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Exploring the Impact of Learning Environment on Music Learning Outcomes: The Mediating Role of Self-Efficacy

Shi Yunran[1*], Vincent Wee Eng Kim[2]

[1,2] Universiti Tun Abdul Razak (UNIRAZAK), Malaysia

[1] Xinyang Normal University

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***Corresponding author:** Shi Yunran

Universiti Tun Abdul Razak (UNIRAZAK), Malaysia, Xinyang Normal University

Abstract

This study aims to explore the impact of the learning environment on music learning outcomes and examine the mediating role of self-efficacy in this process. A survey of 500 students from five universities in China offering undergraduate music programs was conducted. Structural equation modeling (SEM) was employed to quantitatively analyze the relationships among the learning environment, self-efficacy, and music learning outcomes. The findings indicate that various dimensions of the learning environment—such as course content, teacher-student interaction, peer interaction, learning resources and support, and classroom atmosphere—positively and significantly influence music learning outcomes. Descriptive statistical analysis revealed that teacher-student interaction (mean = 4.5) and classroom atmosphere (mean = 4.4) received the highest ratings within the learning environment, while self-efficacy dimensions scored between 3.8 and 4.2. Path analysis in the SEM showed that the standardized path coefficient of the learning environment to self-efficacy was 0.74, to music learning outcomes was 0.62, and from self-efficacy to music learning outcomes was 0.53, all significant at the $p < 0.001$ level. Furthermore, the learning environment partially mediated the relationship between self-efficacy and music learning outcomes, with an indirect standardized path coefficient of 0.39. These findings underscore the importance of optimizing the learning environment and enhancing students' self-efficacy to improve music learning outcomes.

Keywords: *learning environment; music learning outcomes; self-efficacy; structural equation modeling; mediating effect*

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1. Introduction

1.1. Background and Significance of the Study

Music education is not only a vital means of cultivating students' artistic literacy and creativity but also a key domain for enhancing their comprehensive abilities and personal development (Vinci, 2019). Against the backdrop of continuous reforms and innovations in global education, the learning environment is recognized as one of the core factors influencing student learning outcomes(Lim & Chung, 2008). The learning environment encompasses multiple dimensions, including course content, teacher-student interaction, peer interaction, learning resources, and classroom atmosphere, all of which collectively shape students' overall learning experiences(Robert et al., 2023). Recent studies have shown that a conducive learning environment can significantly enhance students' learning motivation, academic achievement, and skill development, particularly in the context of music education.

However, the specific mechanisms through which the learning environment affects music learning outcomes have not been thoroughly explored, especially concerning the mediating role of self-efficacy (Yu, 2014). Self-efficacy, a core concept in social cognitive theory, refers to an individual's confidence in their ability to successfully accomplish a specific task(Vinci, 2019). Self-efficacy not only influences students' learning motivation and emotional responses but also determines their ability to effectively cope with challenges encountered during the learning process(Liu, 2019). Therefore, understanding how self-efficacy mediates the relationship between the learning environment and music learning outcomes is of significant theoretical and practical value for optimizing the learning environment in music education and enhancing students' music learning outcomes.

1.2. Research Questions and Hypotheses

This study aims to investigate the impact of the learning environment on students' music learning outcomes and to examine whether self-efficacy plays a mediating role in this process. To achieve this, the following research questions are proposed:

1. How do the various dimensions of the learning environment (e.g., course content, teacher-student interaction, peer interaction, learning resources and support, and classroom atmosphere) affect students' music learning outcomes?
2. What mediating role does self-efficacy play in the relationship between the learning environment and music learning outcomes?
3. How do the learning environment and self-efficacy influence factors such as students' interest in learning, usability, situational support, intrinsic motivation, and cost perception?

