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The impact of Chinese university music teachers' teaching beliefs on creative teaching behaviors: the mediating role of technological acceptance

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This study focuses on college teachers in the Ningxia Hui Autonomous Region of China, aiming to explore the relationships among teaching beliefs, creative teaching behaviors, and technology acceptance. The research adopts a questionnaire survey method, using scales for teaching beliefs, creative teaching behaviors, and technology acceptance to conduct online surveys of college teachers in the Ningxia Hui Autonomous Region of China. Convenience sampling is employed during the survey. The study mainly verifies the theoretical model proposed by using statistical analysis software such as SPSS and AMOS. The results reveal that teaching beliefs of college teachers in the Ningxia Hui Autonomous Region of China positively predict creative teaching behaviors; teaching beliefs positively predict technology acceptance; technology acceptance positively predicts creative teaching behaviors; and technology acceptance has a significant mediating effect between teaching beliefs and creative teaching behaviors.

KEYWORDS

teaching beliefs, creative teaching behavior, technology acceptance, music education, Chinese teacher

1 Introduction

The starting point of educational reform should be from the teaching level, especially in today's rapidly developing modern globalized and information age. Introducing various forms of innovation in teaching is essential for further improving education (Qurbanovich, 2022). Additionally, teaching itself is a creative activity and behavioral process (Cheng, 2001; Sawyer, 2011). Research indicates that creative teaching behaviors (CTB) can effectively enhance students' learning sensitivity and fluency (Hu et al., 2016). The findings of Rankin and Brown (2016) also demonstrate that CTB can stimulate students' interest in learning, foster meaningful learning experiences, and simultaneously cultivate the required cognitive, emotional, and skillful aspects.

Past studies have pointed out a positive relationship between teaching beliefs (TB) and CTB (Northcote, 2009; Kiss and Lin, 2016). Bandura (1982) social cognitive theory and self-efficacy theory emphasize the importance of "belief," which can inspire people to engage in specific tasks and help them utilize their effective capabilities. Keys (2007) noted that teachers' beliefs and habitual ways of doing things can influence their practices in the classroom. Choi and Ramsey (2009) proposed that actual teaching experiences can help novice teachers cultivate appropriate positive beliefs, attitudes, and teaching abilities. Research by Hall and Hord (2011) also indicates

that only when teachers deeply identify with certain beliefs can there be a possibility of truly changing their behavior. In other words, if one hopes for teachers to demonstrate CTB, it is essential to first understand teachers' beliefs about teaching. Literature suggests that the successful execution of CTB in teachers' classrooms depends on their personal beliefs (Berezcki and Karpati, 2018).

However, relying solely on TB is far from sufficient. The COVID-19 pandemic has swept across the globe, compelling schools to integrate technological solutions into education (Sarikaya, 2021). This new technological backdrop, triggered by the pandemic, along with its corresponding challenges, has posed numerous difficulties for both teachers and students in the teaching process. This has prompted educational systems and scholars to reflect, recognizing the inadequacies in teachers' technological application and attitudes (Arslantas, 2021). Paje et al. (2021) argued that effectively utilizing instructional technology in schools is one of teachers' core responsibilities. Moreover, the planning, maintenance, and assessment of these technologies' effective application are crucial for achieving educational goals, ultimately depending on teachers' abilities and commitment (Kara, 2021). Consequently, in today's era, various sectors of society, including parents and students, hold higher expectations for teachers' performance in the classroom than ever before.

The development of creativity in the modern educational process is closely related to the application of information technology, which serves as an effective innovative means to enhance the quality of teaching at all levels (Gorburnova and Govorova, 2018). The adoption of technology-enhanced teaching by educators may also enable students to acquire digital skills or develop an optimistic attitude toward technology. This has a positive impact on the quality of education, akin to its effects in all other domains (Koliousska and Andreopoulou, 2020). Technology has enabled various industries to enhance efficiency and has become an integral part of everyone's life and work (Mendoza et al., 2015).

