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## Determinants Of Piano Performance Among University Music Students in Hunan, China: Examining the Mediating Role of Technical Accuracy and The Moderating Effect of Conscientiousness

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Ye Zi Qi<sup>1</sup>, & Dr. Raja Azrul Hisham Bin Raja Ahmad<sup>2</sup>,

<sup>1</sup>PHD-ED, City University Malaysia, Malaysia (614908091@qq.com)

<sup>2</sup>City Graduate School, City University, Malaysia ([dr.azrul@city.edu.my](mailto:dr.azrul@city.edu.my))

**Abstract:** *This study investigates the determinants of piano performance among university music students in Hunan Province, China, with particular attention to the mediating role of technical accuracy and the moderating effect of conscientiousness. Drawing on theories of skill acquisition and self-efficacy, the research examines how basic musical literacy, self-efficacy, learning resources, and participation in piano activities influence students' performance outcomes. A quantitative survey design was employed, and data were collected from 400 music students across six universities using validated scales. Structural Equation Modeling (PLS-SEM) was applied to test the hypothesized relationships. The findings reveal that self-efficacy and basic musical literacy are the strongest predictors of piano performance, both directly and indirectly through technical accuracy. Participation in piano activities also showed a significant direct effect, while learning resources had a smaller but meaningful contribution. Furthermore, conscientiousness was found to moderate the effects of learning behaviors, enhancing the influence of practice participation and strategic engagement on performance. These results extend existing theoretical frameworks by integrating cognitive, psychological, and contextual factors into a comprehensive model of musical achievement. Practically, the study underscores the importance of fostering self-belief, technical precision, and responsible learning habits in higher music education, offering actionable implications for curriculum design, teaching strategies, and policy development.*

**Keywords:** *Piano performance; basic musical literacy; self-efficacy; learning resources; participation in piano activities; technical accuracy; conscientiousness; piano performance*

## **I. Introduction**

Piano performance holds a fundamental role within the broader context of music education, serving as a critical skill for developing comprehensive musicianship. In recent years, scholars have increasingly emphasized the importance of piano competence not only for performance but also for pedagogical and professional applications (Kim, Ramoneda, Miron, & Serra, 2022). A solid foundation in piano performance fosters technical mastery, musical expressiveness, and theoretical understanding, all of which are essential for a well-rounded music education.

Research has shown that proficiency in piano performance enhances a musician's overall musical skills, including sight-reading, accompaniment, improvisation, and ensemble collaboration (Gulliyeva, 2023). Moreover, the process of learning piano demands high levels of cognitive, emotional, and motor coordination, which supports broader educational goals such as discipline, creativity, and critical thinking (Franceschi, 2022). These benefits highlight the piano's role as both a primary instrument for soloists and a supportive tool for music educators.

At the same time, individual psychological traits such as conscientiousness have been identified as significant moderators in learning processes. Students with high conscientiousness are more likely to adhere to practice schedules, set clear goals, and persevere through challenges, ultimately achieving higher performance levels (Franceschi, 2022).

Given these developments, understanding the multifaceted determinants of piano performance has become increasingly important for music education programs. This study seeks to explore how basic musical literacy, self-efficacy, learning resources, and participation in piano activities affect university music students' piano performance levels, while also examining the mediating role of technical accuracy and the moderating effect of conscientiousness.

## **II. Literature Review**

A thorough review of existing literature is essential for situating this study within the broader academic discourse and for identifying theoretical and empirical foundations relevant to the research questions. In the context of university-level music education, piano performance has been extensively studied, yet considerable gaps remain regarding the complex interplay of cognitive skills, psychological traits, learning resources, and technical proficiency.

Musical skill acquisition is generally understood as a complex interplay between cognitive abilities, motor coordination, and emotional engagement. These domains are interdependent and evolve over time through continuous and purposeful practice. Early stages of learning typically emphasize motor learning and auditory discrimination, while later stages demand increased focus on expressive control and interpretative refinement.

Motor skills, auditory perception, rhythmic coordination, and emotional sensitivity are identified as core domains essential for successful piano performance (Grinchenko,2022). These skills are often developed in tandem rather than in isolation, suggesting a need for pedagogical approaches that integrate physical technique with musical meaning. For example, students working on staccato articulation must not only develop fingertip agility but also understand the character that such articulation imparts to a piece.

Pellegrino (2020) emphasized that foundational skill acquisition in instrumental instruction should be framed within real-world musical contexts. Isolated drills, while useful, often lack relevance for learners unless explicitly tied to performance goals. Linking technical exercises with expressive repertoire ensures greater engagement and understanding of musical function.