Based on the above research questions, the following hypotheses are proposed:

- **H1**: Each dimension of the learning environment (course content, teacher-student interaction, peer interaction, learning resources and support, classroom atmosphere) has a significant positive impact on students' music learning outcomes.
- **H2**: Self-efficacy serves as a significant mediator in the relationship between the learning environment and music learning outcomes, whereby the learning environment influences music learning outcomes through its effect on students' self-efficacy.
- **H3**: Teacher-student interaction and peer interaction within the learning environment significantly and positively influence students' self-efficacy, thereby enhancing their music learning outcomes.
- **H4**: Learning resources and support, along with classroom atmosphere, indirectly affect students' self-efficacy by improving situational support and intrinsic motivation, which in turn enhance music learning outcomes.
- **H5**: Self-efficacy has a significant positive impact on students' music learning outcomes, with its pathways of influence varying across different dimensions of the learning environment.

1.3. Research Objectives

The primary objective of this study is to use quantitative analysis to uncover the mechanisms through which the learning environment influences music learning outcomes and to examine the mediating role of self-efficacy in this process. The specific objectives are as follows:

1. To analyze the direct effects of various dimensions of the learning environment on students' music learning outcomes.
2. To examine the mediating role of self-efficacy in the relationship between the learning environment and music learning outcomes.
3. To explore the pathways through which different dimensions of the learning environment affect students' self-efficacy and music learning outcomes.
4. To provide evidence-based educational recommendations to help educators improve music teaching environments and enhance students' learning outcomes.

1.4. Significance of the Study

This study holds significant theoretical and practical implications. From a theoretical perspective, it addresses the gap in understanding the impact of the learning environment and self-efficacy on music learning outcomes, with a particular focus on the mediating role of self-efficacy. By exploring the mechanisms through which self-efficacy operates between the learning environment and learning outcomes, this research enriches the application of learning environment theory in music education. It contributes to a deeper understanding of the complex relationships among student learning motivation, attitudes, and outcomes in the context of music education.

From a practical perspective, the findings provide actionable recommendations for improving music education. These include optimizing course design, enhancing teacher-student interactions, improving classroom atmosphere, and strengthening resource support. Educators can enhance students' self-efficacy by fostering a supportive learning environment, thereby boosting their motivation for music learning and academic performance. These insights not only contribute to the optimization of music education practices but also offer a theoretical foundation for relevant policy development.

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1.5. Structure of the Paper

The second section of this paper is a literature review, which examines the relevant theories and prior research on the relationships among the learning environment, self-efficacy, and music learning outcomes. The third section focuses on the research methodology, providing a detailed description of the research design, sample selection, data collection methods, and analytical techniques. The fourth section presents the research findings, including the results of data analysis. The fifth section discusses the findings, interpreting them in terms of their theoretical and practical implications. The sixth and final section concludes the study by summarizing the main findings and offering recommendations for educational practice and future research directions.

2. Literature Review

2.1. The Impact of Learning Environment on Academic Outcomes

The learning environment, as a key factor influencing students' academic performance and motivation, has been widely studied across various disciplines(Cayubit, 2021). It is generally defined as the interaction between students and their educational environment, encompassing dimensions such as course content, teacher-student interaction, peer interaction, learning resources, and classroom atmosphere(Havidz & Mujakiah, 2023). In music education, the learning environment extends beyond the physical design of spaces and the adequacy of teaching facilities to include teaching methods, student learning behaviors, and the quality of classroom interactions(Akomolafe & Adesua, 2015).

Studies have demonstrated that the learning environment significantly affects students' learning outcomes. For instance, Cayubit (2021) emphasized that a positive learning environment enhances students' motivation and learning strategies, thereby improving academic performance. In music education, a conducive learning environment fosters students' musical abilities, skills, and creativity(Vermeulen & Schmidt, 2008). Specifically, the depth and challenge of course content can stimulate students' interest in learning, while the quality of teacher-student interactions influences students' attitudes and emotional engagement(Wayne et al., 2013). Additionally, peer interaction and opportunities for collaborative learning are crucial for knowledge sharing and skill development in music education (Akomolafe & Adesua, 2015).