Not only do teachers' beliefs influence their CTB, but technological acceptance (TA) is also one of the most crucial factors affecting such behaviors (Mirzajani et al., 2016). By utilizing technological tools to help teachers achieve creative solutions and teaching behaviors (Henriksen et al., 2016), teachers' innovative use of information and communication technology, including generating ideas and creative learning applications, allows information and communication technology (ICT) to permeate various aspects of the curriculum, particularly in areas such as learning objectives. When teachers perceive technology as useful and conducive to their productivity, they are more willing to use it. Thus, positive TA has a positive and direct impact on behavioral intentions (Boulton, 2017). Chou et al. (2019) found a significant positive correlation between TA and the use of ICT for CTB.

Although past literature suggests that teachers' beliefs can influence their teaching behaviors, teachers' instructional behaviors may not always align with their beliefs (Assen et al., 2016). Therefore, this study posits that in the process of beliefs translating into behaviors, several factors may influence this process, which could stem from teachers' life experiences, personality traits, work environments, etc. For instance, if teachers hold positive TB, they may be more motivated to adopt new technology-assisted teaching methods, and with stronger motivation, they might exhibit higher levels of TA, thereby leading to higher levels of CTB. Zou et al. (2022) found that preservice teachers' behavioral attitudes play a fully mediating role in the relationship between TB and behavioral intentions. Hence, this study selects TA as an important mediating variable for exploration.

In summary, this study aims to investigate the influence relationships among TB, CTB, and TA, to comprehensively understand how CTB are influenced. This contributes to providing deeper insights into higher education music education and offers practical recommendations and guidance for promoting innovative teaching.

2 Research hypothesis and theoretical framework

2.1 The influence of teaching beliefs on creative teaching behaviors

Based on the studies conducted by Kiss and Lin (2016) and Northcote (2009), it has been indicated that there exists a positive relationship between TB and teaching behaviors. Furthermore, the research conducted by Berezcki and Karpati (2018) suggests that the successful implementation of creative teaching in the classroom by teachers depends on their personal beliefs. Keys (2007) emphasizes that both teachers' beliefs and habitual ways of doing things can influence their practices in the classroom. Additionally, Choi and Ramsey (2009) propose that practical teaching experiences can assist novice teachers in cultivating appropriate positive beliefs, attitudes, and teaching abilities. The research by Hall and Hord (2011) also demonstrates that true behavioral change in teachers is only possible when they genuinely embrace certain beliefs deep within themselves. Hence, this study proposes Hypothesis 1: Chinese university music teachers' TB have a significant positive impact on CTB.

2.2 The influence of teaching beliefs on technological acceptance

Ajzen and Madden (1986) proposed a theory suggesting that beliefs can influence behavior. Subsequently, teachers' TB have been recognized as a key factor influencing their instructional practices (Ng et al., 2010). Research by Taimalu and Luik (2019) found that constructivist TB positively affect teachers' technological integration, while transmission TB have a negative impact on technological integration. Teachers with constructivist TB are more inclined to use technology to support student learning, whereas those with traditional TB tend to use technology to support their own curriculum control (Ertmer et al., 2012). Zou et al. (2022) examined the impact of preservice teachers' TB on their intention to empower student learning using technology from both constructivist and transmission perspectives, with results indicating a positive effect in this research pathway. Therefore, this study proposes Hypothesis 2: Chinese university music teachers' TB have a significant positive impact on TA.

2.3 The influence of technological acceptance on creative teaching behaviors

Research indicates that teachers' TA is associated with their adoption of innovative teaching methods and materials (Nikolopoulou and Gialamas, 2016). TA can be understood as the willingness of certain teachers to pioneer the adoption of innovative educational technologies and methods within the school environment (Agyei and Voogt, 2014;

Teo, 2014; Daniels, 2015). Teachers with high TA are adept at utilizing information and communication technologies as educational tools, seamlessly integrating content and instructional methods. Consequently, they are more inclined to apply ICT to address instructional challenges and select appropriate teaching methods. The extent to which teachers accept innovative technologies also influences their willingness to use these technologies in their daily teaching practices. Teachers who are more receptive to new methods are more effective in introducing new pedagogical approaches, thereby facilitating the dissemination of ICT innovative teaching (Chou et al., 2019). Chou et al. (2019) found a significant positive correlation between TA and the use of ICT for CTB. Therefore, this study proposes Hypothesis 3: TA among Chinese university music teachers has a significant positive impact on CTB.

