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# Artificial intelligence adoption and readiness among music teachers and students in Chinese higher education

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# Abstract

Artificial intelligence (AI) is increasingly used for composition, performance assessment, personalized practice, and digital tutoring, yet its acceptance in music education remains insufficiently understood. This study investigates factors associated with AI adoption among music teachers and music-major students in Chinese higher education using an extended Technology Acceptance Model (eTAM) informed by technological pedagogical content knowledge (TPACK). A cross-sectional quantitative survey was conducted across 20 Chinese universities, yielding 300 valid responses, including 150 music teachers and 150 music students. The model examined TPACK, social norms, trust, perceived usefulness (PU), perceived ease of use (PEOU), pedagogical compatibility, creativity concerns, attitude, behavioral intention (BI), and actual usage (AU). Multiple linear regression showed that TPACK significantly predicted PEOU ($\beta = 0.1347$, $p = 0.033$) and was significantly but negatively associated with PU ($\beta = -0.1448$, $p = 0.014$). Social norms and trust did not significantly predict PU or PEOU. PU and PEOU did not significantly predict attitude, while pedagogical compatibility and creativity concerns were also non-significant. Attitude did not significantly predict BI, and BI did not predict AU. These findings suggest that AI adoption in music education may not follow the conventional linear pattern proposed by TAM. Discipline-specific pedagogical values, creative autonomy, institutional conditions, and practical access may be important in explaining the gap between favorable perceptions and actual use.


# 1 Introduction

Artificial intelligence (AI) has developed from rule-based problem solving into a broad set of machine-learning and data-driven technologies used across education and the creative arts. In music education, AI applications now include intelligent tutoring, automated performance assessment, composition support, accompaniment, and online learning systems [1–6]. These tools may expand access to feedback and individualized practice, but music education is also strongly shaped by creativity, interpretation, embodied performance, and teacher-student interaction. Adoption therefore depends on more than technical efficiency alone.

Technology acceptance research commonly begins with the Technology Acceptance Model (TAM), which proposes that perceived usefulness (PU) and perceived ease of use (PEOU) influence attitudes and intentions toward technology use [7]. Later extensions incorporated social influence, self-efficacy, facilitating conditions, and other contextual factors [8–10]. For educators, the TPACK framework further emphasizes that technology integration requires the interaction of technological, pedagogical, and subject-content knowledge [11].

Music education provides a particularly demanding context for combining these perspectives. AI may assist technical accuracy and practice efficiency while simultaneously raising concerns about artistic authorship, creative autonomy, authenticity, and the role of human judgment. Previous studies have examined AI-supported music teaching and digital music learning [1–6], but fewer studies have tested a

multi-construct technology acceptance model that includes both general adoption factors and discipline-specific concerns among music educators and learners.

This study therefore examines AI adoption and readiness in Chinese higher education through an extended TAM informed by TPACK and music-specific constructs. It tests whether TPACK, social norms, and trust predict PU and PEOU; whether PU and PEOU predict attitude; whether pedagogical compatibility and creativity concerns predict PU and attitude; and whether attitude predicts behavioral intention, which in turn predicts actual usage.

## 2 Literature review and hypotheses

# 2.1 Technology acceptance in educational settings

TAM identifies PU and PEOU as central determinants of technology acceptance [7]. TAM2 introduced social influence and cognitive instrumental processes [8], while TAM3 incorporated additional determinants of ease of use and intervention-oriented factors [9]. UTAUT similarly emphasizes performance expectancy, effort expectancy, social influence, and facilitating conditions [10]. These models have been widely used to explain technology adoption, but their predictive relationships can vary across professional and educational contexts.

# 2.2 TPACK and music-specific adoption factors

TPACK describes the knowledge educators need to combine technology with pedagogy and disciplinary content [11]. In music education, this integration can include selecting digital tools for ear training, performance feedback, composition, accompaniment, and theory instruction. Prior research on digital technology in music classrooms suggests that access to technology alone does not guarantee meaningful pedagogical integration [12, 13]. AI-based systems may be useful for individualized feedback and online music learning [1–6], but their acceptance may depend on whether they fit teachers' instructional approaches and preserve space for human interpretation and creativity.

# 2.3 Trust, risk, compatibility, and creativity

Trust can shape acceptance when users rely on algorithmic outputs, while perceived risk may arise from privacy, reliability, copyright, or dependency concerns [14]. In creative disciplines, pedagogical compatibility and creativity concerns may be especially salient because a tool can be technically functional without being perceived as appropriate for artistic instruction. This distinction motivates the inclusion of music-specific constructs alongside conventional TAM variables.

### 2.4 Hypotheses

- H1: TPACK, social norms, and trust significantly predict perceived usefulness (PU) and perceived ease of use (PEOU).

