, the prevalence rate of multimedia equipment in universities in eastern China is higher than in midland and western China. Integrating technology into music teaching is challenging for music instructors in China.

According to Mroziak & Bowman (2016), although music instructors may be familiar with general technology for learning or teaching, knowledge of specific software or applications for music may be limited. This is due to the traditional nature of music education, where music instructors may have been taught using traditional or classical

approaches used in music conservatories. It could be that those technologies did not exist before or were not a part of their training. Therefore, those instructors are less likely to use technology, or they may not have competence. Research on music technology development in China seems to confirm this. According to Wang (2016), the use of music technology started late in college music teaching. This disadvantage stems from the following reasons: only a small number of universities and instructors can use technology in their music teaching; the traditional ways of teaching dominate; there is a lack of access to technology for music teaching. This situation confirms the need to help music instructors in higher education in China develop TPACK to increase technology integration into their music teaching.

The theoretical framework of this research is based on the Technological Pedagogical Content Knowledge Framework (TPACK) by Koehler & Mishra (2009) and the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. (2003). TPACK, or the Technological Pedagogical Content Knowledge Framework, was designed to explain the set of knowledge that instructors need to teach their students through technology. Venkatesh and others formulated the Unified Theory of Acceptance and Use of Technology, incorporating previous models and theories into what is known as UTAUT, which attempts to explain users' intentions to use technology and their subsequent behavior.

Technological Pedagogical Content Knowledge Framework (TPACK) refers to teachers' knowledge when using technology to merge with their teaching practice. TPACK is the comprehensive knowledge of technological, pedagogical, and teaching content. According to these three knowledge systems, teachers influence students' classroom learning process (Graham &Cox , 2009; Koehler, Mishra & Cain, 2013). TPACK is a widely used tool to detect and improve the frequency and competence of the instructors' use of technology in the classroom (Graham et al., 2009; Baran et al., 2011; Mouza et al., 2014; Crompton et al., 2017; Claro et al., 2018). It effectively integrates teaching objectives with technology so that the technology integration teaching can exert the most significant advantage. Himmelsbach (2019) believes TPACK is a model for enhancing school teaching and education, improving students' learning methods, and teachers' professional development. Teachers create novel teaching methods to ensure students learn more effectively and interestingly and enhance student achievement. Thus, to create a positive teaching environment, technology integration in the classroom is one of the effective ways to make the classroom a student-centered teaching model.

The Unified Theory of Acceptance and Use of Technology (UTAUT): Over three decades ago, many information technology researchers were paying attention to technology acceptance theories such as Davis' (1989) Technology Acceptance Model (TAM), the Theory of Reasoned Action (TRA), the Motivational Model, the Theory of Planned Behavior (TPB), a combined TBP/TAM, the Model of PC Utilization, Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT) to try to understand what drives or predicts individuals to use technology. In 2003, Venkatesh et al. measured more than 20 variables from these theoretical models, which eventually

evolved into the basic theoretical framework of the UTAUT model. This comprehensive model predicts and explores the factors influencing user acceptance and usage behavior. It has been reduced to four key constructs which directly affect the intention and behavior of people to use technology: 1) performance expectancy, 2) effort expectancy, 3) social influence, and 4) facilitating conditions. In addition, the four variables of gender, experience, age, and willingness to use are important factors regulating the relationship between the key constructs and willingness to use and behavior (Venkatesh et al., 2003). UTAUT is a practical theory to study and explains users' intentions and behavior from a theoretical perspective (Williams et al., 2015).

Conceptual Framework

The following figure depicts the conceptual framework of this study.