2.4 The mediating effect of technological acceptance on the relationship between teaching beliefs and creative teaching behaviors

Van Twillert et al. (2020) found that teachers' TB constitute a significant belief that directly predicts their behavioral intentions. Additionally, scholars have observed that different TB have varying degrees of influence on behavioral intentions. Bahçivan et al. (2018) investigated the relationship between TB and attitudes among 1,028 teacher candidates and found significant effects of both types of TB on attitudes, with constructivist TB predicting attitudes more strongly than transmission TB. However, differing viewpoints have been proposed as well. Liu et al. (2017) argued that teachers' constructivist TB significantly influence attitudes, while transmission TB have no significant impact on attitudes. Moreover, scholars have noted that different attitudes have varying degrees of predictive power on behavioral intentions (Wixom and Todd, 2005). Broadly defined, behavioral attitudes are understood as the willingness of individuals to use information technology, use related materials (such as digital textbooks or electronic whiteboards), or engage in teaching practices (Scherer et al., 2018).

Ajzen and Madden (1986) confirmed that behavioral attitudes are more effective predictors of behavioral intentions than attitudes toward objects. In this study, behavioral attitudes refer to teachers' attitudes toward the use of technology to empower teaching practices, which are expected to strongly predict behavioral intentions. Zou et al. (2022) conducted a study with teacher candidates from seven universities in Zhejiang Province, distributing questionnaires through the online platform "Questionnaire Star," with a total of 1,120 valid responses. The study found that the behavioral attitudes of teacher candidates played a fully mediating role in the relationship between TB and behavioral intentions. Therefore, this study proposes Hypothesis 4: TA among Chinese university music teachers serves as a significant mediating factor in the relationship between TB and CTB.

3 Research method and design

3.1 Research framework

Based on the discussions above, this study aims to investigate the influence relationships among TB, CTB, and TA among Chinese

university music teachers. The research framework is designed as depicted in the Figure 1.

3.2 Research participants and sampling procedure

In this study, an online questionnaire survey was conducted using the TB scale, CTB scale, and TA scale among Chinese university music teachers. A total of 3 Chinese universities were selected, including one comprehensive university, one applied university, and one vocational and technical university. Comprehensive universities typically offer a variety of disciplines and majors, including arts, sciences, engineering, medicine, law, etc., and possess the authority to grant complete undergraduate, master's, and doctoral degrees. Applied universities focus on cultivating applied talents, emphasizing the integration of theoretical knowledge and practical application. They usually offer majors closely related to social demands, such as engineering technology, management, design, etc. Vocational and technical universities mainly train talents with technical skills, emphasizing the cultivation of practical skills. The majors offered are often related to specific vocational skills, such as mechanical manufacturing, automotive maintenance, catering management, etc.