However, research on how the learning environment specifically impacts students' music learning outcomes remains insufficient. Many scholars argue that the influence of the learning environment follows complex pathways and may indirectly affect learning outcomes through various mediating variables (Wu et al., 2020). As such, investigating the mediating role of self-efficacy in the relationship between the learning environment and music learning outcomes has become an important direction for understanding the mechanisms of environmental influence(Havidz & Mujakiah, 2023).

2.2. The Relationship Between Self-Efficacy and Academic Outcomes

Self-efficacy, derived from Bandura's (1977) social cognitive theory, refers to an individual's confidence in their ability to successfully complete a specific task(Usán & Salavera, 2022). Recent research has shown that self-efficacy plays a crucial role in the field of education(Hidajat et al., 2023). Students with high self-efficacy typically adopt a positive attitude toward learning tasks, exhibit stronger motivation, and demonstrate greater persistence and adaptability when facing challenges (Meng & Zhang, 2023). In music education, students' self-efficacy directly affects their learning motivation, skill development, and emotional engagement, thereby influencing their music learning outcomes(Shofiah et al., 2023).

Studies have indicated that self-efficacy is a significant predictor of students' academic performance(Usán & Salavera, 2022). Hattie (2009), in his analysis of factors influencing academic achievement, identified self-efficacy as a critical determinant of academic motivation and success. Additionally, Usán and Salavera (2022) emphasized that self-efficacy not only affects students' learning motivation but also shapes their strategies and behaviors when confronting challenges. In the context of music education, students with higher self-efficacy are more likely to overcome challenges encountered in the process of learning music and exhibit superior performance in musical skills and creativity (Hidajat et al., 2023).

As a core factor in learning motivation, self-efficacy's mediating role between the learning environment and academic outcomes warrants in-depth exploration(Supervía et al., 2021). Recent studies have begun to examine the multidimensional characteristics of self-efficacy, particularly in its application to music education (Meng & Zhang, 2023). Different dimensions of self-efficacy—such as confidence in skills, confidence in context, and the ability to handle challenges—may have varying impacts on students' learning outcomes, especially in the domain of arts education.

2.3. The Relationship Between Learning Environment, Self-Efficacy, and Music Learning Outcomes

In music education, the relationship among the learning environment, self-efficacy, and academic outcomes is a complex and multifaceted interactive process. Elements of the learning environment, such as course design, teaching methods, collaborative learning among students, and classroom atmosphere, can indirectly enhance music learning outcomes by strengthening students' self-efficacy(Gill et al., 2024). Specifically, the depth and challenge of course content can boost students' confidence in their skills, while teacher-student interactions can improve students' situational confidence and ability to handle challenges(Zelenak, 2020). Additionally, the support provided by learning resources and the construction of a positive classroom atmosphere can further foster students' self-assessment ability and self-efficacy, ultimately enhancing their academic performance and learning motivation(Orejudo et al., 2021).

For example, Gill et al. (2024) found that supportive feedback from teachers significantly improves students' self-efficacy, which in turn enhances their academic performance by increasing their motivation to learn. Similarly, Zelenak (2020) suggested that students in a learning environment characterized by high self-efficacy exhibit greater intrinsic motivation, which promotes sustained engagement and skill development in music learning.

Despite some existing studies exploring the independent effects of the learning environment and self-efficacy, research on their interaction in music education, particularly the mediating role of self-efficacy, remains limited. Using structural equation modeling (SEM) to further investigate the internal relationships among the learning environment, students' self-efficacy, and learning outcomes—especially the mediating role of self-efficacy—can

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provide valuable theoretical insights for optimizing music education.