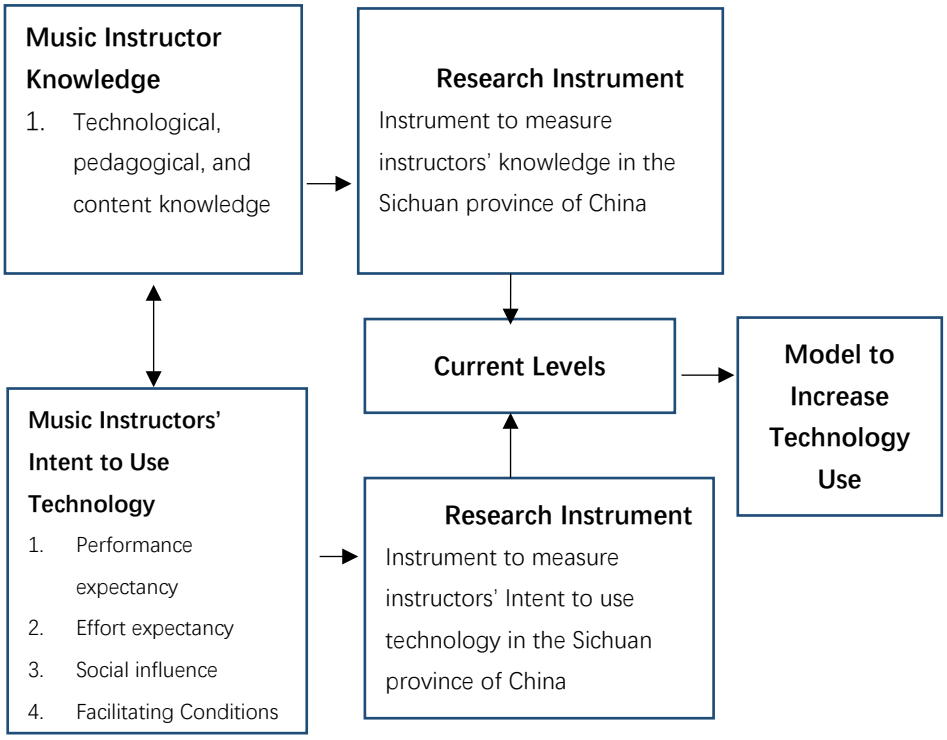

Figure 1. Conceptual framework of the study

Research Methodology

This study used an exploratory sequential mixed-methods design. According to Creswell & Plano Clark (2018), this approach involves combining qualitative and quantitative data collection and analyses in a sequence. The rationale for using this method was to enable the researcher to create an instrument that would be used to collect data. In the first phase, qualitative data related to music instructors' pedagogical, content, and technological knowledge and the behavioral determinants of technology adoption

were determined by conducting a systematic literature review and qualitative analysis. Findings from this phase were used to develop the instrument, which also later informed the other research objectives, which were analyzed quantitatively. Finally, a model was developed and validated by experts.

Population and Sample

The population for this study was music instructors at four comprehensive normal universities and professional music colleges in Sichuan Province, China. Music instructors are instructors employed in music colleges and comprehensive universities and have a professional title as an instructor or above. Therefore, the sample size for this study was 412 music instructors.

Research Findings

A systematic literature review was conducted with reputable and peer-reviewed sources of literature to arrive at the significant variables from which question items were developed for both the music instructors' technological, pedagogical, and content knowledge and for the sub-dimensions comprising music instructors' intent to use technology (Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions). In addition, the developed instrument was validated and pilot-tested for reliability. Finally, it was distributed online to the respondents. A total number of 412 music instructors responded to the survey. The gender distribution of the respondents was 200 males (48.5 percent) and 212 females (52 percent). Most of the respondents were between the ages of 31 and 40 (56 percent). Most respondents had between 1 - 10 years of teaching experience (76 percent), and almost all respondents, 99 percent, reported using some technology for music teaching.

The following tables show the reported levels of music instructors' level of TPACK knowledge and levels of Intent to Use technology.