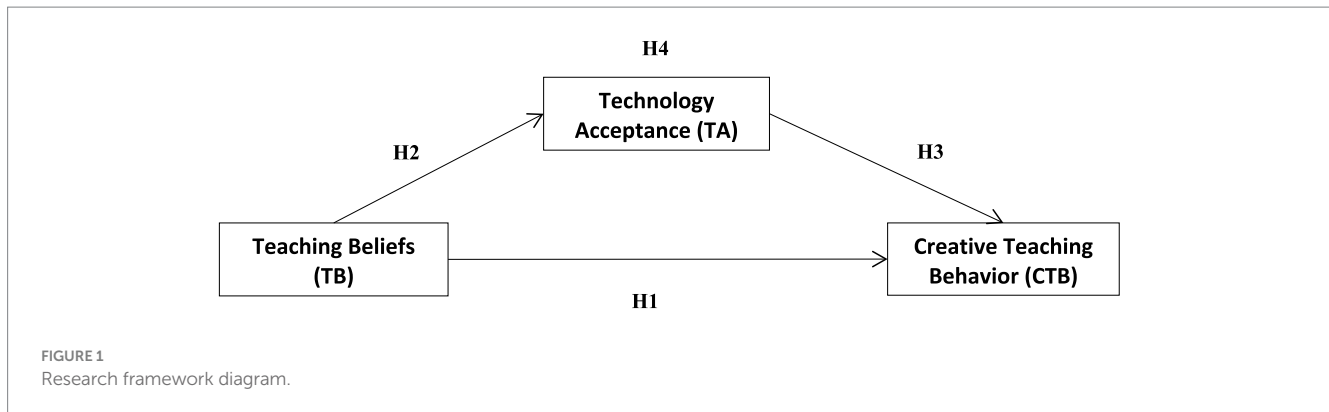
Convenience sampling was employed in the survey, which was conducted in two phases. This study collected questionnaires online. Both batches of samples were collected using convenience sampling methods and distributed via the online platform "Questionnaire Star." During the pilot phase, a total of 150 questionnaires were distributed to analyze the item analysis, exploratory factor analysis, and reliability analysis of the scales used in this study. Ultimately, 136 valid pilot questionnaires were collected, resulting in an effective rate of 90.667%.

During the formal survey, questionnaires were distributed with the assistance of colleagues, friends, and through collective activities such as local teacher training. A total of 480 questionnaires were distributed during the formal survey phase. During the data collection process, questionnaires with completion times less than 10 min or incomplete responses were excluded. Eventually, 458 valid questionnaires were collected. When using the questionnaire survey method, the researchers explained the research content, purpose, and requested the participants to sign informed consent forms. Participants were informed that their responses would be anonymous and they could withdraw from the survey at any time.

3.3 Research tools

3.3.1 Teaching beliefs scale

The TB scale developed by Lü and Wang (2004) consists of 38 items in its formal version. The scale comprises four dimensions: beliefs about student management (items 1–12), beliefs about curriculum (items 12–20), beliefs about assessment (items 21–32), and beliefs about student learning (items 33–38). Responses are measured using a five-point Likert scale. The model fit indices for the TB scale in this study are as follows: $\chi^2/df = 1.219$, RMR = 0.030, AGFI = 0.911, RMSEA = 0.022, NFI = 0.944, TLI = 0.989, CFI = 0.989, RFI = 0.940, IFI = 0.989, PNFI = 0.881, PCFI = 0.923. All fit indices meet the standard criteria. The overall Cronbach's Alpha for TB is 0.965.



3.3.2 Creative teaching behaviors scale

The CTB evaluation scale, developed and revised by Zhang et al. (2008), is used to measure teachers' CTB. The scale consists of 28 items divided into four dimensions: instructional guidance, motivation stimulation, viewpoint evaluation, and encouragement of flexibility. Responses are scored using a 5-point Likert scale. There are no reverse-scored items in this scale.

The model fit indices of the CTB scale used in this study are as follows: $\chi^2/df=1.325$, $RMR=0.029$, $AGFI=0.924$, $RMSEA=0.027$, $NFI=0.939$, $TLI=0.983$, $CFI=0.984$, $RFI=0.933$, $IFI=0.984$, $PNFI=0.851$, $PCFI=0.892$, all fitting indices meet the standards. Cronbach's Alpha=0.920.

3.3.3 Technological acceptance scale

In this study, the TA scale designed by You et al. (2014) was used to assess teachers' acceptance of digital teaching materials. The scale comprises 6 items divided into two factors: perceived usefulness and perceived ease of use, with each factor containing 3 items. Responses are scored using a 5-point Likert scale. The model fit indices of the TA scale used in this study are as follows: $\chi^2/df=3.543$, which meets the standard of being less than 5; $RMR=0.023$, $AGFI=0.945$, $RMSEA=0.075$, $NFI=0.981$, $TLI=0.977$, $CFI=0.986$, $RFI=0.968$, $IFI=0.986$, $PNFI=0.588$, $PCFI=0.592$, all fitting indices meet the standards. Cronbach's Alpha=0.910.