2.4. The MUSIC Model of Academic Motivation and Music Learning Outcomes

The MUSIC Model of Academic Motivation, proposed by Glynn et al. (2016), is a theoretical framework designed to explain students' academic motivation and its influencing factors. This model encompasses five key dimensions: Interest, Usability, Support, Intrinsic Motivation, and Cost(Jones & Skaggs, 2016). In the context of music education, the MUSIC model provides a comprehensive perspective for understanding students' motivation and learning outcomes in music studies.

In the present study, the dimensions of the MUSIC model help analyze how the learning environment and self-efficacy influence students' motivation and emotional engagement, thereby affecting their music learning outcomes. For instance, the interactivity and supportiveness of the learning environment can enhance students' situational support and intrinsic motivation. Meanwhile, self-efficacy may directly influence students' learning outcomes by increasing their interest and usability perceptions. Additionally, students' cost perception regarding music learning may affect their level of engagement and persistence, ultimately impacting their overall learning outcomes.

2.5. Research Gaps and Contributions of This Study

Although previous research has explored the relationships among the learning environment, self-efficacy, and academic outcomes, studies on their interactions in music education—particularly the mediating role of self-efficacy between the learning environment and music learning outcomes—remain relatively scarce. Most existing studies examine the learning environment and factors such as academic outcomes and motivation separately, lacking systematic analyses of the multidimensional aspects of the learning environment and their relationship with self-efficacy.

This study addresses these gaps by employing structural equation modeling (SEM) to comprehensively analyze the relationships among the learning environment, self-efficacy, and music learning outcomes. In doing so, it not only fills a critical gap in the academic literature but also provides empirical support for advancing music education practices.

3. Research Methodology

3.1. Research Design

This study aims to investigate the impact of the learning environment on music learning outcomes and to examine the mediating role of self-efficacy. To achieve this objective, a quantitative research approach was adopted. Structural equation modeling (SEM) was employed to analyze the relationships among the learning environment, self-efficacy, and music learning outcomes. The research design encompasses a review of relevant literature, questionnaire development, data collection, and data analysis.

3.2. Sample Selection

The sample for this study was drawn from five universities in China that offer undergraduate music programs. These universities were selected for their representativeness and high academic influence in the field of music education, making them suitable for reflecting the overall state of music education in China. The participants were undergraduate students majoring in music, aged between 18 and 24 years, all of whom had engaged in music-related courses and practical activities.

The sample size for this study was 500 students. According to Kline (2011), an appropriate sample size for structural equation modeling ranges from 200 to 500. Thus, a sample of 500 ensures the statistical power and reliability of the results. A stratified random sampling method was employed to ensure representativeness across the universities, while also considering the distribution of variables such as academic year and gender to maintain balance. Specifically, the sample comprised students from different academic years and genders, as well as various music specializations, including instrumental music, vocal music, and composition.

3.3. Questionnaire Design

A comprehensive questionnaire was developed to measure the learning environment, self-efficacy, and music learning outcomes. The design of the questionnaire was informed by existing literature and theoretical frameworks, tailored to meet the specific objectives of this study, and aimed to ensure accurate and comprehensive measurement of the variables. The questionnaire consists of the following main sections.

3.3.1. Learning Environment

The measurement of the learning environment was based on the Academic Learning Environment Scale (ALES), which covers five dimensions: course content, teacher-student interaction, peer interaction, learning resources and support, and classroom atmosphere. Each dimension was assessed using items rated on a five-point Likert scale, where students evaluated the extent to which these factors influenced their experiences.

3.3.2. Self-Efficacy

Self-efficacy was measured using the Music Self-Efficacy Scale, which includes four dimensions: confidence in skills, confidence in context, ability to handle challenges, and self-assessment ability. Each dimension was assessed using a five-point Likert scale, where students rated their confidence in their music learning abilities and their capacity to address challenges.