- H2: Perceived usefulness (PU) and perceived ease of use (PEOU) positively predict attitude toward AI adoption.
- H3: Pedagogical compatibility and creativity concerns significantly predict perceived usefulness (PU) and attitude toward AI adoption.
- H4: Attitude toward AI adoption positively predicts behavioral intention (BI), and BI positively predicts actual usage (AU).

## 3 Methods

# 3.1 Research design and participants

A cross-sectional quantitative survey design was used to test the proposed extended technology acceptance model. The target population comprised music teachers and music-major students from 20 universities in China with established music programs or conservatory-level faculties. Institutions were selected to cover different geographical regions and institutional types, including comprehensive universities, normal universities, and specialist music institutions. The final quantitative dataset contained 300 valid responses: 150 music teachers and 150 music students.

# 3.2 Measures

Questionnaire items were adapted from established technology-acceptance and teacher-technology frameworks. Core TAM measures included PU, PEOU, attitude, behavioral intention, and actual usage [7–10]. TPACK items reflected technological, pedagogical, and content-related integration knowledge [11]. Additional measures captured social norms, trust, pedagogical compatibility, and creativity concerns. Items were rated using Likert-type response scales. Prior to the main survey, the instrument was reviewed for contextual relevance and clarity.

# 3.3 Data analysis

Descriptive statistics and reliability checks were followed by multiple linear regression analyses. Separate regression models were estimated for PU, PEOU, attitude, BI, and AU according to the proposed hypotheses. Statistical significance was evaluated at $p < 0.05$. Regression coefficients, standard errors, t statistics, and p values are reported below.

## 4 Results

# 4.1 TPACK, social norms, trust, PU, and PEOU

Table 1
Regression results for H1

| Outcome | Predictor | Estimate | SE | t | p |
|---|---|---|---|---|---|
| PU | TPACK | -0.1448 | 0.0583 | -2.485 | 0.014 |
| PU | Social norms | -0.0553 | 0.0534 | -1.035 | 0.302 |
| PU | Trust | 0.0537 | 0.0551 | 0.976 | 0.330 |
| PEOU | TPACK | 0.1347 | 0.0629 | 2.140 | 0.033 |
| PEOU | Social norms | -0.0616 | 0.0577 | -1.068 | 0.287 |
| PEOU | Trust | -0.0589 | 0.0595 | -0.990 | 0.323 |

TPACK significantly predicted both outcomes, but in different directions. Higher TPACK was associated with lower PU (β = -0.1448, p = 0.014) and higher PEOU (β = 0.1347, p = 0.033). Social norms and trust were not significant predictors of either PU or PEOU. H1 was therefore only partially supported.

## 4.2 PU, PEOU, and attitude

Table 2
Regression results for H2 (outcome: attitude)

| Predictor | Estimate | SE | t | p |
|---|---|---|---|---|
| PEOU | 0.0106 | 0.0567 | 0.186 | 0.852 |
| PU | 0.0521 | 0.0611 | 0.852 | 0.395 |

Neither PEOU (β = 0.0106, p = 0.852) nor PU (β = 0.0521, p = 0.395) significantly predicted attitude. H2 was not supported.

## 4.3 Pedagogical compatibility, creativity concerns, PU, and attitude

Table 3
Regression results for H3

| Outcome | Predictor | Estimate | SE | t | p |
|---|---|---|---|---|---|
| PU | Pedagogical compatibility | -0.0279 | 0.0588 | -0.476 | 0.635 |
| PU | Creativity concerns | -0.0420 | 0.0563 | -0.747 | 0.456 |
| Attitude | Pedagogical compatibility | 0.00561 | 0.0617 | 0.0909 | 0.928 |
| Attitude | Creativity concerns | -0.09587 | 0.0591 | -1.6217 | 0.106 |

Pedagogical compatibility and creativity concerns did not significantly predict PU or attitude. The coefficient for creativity concerns predicting attitude was negative (β = -0.09587), but the relationship did

not reach statistical significance (p = 0.106). H3 was not supported.

## 4.4 Attitude, behavioral intention, and actual usage

Table 4
Regression results for H4

| Outcome | Predictor | Estimate | SE | t | p |
|---|---|---|---|---|---|
| BI | Attitude | 0.0675 | 0.0547 | 1.23 | 0.218 |
| AU | Behavioral intention | -0.0126 | 0.0639 | -0.197 | 0.844 |

Attitude did not significantly predict BI (β = 0.0675, p = 0.218), and BI did not significantly predict AU (β = -0.0126, p = 0.844). H4 was not supported.