Creech and Hallam (2021) examined adult beginner musicians and noted that initial successes—such as correctly playing a short phrase—helped build confidence and intrinsic motivation. These early positive experiences created a feedback loop where emotional satisfaction enhanced practice intensity and frequency, especially in self-paced learning settings.

Skill acquisition in this view is inherently multidimensional and student-centered. Teachers should consider each student's unique emotional and cognitive profile, tailoring instruction in a way that promotes autonomy, relevance, and confidence. This holistic approach ensures that technical learning becomes a vehicle for personal expression rather than a mechanical exercise.

### **III. Research Methodology**

This study adopts a quantitative, non-experimental, cross-sectional, and descriptive-correlational research design to examine the factors that influence piano performance levels among university music students in Hunan Province, China. Specifically, the research utilizes a descriptive survey method, which is commonly employed in educational and behavioral research to collect information from a large population at a single point in time (Fraenkel & Wallen, 2003; Creswell, 2007).

Quantitative research is characterized by the systematic collection and statistical analysis of numerical data, making it particularly suitable for identifying patterns, testing hypotheses, and validating theoretical models (Ary, Jacobs, & Sorensen, 2010). A descriptive-correlational approach is appropriate when the goal is to describe existing phenomena and explore relationships among multiple variables without manipulating them (Best & Kahn, 2006). This design aligns with the objectives of the study, which seeks to: Identify the direct effects of basic musical literacy, self-efficacy, learning resources, and participation in piano activities on students' piano performance levels; Investigate the mediating role of technical accuracy; Examine the moderating effect of conscientiousness. A cross-sectional survey is employed to obtain data from a representative sample of music students at one point in time, providing a "snapshot" of the variables under study. This approach is cost-effective and time-efficient, allowing for the simultaneous collection of data across multiple institutions and participant levels (Cohen, Manion, & Morrison, 2018).

The target population of this study includes undergraduate and postgraduate students majoring in piano performance or closely related programs across universities institutions in Hunan Province, China. Based on institutional data, at least seven major universities and colleges in the province offer formal piano-related programs, including Hunan Normal University, Central South University, Hunan Institute of Science and Technology, Hunan Vocational College of Art, Hunan First Normal University, Hunan University of Science and Technology, and Central South University of Forestry and Technology. These institutions provide structured training in piano performance, music theory, and instrumental techniques through programs such as Music Performance (Piano Specialization) and Music Education (Piano Curriculum). Although exact enrollment figures vary by institution and year, it is estimated that approximately 3,000 to 4,000 students are currently enrolled in piano-focused tracks across these universities. The selected population is thus representative of higher music education in the region and aligned with the study's focus on piano performance development. The identification of these institutions is based on public data obtained from official university admissions websites, departmental brochures, and Hunan Provincial Education Department publications. A total of 12 universities in Hunan Province were reviewed for eligibility, of which six were purposively selected for data collection based on program scale, availability of piano-focused majors, and institutional collaboration feasibility.

The required sample size from six universities was determined using a standard sample size calculator commonly applied in educational survey research (Fink, 2013; Raosoft Inc., 2004; SurveyMonkey, 2021). Thus, the minimum required sample size is approximately 351 participants. Considering potential non-responses and incomplete submissions, this study aims to collect at least 400 valid responses to ensure robust data for mediation and moderation analyses.

Table 1. Sampling Frame and School Distribution

<b>Institution</b>	<b>City</b>	<b>Institution Type</b>	<b>Estimated Majors</b>	<b>Piano Sample Assigned</b>	<b>Size</b>
Hunan University	Normal Changsha	Comprehensive Normal	900	80	
Hunan University of Arts and Science	Changde	Comprehensive	600	70	
Hunan First University	Normal Changsha	Teacher Training	500	60	
Hengyang University	Normal Hengyang	Normal University	500	60	
Shaoyang University	Shaoyang	Normal University	700	70	
Xiangnan University	Chenzhou	Teacher Education	800	60	
<b>Total</b>	—	—	<b>4,000</b>	<b>400</b>	

*Note: Estimates based on university enrollment records and internal music faculty reports.*

The primary data collection tool for this study is a structured, self-administered questionnaire developed to measure the constructs outlined in the conceptual framework. The questionnaire integrates existing validated instruments and self-developed items based on the relevant literature. It consists of 46 items across seven key constructs: four independent variables, one mediating variable, one moderating variable, and one dependent variable. All items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The Likert scale is widely used in social science and educational research due to its simplicity, reliability, and ability to quantify subjective perceptions (Likert, 1932; DeVellis, 2016).