Table 1. Level of TPACK Knowledge (n = 412)

Extracurricular Activities	Mean	SD	Interpretation
Content knowledge	3.74	1.01	High
Pedagogical knowledge	3.74	1.01	High
Technological knowledge	3.69	.99	Moderate
TRACK	3.72	.77	High
Overall Mean	3.72	.95	High

Table 2. Levels of Instructors' Intent to Use Technology (n = 412)

Dimensions	Mean	SD	Interpretation
Performance Expectancy	3.63	1.09	High
Effort Expectancy	3.60	1.05	High

Social Influence	3.69	1.18	High
Facilitating Conditions	3.60	1.07	High
Overall Mean	3.63	1.10	High

A significant correlation was determined to determine a relationship between music instructors' levels of TPACK knowledge and their Intent to Use Technology, and multicollinearity was ruled out to conduct the multiple regression further. Additionally, the variables of gender, age, and work experience were included in the analysis. The results of the multiple regression analysis are found in the following tables.

Table 3. Results of the multiple linear regression analysis

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.818	.613		1.335	.183
	CK	.320	.044	.315	7.343	.000
	PK	.182	.042	.179	4.365	.000
	TK	.375	.043	.359	8.697	.000
	Gender	.089	.076	.043	1.175	.241
	Age	.030	.081	.017	.366	.715
	Experience	-.057	.096	-.027	-.597	.551
	Current Use of Tech.	-.553	.544	-.037	-1.016	.310

a. Dependent Variable: (Intent to Use Technology)

b. Predictors: Music Content Knowledge (CK), Music Pedagogical Knowledge (PK), and Music Technological Knowledge (TK)

Results showed that TK, PK, and CK were significantly related to Intent to Use technology with significant levels all less than $p < .01$. For the variables of gender, age, experience, and current use of technology, no significant relationships were found. Table 4 shows a summary of the regression model.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.675[a]	.455	.451	.76254

From the regression results, In the coefficients table of the new model, the significant results are all sig< 0.01. The findings show that the independent variables of CK, PK, and TK significantly impact the dependent variable of Intent to Use technology. The multiple regression results indicate that as R^2 = .45, the IVs account for 45.5% of the variance of the DV.

A model was developed incorporating the significant variables and subsequently sent to six experts for model validation. Model validation was conducted using the focus group method, which was conducted in two sessions. The final verified model is shown in Figure 2.

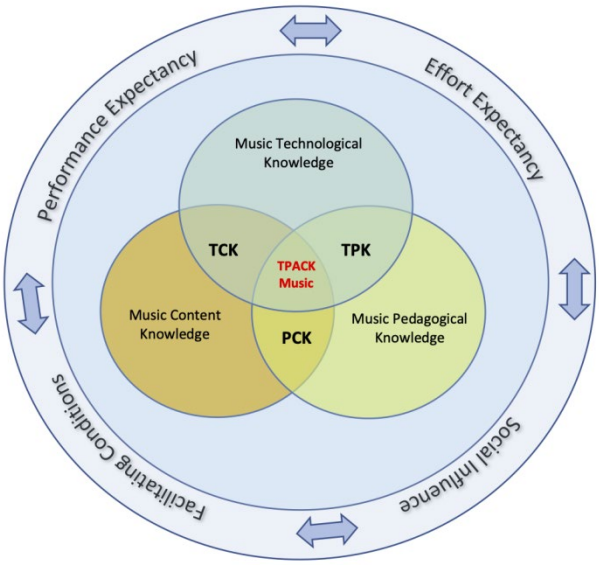

Figure 2 Validated Model for Increasing Technology Use for University Music Instructors in Sichuan Province, China

Model Implications and Implementation

The model shows the knowledge requirements of music instructors. These knowledge requirements significantly impact how instructors apply technology for instruction. According to TPACK theory, technological pedagogical content knowledge are the kinds of knowledge that are required for instructors to have successful integration of technology in their teaching. Concerning this model, music instructors need to have Music Content Knowledge comprising performance skills, composition skills, music history, music theory, music notation, music arranging, the ability to play a musical instrument, music training, and aural skill development. In addition, music instructors also need to have Music Pedagogical Knowledge that includes the ability to plan music instruction and lesson planning, knowledge of music teaching techniques, ability to engage students with music, implement the music curriculum, assess the student's abilities, rehearsal skills and giving feedback, build relationships with students, classroom management, and the ability to adapt to the diverse abilities and skills of learners. Finally, music instructors need to have Music Technological Knowledge that

includes how to incorporate the following technology into their teachings: video, internet sources, music software, music hardware, and composition application and software. There needs to be an intersection of these types of knowledge for efficient teaching.