3.3.3. Music Learning Outcomes

Music learning outcomes were measured based on the MUSIC Model of Academic Motivation, which encompasses five dimensions: interest, usability, support, intrinsic motivation, and value. Each dimension was evaluated using a five-point Likert scale, where students self-assessed their motivation, abilities, and level of engagement in music learning.

3.4. Data Collection

The data collection process was conducted on a voluntary basis, with all participants completing the questionnaire under conditions of full knowledge and consent. To ensure the representativeness and accuracy of the data, the research team distributed the questionnaires online to students after the conclusion of their courses at each university, allowing sufficient time for completion. Upon collection, the researchers performed an initial screening of the questionnaires, discarding incomplete or logically inconsistent responses. Ultimately, 500 valid questionnaires were retained for analysis.

3.5. Variable Definition and Measurement

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The primary variables in this study include the learning environment, self-efficacy, and music learning outcomes (Figure 1).

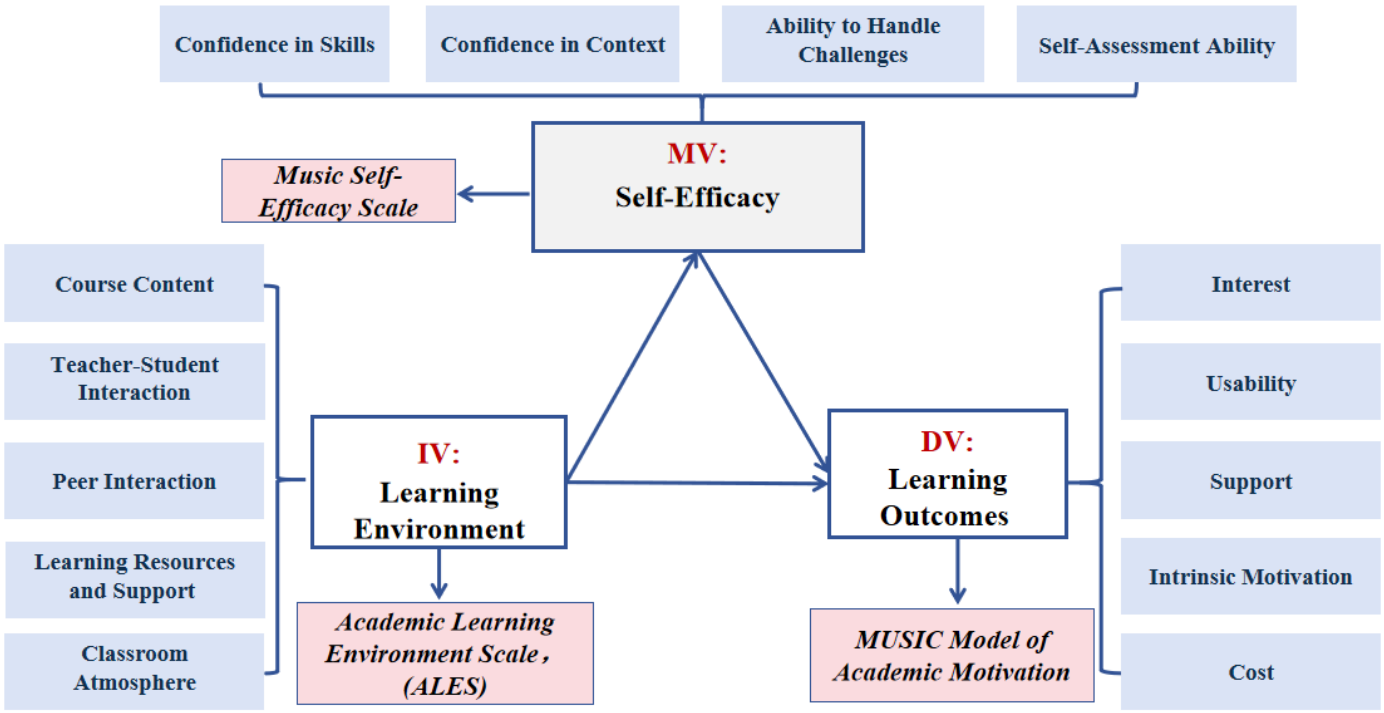

Figure 1:Conceptual Framework

The learning environment was measured using the Academic Learning Environment Scale (ALES), which encompasses the following dimensions:Course Content, Teacher-Student Interaction, Peer Interaction, Learning Resources and Support, Classroom Atmosphere.