#### **IV. Results**

This section provides descriptive statistics for all study variables, including the four independent variables (basic musical literacy, self-efficacy, learning resources, participation in piano activities), the mediating variable (technical accuracy), the moderating variable (conscientiousness), and the dependent variable (piano performance level) based on gender, age range and academic level.

Descriptive statistics revealed notable gender differences in students' perceptions across all key study variables. On average, female students scored higher than male students on every construct measured. For example, females reported higher levels of basic musical literacy ( $M = 4.02$  vs.  $3.85$ ), self-efficacy in piano learning ( $M = 4.01$  vs.  $3.76$ ), and participation in piano activities ( $M = 3.91$  vs.  $3.54$ ). Similarly, they perceived themselves as having greater conscientiousness ( $M = 4.05$  vs.  $3.82$ ), technical accuracy ( $M = 4.00$  vs.  $3.80$ ), and overall piano performance ( $M = 4.08$  vs.  $3.77$ ). These findings suggest gender may be a meaningful factor in shaping perceptions of musical competence and engagement. Inferential analysis (see Table 4.5) was conducted to further assess the statistical significance of these differences.

Descriptive statistics indicate progressive increases in all measured constructs with age. Students aged Above 26 reported the highest means across all variables, particularly in self-efficacy ( $M = 4.10$ ), conscientiousness ( $M = 4.10$ ), and piano performance level ( $M = 4.12$ ). Students aged 18–20 showed the lowest mean scores in all domains, such as self-efficacy ( $M = 3.68$ ) and learning resources ( $M = 3.60$ ). These trends suggest that age and possibly experience contribute positively to piano-related confidence, resource utilization, and perceived performance. Inferential tests (e.g., ANOVA) are recommended to verify the statistical significance of these age-related differences.

Descriptive statistics based on academic level revealed consistent differences between undergraduate and postgraduate students across all variables. Postgraduate students reported higher average scores in basic musical literacy ( $M = 4.06$  vs.  $3.83$ ), self-efficacy ( $M = 4.05$  vs.  $3.74$ ), and conscientiousness ( $M = 4.08$  vs.  $3.79$ ). The same pattern was evident in learning resources, technical accuracy, and piano performance level. These results indicate that students at the postgraduate level may possess greater confidence, experience, and discipline in piano-related learning and performance. Further inferential analysis (e.g., independent samples t-test) is recommended to assess the statistical significance of these differences.

As shown in Table 2, all variables had mean scores above 3.8, indicating that respondents generally reported moderately high levels of musical literacy, self-efficacy, learning support, technical accuracy, and conscientiousness. Standard deviations were relatively low, suggesting consistency in responses across the sample.

Table 2 Descriptive Statistics for Latent Variables (n = 400)

<b>CONSTRUCT</b>	<b>Mean</b>	<b>Std. Dev.</b>
Basic Musical Literacy (BML)	4.12	0.56
Self-Efficacy (SE)	4.18	0.51
Learning Resources (LR)	4.03	0.59
Piano Participation (PPA)	3.81	0.67
Technical Accuracy (TA)	3.96	0.61
Conscientiousness (CONS)	4.15	0.54
Piano Performance Level (PPL)	4.09	0.53

Among the seven constructs, Self-Efficacy ( $M = 4.18$ ) recorded the highest mean score, suggesting that most students generally feel confident in their ability to learn and perform piano pieces. This indicates strong internal motivation and belief in personal musical competence among the sample.

Conversely, Piano Participation ( $M = 3.81$ ) had the lowest mean score, implying relatively lower levels of involvement in piano-related activities such as recitals, competitions, or ensemble performances. The higher standard deviation for this construct ( $SD = 0.67$ ) also suggests greater variability among students in terms of their participation levels.

The remaining constructs—Basic Musical Literacy, Learning Resources, Technical Accuracy, Conscientiousness, and Piano Performance Level—show moderately high mean scores (ranging from 3.96 to 4.15), indicating overall positive perceptions among students in these areas, with relatively low dispersion, reflecting consistent responses across the sample.

These results provide an initial overview of students' self-assessed strengths and limitations, suggesting that while internal confidence (self-efficacy) and personal traits (conscientiousness) are strong, experiential opportunities (participation in piano activities) may be an area needing greater institutional support.

Before proceeding to the structural model, it is essential to verify the validity of the measurement model. Validity refers to the degree to which the indicators accurately measure the underlying theoretical constructs. In this study, construct validity, convergent validity, and discriminant validity were evaluated using SmartPLS 4.0. These tests help ensure that the latent variables are statistically distinct, conceptually meaningful, and properly reflected by their observed indicators.