According to the theoretical framework of UTAUT, four dimensions predict and influence instructors' willingness to use technology: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. If the perceptions of these dimensions are high, then instructors will be more willing to use technology regularly as a part of their teaching. For example, Performance Expectancy is related to instructors' personal beliefs that using technology benefits their teaching. Many instructors may use basic technology to teach because it is a regular occurrence or university provision. However, they may not be motivated to seek new or innovative ways once initial use is established. To encourage the development of Performance Expectancy, the organization may introduce innovative music technology and software to show instructors the benefits of use. This can be done by inviting music software developers or providers to demonstrate their applications. Regular demonstrations will not only introduce instructors to new technology but may also motivate them to seek out their own.

Effort Expectancy is related to how the instructor perceives the technology as easy to use. Many instructors, especially those that are not familiar with or are of a generation that may not be comfortable with technology, do not willingly embrace technology because they feel they do not know how to use it, that the technology is too complex, or it takes too much time to learn how to use it. The university may help to overcome this by using training sessions to help instructors become familiar with the technology. Additionally, time should be given for instructors to adapt, especially to new music technology innovations.

Social Influence is how an instructor perceives that the administration or leaders believe in using technology. Although it may be mandated in the university that instructors use a specific type of basic technology for teaching, compliance requirements are often followed to the minimum. To get instructors to want to use the technology of their own accord, music program leaders or administrators must make clear that technology use is essential and focus on technology to increase efficient teaching and as a means of teaching that today's students expect. Therefore, the model proposes consistent focus and effort by leaders to encourage technology use.

Finally, Facilitating Conditions are defined as the instructor's belief that the university has the appropriate technical infrastructure to support the use of technology. In addition to advocating the use of technology in the university, music instructors need to see support systems that can help them if they have problems, IT specialists, and other staff they can contact for immediate assistance. Once music instructors feel comfortable with the level of organizational support, they will be more willing to try and use various techniques for music teaching.

Discussion

The findings from this study indicated that overall, the teachers sampled perceived themselves to have relatively high levels of music TPACK knowledge, except for technology knowledge which was perceived as moderate. These findings are similar to a previous study conducted by Bauer (2012). In that study, the researcher also developed an instrument to measure music instructors' TPACK, looked at how instructors acquire TPACK, and determined if a relationship existed between TPACK and technology integration. Findings from the study found that of all the types of knowledge, technological knowledge was lower than content and pedagogical knowledge and that there was a significant moderate correlation between levels of TPACK and the level of technology integration.

According to Mroziak & Bowman (2016), although music instructors may be familiar with general technology for learning or teaching, knowledge of specific software or applications for music may be limited. This is due to the traditional nature of music education, where music instructors may have been taught using traditional or classical approaches used in music conservatories. It could be that those technologies did not exist before or were not a part of their training. Therefore, those instructors are less likely to use technology, or they may not have competence. Nevertheless, the overall 'high' levels of intent to use technology determined from the sample shows that music instructors are optimistic about the aspects of using technology. Similar findings are also seen in other studies of technology and music teaching. According to Gorgoretti (2019), who studied student music teachers in Cyprus, the teachers reported positive perceptions of how technology has influenced music teaching and that it motivates music students, creates a less monotonous class, and helps students to retain more knowledge. The shift to more technology is encouraged, and it is recommended that music teachers should not only be prepared but more competent in using technology. Nonetheless, the use of technology in music teaching in higher education is not uniform. There are issues of access and adoption. According to Dammers (2020), the question is not whether technology is helpful for music education and educators but whether music educators are competent. This is directly related to how music instructors see themselves as knowledgeable about technology, as in the findings of this study, which was moderate.