3.4 Data analysis

This study primarily utilizes statistical analysis software such as SPSS and AMOS to validate the proposed theoretical model. The specific research contents include descriptive statistical analysis, common method bias testing, Pearson correlation analysis, structural equation modeling (SEM), and mediation effect testing.

4 Research results

4.1 Basic information analysis

Regarding gender, there were 233 male participants, accounting for 50.900%, and 225 female participants, accounting for 49.100%. In terms of education level, 102 participants had a bachelor's degree, accounting for 22.300%, 211 participants had a master's degree,

accounting for 46.100%, and 145 participants had a doctoral degree, accounting for 31.700%.

4.2 Common method bias testing

As self-reporting was utilized for data collection in this study, there might be a possibility of common method bias. Therefore, both procedural control and statistical tests were employed to address this issue. Firstly, strict procedural control measures were implemented during the questionnaire administration process, emphasizing that the results of the survey were solely for academic research purposes and ensuring absolute confidentiality of the data provided, with responses being anonymous. Subsequently, to examine whether variables exhibited common method bias, an exploratory factor analysis was conducted for Harman's single-factor test. If a single factor explains more than 50% of the variance for all variables, it indicates significant common method bias. The analysis revealed that, prior to factor rotation, 12 factors with eigenvalues greater than 1 were extracted. The first factor accounted for 28.955% of the variance, which was less than 50%. Hence, it was concluded that there was no significant common method bias in this study.

4.3 Correlation analysis of variables

To understand the relationships between predictor variables and to avoid multicollinearity issues, Pearson product-moment correlations were used to explore the relationships among TB, CTB, and TA. The correlations between variables are presented in Table 1. All constructs exhibited significant positive correlations. Moreover, the correlation coefficients between predictor variables were all <0.700 , indicating moderate correlations, suggesting the absence of severe multicollinearity issues. Therefore, further examination of the relationships between variables using SEM can be pursued.

4.4 Overall structural model fit assessment

In this study, a total of 458 valid samples from the formal questionnaire were included and subjected to SEM for validation. Maximum likelihood estimation was utilized for estimation. The model fit indices were obtained to assess the model's goodness of fit.

A smaller χ^2 value indicates a higher model fit (Jöreskog, 1970); the χ^2/df ratio should not exceed 5 (Bentler and Bonett, 1980). The GFI should exceed the recommended value of 0.900, while the AGFI should surpass 0.800. Additionally, the RMSEA and SRMR should be less than the recommended value of 0.080. The CFI should exceed 0.800, and the NFI should surpass 0.800. The results, as shown in Table 2, indicate that all model fit indices meet the standards.

4.5 Structural equation modeling analysis

In this study, SEM was employed to investigate the relationships among TB, CTB, and TA, as well as to examine the mediating role of TA and validate the hypotheses proposed in this study.

As shown in Table 3, the standardized path coefficient from TB to CTB is 0.432, with $p < 0.001$, indicating a significant positive impact of TB on CTB. This suggests that stronger TB are associated with higher levels of CTB, thus validating Hypothesis 1.

Similarly, the standardized path coefficient from TB to TA is 0.517, with $p < 0.001$, revealing a significant positive influence of TB on TA. This supports the validation of Hypothesis 2, indicating that stronger TB leads to higher levels of TA.

Furthermore, the standardized path coefficient from TA to CTB is 0.236, with $p < 0.010$, indicating a significant positive impact of TA on CTB. Therefore, Hypothesis 3 is validated, suggesting that higher levels of TA are associated with increased levels of CTB.

4.6 Mediation analysis

To examine the stability of the mediating effect, this study employed the Bootstrap method based on the recommendations of Preacher and Hayes (2008). Specifically, 5,000 bootstrap samples were drawn from the data-set to estimate the coefficients of the mediating effect with a 95% confidence interval.

As shown in Table 4, the results of the analysis confirmed the direct effect of TB on CTB ($\beta = 0.432, p = 0.001$). The indirect effect 1, representing the pathway from TB to TA to CTB, had an effect value of 0.122, with a 95% confidence interval ranging from 0.019 to 0.215.

Since this confidence interval does not include zero, it suggests that TA mediates the relationship between TB and CTB, thus further validating Hypothesis 4.