## 4.5 Summary of hypothesis testing

Table 5
Summary of hypothesis tests

| Hypothesis | Result | Summary |
|---|---|---|
| H1 | Partially supported | TPACK significantly predicted PU and PEOU; social norms and trust were non-significant. |
| H2 | Not supported | PU and PEOU did not significantly predict attitude. |
| H3 | Not supported | Pedagogical compatibility and creativity concerns were non-significant predictors. |
| H4 | Not supported | Attitude did not significantly predict BI; BI did not significantly predict AU. |

# 5 Discussion

The findings only partially reproduce the relationships expected from conventional technology acceptance models. The clearest result concerns TPACK. Respondents with stronger technology-pedagogy-content integration knowledge perceived AI tools as easier to use, consistent with the idea that domain-relevant technological knowledge reduces operational barriers. However, the negative association between TPACK and PU suggests that more knowledgeable users may also evaluate AI tools more critically. Greater expertise may raise expectations about pedagogical fit, musical nuance, and instructional value, making generic AI functionality less persuasive.

Social norms and trust did not significantly predict PU or PEOU. This may indicate that judgments of AI in music education are shaped more by direct experience and disciplinary practice than by institutional encouragement alone. Trust remains relevant to privacy, reliability, and copyright concerns, but confidence in a system does not necessarily make it pedagogically useful or easier to operate.

The non-significant effects of PU and PEOU on attitude are especially noteworthy because these paths are central to TAM [7]. In music education, efficiency and usability may be necessary but insufficient. Teachers and students may judge AI in relation to authenticity, expressive control, interpretation, and creative identity. A tool can therefore be useful in a technical sense without generating a favorable attitude toward deeper curricular integration.

Pedagogical compatibility and creativity concerns were also non-significant. The negative direction of creativity concerns on attitude is consistent with possible caution, but the evidence in this study is insufficient to establish a reliable effect. Future studies should use more detailed measures of creative autonomy, authorship, assessment legitimacy, and human-AI co-creation, and should test whether these factors operate as moderators rather than direct predictors.

Finally, attitude did not predict behavioral intention and intention did not predict actual use. This intention-use gap may reflect institutional constraints, access to suitable tools, curriculum requirements, technical infrastructure, and opportunities for supervised experimentation. The result suggests that future models of AI adoption in music education should integrate individual acceptance variables with facilitating conditions and actual opportunities for use.

## 6 Implications

# 6.1 Theoretical implications

The study indicates that a linear TAM pathway may not fully explain AI adoption in a creative educational domain. TPACK appears useful for explaining perceived ease of use, but the weak relationships among PU, attitude, intention, and usage suggest that discipline-specific values and institutional conditions should be incorporated more explicitly into future models.

# 6.2 Practical implications

Teacher development should move beyond general AI literacy and demonstrate subject-specific applications, such as intelligent accompaniment, composition support, performance feedback, and music-theory tutoring. Institutions should also provide safe environments for experimentation, clear guidance on data and copyright, and opportunities for educators to evaluate whether AI supports rather than replaces musical judgment.

## 7 Limitations and future research

This study has several limitations. First, the cross-sectional design does not establish causal relationships. Second, self-reported actual usage may not correspond perfectly to observed use. Third, the sample combines teachers and students, whose adoption decisions may differ in important ways. Future research should test teacher and student models separately, report measurement-model statistics in greater detail, and use longitudinal or behavioral usage data. Qualitative interviews could

also clarify why knowledgeable users sometimes perceive AI as easy to use but not especially useful for core musical pedagogy.

## 8 Conclusion

AI adoption in music education appears more complex than the conventional sequence from usefulness and ease of use to attitude, intention, and actual use. In this study, TPACK was the principal significant predictor, positively associated with PEOU and negatively associated with PU. Other proposed relationships were not statistically significant. These results do not imply that established technology acceptance models are irrelevant; rather, they suggest that creative and pedagogical contexts may require extensions that better represent artistic values, institutional opportunity, and the conditions under which AI is actually used.

## Declarations

# Competing interests:

The author declares no competing financial or non-financial interests.

# Funding:

The author declares that no specific funding was received for this study.

Ethics approval and consent to participate: This study involved human participants and was approved by the Institutional Ethics Committee of Rajamangala University of Technology Krungthep, Bangkok, Thailand. The study was conducted in accordance with the Declaration of Helsinki and the relevant institutional ethical guidelines for research involving human participants. Informed consent was obtained from all participants before data collection.

Consent for publication: Not applicable; no identifiable individual participant data are reported.

Data availability: The data supporting the findings of this study are available from the corresponding author on reasonable request, subject to ethical and institutional restrictions.

# Author Contribution

M.Z. conceived and designed the study, developed the research framework and methodology, conducted the data analysis, interpreted the findings, and drafted the manuscript. C.C.A. provided academic supervision, methodological guidance, and critical review and revision of the manuscript. Both authors reviewed and approved the final version of the manuscript for publication.

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