The perception of music teachers using technology to make traditional teaching methods more accessible has been around for over 20 years. Beckstead (2001) had already written about how music technology had the potential to change how teachers approach music pedagogy. Beckstead talked about synthesizers, computers, and technologies to make music compositions more creative. He emphasized that used effectively, music technologies could have a 'transformative' effect in that they could affect a qualitative change in music students and how they think and act. Nevertheless, it was noted that music teachers tended to use technology in an 'amplicative' way. Technology was used to help students complete tasks and activities more efficiently than for creative purposes. This perception is still pervasive today, over two decades later.

Although the researcher does not have specific information in the context of China, music teacher training programs in the country would be assumed not to be much different.

Concerning the model developed in the research, there have also been other studies that have used the TPACK and UTAUT theories in China and tried to understand Chinese music teachers' technological beliefs and behavioral intentions. An example is a study by Zhang, King, and Prior (2021), which also employed these two theories to try to explain the behavioral intent of music teachers to use technology. The study confirms that there may be other reasons that affect the intent to use technology, as indicated in the regression results of this study. However, it is vital to increase personal motivations related to the benefits of using technology for teaching, increasing social influence, and finding ways to increase the personal enjoyment teachers can derive from using technology.

Recommendations

The following recommendations are made concerning how to increase the music instructors' TPACK knowledge and how to influence the sub-dimensions in a positive way to increase music instructors' technology use behavior.

Increasing the relevance of TPACK in music instruction

As TPACK has been shown to influence levels of technology use, increasing TPACK should also increase the music instructors' use of technology. The teaching of music focuses on three areas: performing, listening, and composing. Therefore, TPACK should focus on these areas, and deliberate instructional design should focus on technology-enhanced learning based on TPACK principles (Macrides & Angeli, 2018). These guidelines include 1) identification of content where technology integration will add value, such as by making complex concepts easier to understand or helping teachers to present content, 2) identification of representations for transforming content taught into a more easily understandable form that would not be feasible without technology, 3) identify teaching methods that would be difficult to do or implement through traditional means without technology, 4) choose the appropriate and affordable technological tools and, 5) design learner-centered activities that integrate technology into the classroom.

Increasing instructors' knowledge concerning technology knowledge

Regarding technology use and integration behavior, the four dimensions stated to influence technology integration behavior: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions can also be encouraged for music instructors in the Sichuan context. To increase performance expectancy, which is how the instructor perceives that using technology will help them to teach better, and effort expectancy, which is the degree to which music instructors know how to use technology, instructors need to be exposed to new music technologies and to see how they can make their teaching better. This can be done through professional development opportunities. Research has shown that even a one-week workshop can effectively increase knowledge, comfort, and frequency of use (Bauer, Reese & McAllister, 2003).

Social influence is the degree to which the music instructor feels that their boss or superior supports the use of technology. This is directly related to the context of the university in which the music instructor works, which is also related to the facilitating conditions. Although the history of music technology in China has been stated to be in a less developed state than in the west, there is a trend towards more emphasis in the area of music teaching, technology and research that is supported by both the government and in collaboration and partnerships with international universities (Zhang & Marins, 2016). This trend will encourage university administrators and programs to emphasize music and technology to provide the resources, opportunities, and experiences for music instructors. Furthermore, providing clear guidance and expectations that music technology is required will send music instructors a message that they must thoughtfully incorporate technology into their everyday teaching. Similarly, at the university level, it is essential to ensure that instructors support sourcing, maintaining, training, and timely assistance about technology and technology issues.

This study attempted to develop a model to increase technology use by music instructors in universities in Sichuan province. Some methodological limitations are related to sample bias, which may limit its generalization ability to other contexts in China. Furthermore, the scope of the study was limited to the stated variables, which did not include other moderating variables that may affect the intention to use technology. As this was also survey research, there may be biasedness in the responses. Future researchers may want to incorporate additional variables and collect data from other types of respondents to develop additional perspectives and add to the literature related to this topic.

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