5 Research conclusion

Based on the discussions above, the conclusions drawn from this study are as follows:

- 1 TB of music educators in Chinese universities positively influence their CTB. The findings are consistent with those of Zielińska et al. (2024). The reason lies in the fact that teaching beliefs constitute a set of attitudes, perceptions, and convictions

TABLE 2 Structural model fit indices.

Index	Fit criterion	Model fit	Fit status
χ^2	Smaller is better	159.636	–
χ^2/df	<5.000	1.400	Fit
GFI	<0.900	0.961	Fit
AGFI	>0.800	0.948	Fit
RMSEA	<0.080	0.030	Fit
SRMR	>0.080	0.039	Fit
CFI	>0.800	0.988	Fit
NFI	>0.800	0.958	Fit

Data source is compiled from this study.

TABLE 3 SEM analysis results.

Path	Standardized path coefficient	S.E.	C.R.
TB → CTB	0.432***	0.045	6.201
TB → TA	0.517***	0.066	9.351
TA → CTB	0.236**	0.048	2.646

* $p < 0.050$; ** $p < 0.010$; *** $p < 0.001$.

TABLE 1 Summary table of variable correlation analysis.

Construct	Number of items	A1	A2	A3	A4	B1	B2	B3	B4	C
A1	11	1								
A2	8	0.547***	1							
A3	11	0.526***	0.587***	1						
A4	6	0.530***	0.585***	0.582***	1					
B1	6	0.252***	0.335***	0.329***	0.324***	1				
B2	6	0.276***	0.351***	0.315***	0.284***	0.402***	1			
B3	8	0.304***	0.309***	0.249***	0.356***	0.320***	0.299***	1		
B4	7	0.241***	0.275***	0.242***	0.314***	0.290***	0.391***	0.391***	1	
C	6	0.333***	0.362***	0.358***	0.370***	0.366***	0.380***	0.340***	0.335***	1

A1 represents the dimension of student management beliefs, A2 corresponds to curriculum beliefs dimension, A3 pertains to assessment beliefs dimension, A4 denotes student learning beliefs dimension, B1 stands for learning approach guidance dimension, B2 signifies motivation stimulation dimension, B3 represents viewpoint evaluation dimension, B4 indicates encouragement of innovation dimension, and C denotes the dimension of perceived usefulness. The values on the diagonal represent the square roots of the average variance extracted (AVE) of latent variables, which should be greater than the off-diagonal values. * $p < 0.050$; ** $p < 0.010$; *** $p < 0.001$.

TABLE 4 Summary of mediation effects.

Path	Effect size	Standard error	95% Confidence interval (Lower)	95% Confidence interval (Upper)	<i>p</i> -value
Direct Effect 1	0.432	0.066	0.306	0.565	0.001
Indirect Effect 1	0.122	0.050	0.019	0.215	0.022

The sample size for percentile bootstrap confidence intervals is 5000.

that directly influence teachers' instructional practices. If a music educator strongly believes in the benefits of creative teaching for student development and learning, they are more likely to adopt creative teaching methods and strategies.

- 2 TB of music educators in Chinese universities positively influence their TA. The findings are consistent with those of [Gurer and Akkaya \(2022\)](#). Teaching beliefs may influence teachers' confidence in their technological abilities. If a music educator believes they can master and effectively utilize teaching technology, they are more inclined to accept and experiment with new technologies. Additionally, if teachers perceive technology as necessary and beneficial for music education, they are more likely to actively accept and explore new technological tools and applications.
- 3 TA of music educators in Chinese universities positively influences their CTB. The findings are consistent with those of [Sofwan et al. \(2021\)](#). Teachers with high levels of technological acceptance may be more inclined to experiment with innovative teaching methods and strategies. These methods may include technology-based creative activities such as music composition, virtual performance, and multimedia presentations. Through technological tools, teachers can more easily adjust teaching content and activities, making teaching more flexible and creative.
- 4 TA of music educators in Chinese universities mediates the relationship between TB and CTB. The findings are consistent with those of [Zou et al. \(2022\)](#). Teaching beliefs among music educators directly influence their attitudes toward and acceptance of technology. If educators perceive technology as beneficial and essential in music education, they are more likely to utilize various technological tools and applications to support creative teaching practices and behaviors.