Construct validity assesses how well a set of observed variables represents the latent construct they are intended to measure. One of the most widely accepted criteria in PLS-SEM for construct validity is the factor loading, which should ideally exceed 0.70 for each item. Items with factor loadings above this threshold are considered to be reliable indicators of their respective constructs. All measurement items achieved factor loadings between 0.72 and 0.86, thereby meeting the recommended criterion. Each construct displayed strong internal

consistency, with no item falling below the accepted threshold. This confirms that the measurement items are appropriate and statistically valid for representing the intended latent variables. Construct validity was assessed by examining the factor loadings of each item on its corresponding latent construct. According to standard PLS-SEM guidelines, a factor loading of 0.70 or higher is considered acceptable, indicating that the item contributes meaningfully to the underlying construct.

Collectively, these results provide strong evidence that the items used in this study reliably measure their intended constructs, thereby affirming the construct validity of the measurement model.

## **V. Conclusion**

The descriptive statistics revealed that students reported moderately high levels of self-efficacy and basic musical literacy, with mean values clustering around the upper midpoint (i.e., 3.8–4.2) of the 5-point Likert scale. These results indicate that the majority of participants perceive themselves as confident and competent in core areas of piano learning, including theoretical understanding and personal belief in their ability to succeed. The relatively elevated scores suggest that the sampled cohort—comprising music students from universities and conservatories in Hunan Province—is generally well prepared in terms of both cognitive knowledge and psychological readiness for piano performance. This profile is consistent with previous research emphasizing the role of conservatory-style environments in building foundational skills and reinforcing students' confidence through structured curricula and frequent evaluations (Franceschi, 2022). Such institutions often emphasize music theory, ear training, and applied performance in an integrated manner, which may explain the higher-than-average literacy and self-belief among these participants. Moreover, the presence of dedicated faculty supervision, regular solo or ensemble performance opportunities, and clear progression benchmarks likely reinforces students' perceived efficacy in mastering increasingly challenging repertoire.

The participation in piano activities variable, reflecting students' self-reported practice habits and metacognitive behaviors, also showed relatively high means, suggesting that most participants adopt intentional, goal-oriented approaches to learning. These include time management, segmentation of difficult passages, and regular feedback-seeking behavior. The alignment of high self-efficacy with strategic learning confirms earlier findings by Suzuki and Mitchell (2021), who reported that students with strong confidence in their ability are more likely to engage in deliberate practice and utilize reflective techniques. Notably, effective participation in piano activities further amplifies the benefits of self-efficacy, as students are better equipped to convert motivation into tangible skill development.

In contrast, participants' perceptions of learning resources—particularly in terms of access to resources such as instruments, rehearsal spaces, and instructional technologies—were more variable. The average scores for this construct were slightly lower than for the cognitive and

behavioral variables, falling closer to the midpoint of the Likert scale (approximately 3.2–3.6). This discrepancy may reflect institutional disparities across the sampled universities. For example, students in top-tier conservatories may enjoy abundant resources, including high-quality instruments, personalized instruction, and digital practice tools, while those in smaller or more rural institutions might encounter limited infrastructure, shared practice facilities, or outdated equipment.

Some respondents may also have interpreted “learning resources” to include extracurricular performance opportunities or access to modern pedagogical tools, which are not evenly distributed across schools. These gaps are consistent with national concerns about resource imbalances within China’s higher music education system, particularly between urban and regional institutions (Luo & He, 2023). Despite the variation in this dimension, it is important to note that standard deviations for all measured variables remained within acceptable statistical thresholds, suggesting moderate variability but no severe skewness or presence of outliers. This statistical consistency enhances the reliability of the dataset and supports the validity of the comparisons made in later analytical sections.

In sum, The cognitively capable, behaviorally strategic, and moderately confident, but not equally resourced in their learning resources. These preliminary findings highlight the complex and uneven landscape of piano education in Hunan and provide an important backdrop for understanding the interaction effects explored in later phases of the study.

In sum, these practical implications suggest that improving piano performance level is not merely a matter of natural talent or the number of instructional hours provided. Instead, progress depends on the effective alignment of curriculum structures, teaching practices, and student self-management strategies with the psychological and behavioral mechanisms identified in this study. By adopting a holistic, learner-centered approach that addresses both skill development and personality-informed support, higher education institutions can foster more equitable and effective training environments. Such an approach will ultimately produce not only technically proficient and expressive performers but also self-aware, disciplined, and resilient musicians capable of sustaining their growth across diverse professional and artistic contexts.

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