6 Research contributions

6.1 Theoretical contributions

This study reveals the mechanism of the influence of teachers' teaching beliefs on creative teaching behavior. Creative teaching behavior is crucial for cultivating innovative talents, and teachers' teaching beliefs are important factors influencing their behavior ([Northcote, 2009](#); [Kiss and Lin, 2016](#)). Through the mediating role of technological acceptance, this study delves into the intrinsic mechanism of how teachers' teaching beliefs transform into creative teaching behavior. This finding is of significant importance for guiding teacher education, promoting teachers' professional development, and improving the teaching quality of music disciplines.

6.2 Practical contributions

This study explores the impact of Chinese university music teachers' teaching beliefs on creative teaching behavior and examines the mediating role of technological acceptance. This research not only has theoretical significance but also profound implications in practical applications. Teachers' teaching beliefs not only affect their choice of teaching methods and means but also directly relate to students' learning outcomes and the quality of talent cultivation ([Berger et al., 2018](#)). Therefore, by guiding teachers to establish scientific teaching beliefs, it is possible to promote teachers to continuously update teaching methods, improve teaching quality, and cultivate more high-quality talents in the field of music.

7 Practical recommendations

7.1 Strengthening the integration of teaching and music technology

When conducting music teaching, teachers should select suitable music technology tools based on teaching objectives. For instance, if the goal is to enhance students' music composition skills, digital music production software can be used. If the objective is to reinforce students' music theory knowledge, interactive music theory learning platforms may be preferable. To ensure that teachers can fully utilize music technology tools, schools need to provide necessary technical training, which may include software operation guidance and sharing of music production techniques. As music technology continues to evolve, teachers need to continuously update their knowledge and skills to ensure that teaching content remains current. Furthermore, it is essential to pay attention to the potential applications of new technologies in teaching and promptly integrate them into instruction.

7.2 Reinforcing teachers' teaching beliefs

To reinforce teachers' TB, universities can organize a series of teaching training activities to help teachers clarify their teaching philosophies and methods and enhance their teaching skills. Through training, teachers can gain a deeper understanding of their teaching practices. Regularly organizing activities to commend outstanding teaching and inviting experienced teachers to share their teaching experiences and insights can also be beneficial. Through exchanges and discussions, teachers can engage in deeper reflection and understanding of their teaching practices. Additionally, universities can establish teaching incentive mechanisms to recognize teachers who demonstrate excellence in teaching practice. Through incentives, teachers can be encouraged

to remain steadfast in their TB and actively engage in teaching activities.

8 Limitations and future research directions

This study relies on self-reported data from teachers, which may introduce subjectivity and memory bias, affecting the accurate understanding of the relationship between teachers' TB and CTB. While self-reported data provide an intuitive source of information for the study, they may also be influenced by individual subjective perceptions and recollections, thus reducing the objectivity and reliability of the research findings. This limitation arises partially from the choice of research design. In practical research, the use of self-reported data from teachers may be chosen to enhance the feasibility of the study. However, it represents a trade-off made in the research design, sacrificing potentially more objective assessment methods for convenience and practicality, thus resulting in limitations.

Future research can mitigate and avoid this limitation through various means. To alleviate the reliance on self-reported data, future studies can adopt a mixed-methods research design, combining quantitative and qualitative approaches such as in-depth interviews or observations to gain a more comprehensive understanding of the relationship between TB, CTB, and TA. The integrated use of these methods helps enhance the credibility and reliability of the research findings. Overall, by recognizing and analyzing the limitations of the study, future research can systematically and comprehensively explore the relationship between teachers' TB and CTB, providing the field of education with more in-depth and extensive research evidence.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

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Ethics statement

The studies involving humans were approved by Dhurakij Pundit University Human Research Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

Author contributions

RZ: Data curation, Formal analysis, Investigation, Validation, Writing – original draft. H-PW: Conceptualization, Project administration, Supervision, Writing – review & editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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