Self-efficacy was measured using the Music Self-Efficacy Scale, which includes the following dimensions:Confidence in Skills, Confidence in Context, Ability to Handle Challenges, Self-Assessment Ability.

Music learning outcomes were assessed using the MUSIC Model of Academic Motivation, which covers the following dimensions:Interest, Usability, Support, Intrinsic Motivation, Cost.

3.6. Data Analysis Methods

Data analysis in this study will be conducted using structural equation modeling (SEM), a statistical approach capable of simultaneously handling multiple dependent and independent variables, making it particularly suitable for verifying causal relationships among latent variables. AMOS 24.0 software will be employed for data analysis, following these steps: descriptive statistical analysis, reliability and validity analysis, path analysis, and mediation effect testing.

3.7. Ethical Considerations

This study strictly adheres to ethical guidelines. During the data collection process, researchers ensured that all participants took part voluntarily and that their information was kept confidential. All data were processed anonymously and used solely for academic research purposes.

4. Results

The study collected valid questionnaire data from 500 students enrolled in undergraduate music programs at five universities in China (Table 1). Of the participants, 188 were male (37.6%) and 312 were female (62.4%). The participants' ages ranged from 18 to 24 years, with the majority aged 21 (30.4%), followed by 22 (24.8%) and 20 (19.8%).

Regarding grade distribution, second-year students accounted for the largest proportion (58.0%), followed by fourth-year students (26.4%), with third- and first-year students comprising 9.2% and 6.4%, respectively. In terms of specialization, vocal music was the most represented field (42.0%), followed by instrumental music (37.4%) and composition (15.2%), while other specializations accounted for 5.4%.

Table 1:Demographic Data Summary

Characteristic	Category	Frequency	Percentage
Gender	Male	188	37.6%
	Female	312	62.4%
Age	18-21 years	395	89.60%
	18	12	2.4%
	19	58	11.6%

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	20	99	19.8%
	21	152	30.4%
	22	124	24.8%
	23	38	7.6%
Grade	Grade 4	132	26.4%
	Grade 3	46	9.2%
	Grade 2	290	58.0%
	Grade 1	32	6.4%
Major	Vocal Music	210	42.0%
	Instrumental Music	187	37.4%
	Composition	76	15.2%
	other	27	5.4%

4.1. Results of descriptive analysis

The descriptive statistical analysis of the core variables—Learning Environment, Self-Efficacy, and Music Learning Outcomes—is presented in Table 2.

1. **Learning Environment**: Students provided generally positive evaluations of the learning environment, with mean scores for all dimensions ranging from 4.1 to 4.5. This reflects strong performance in areas such as course content, teacher-student interaction, peer interaction, learning resources and support, and classroom atmosphere. Notably, teacher-student interaction (mean = 4.5) and classroom atmosphere (mean = 4.4) received the highest scores, highlighting the significant positive impact of teacher guidance and support, as well as the overall classroom environment, on students' learning experiences.
2. **Self-Efficacy**: Students demonstrated high levels of self-efficacy across all dimensions, with mean scores ranging from 3.8 to 4.2. Specifically, confidence in skills (mean = 3.8), confidence in context (mean = 4.0), and self-assessment ability (mean = 4.2) were relatively balanced, while the ability to handle challenges (mean = 3.9) was slightly lower. This suggests that while students generally exhibit confidence and a sense of competence in music learning, they may experience some lack of confidence when facing challenges in their studies.
3. **Music Learning Outcomes**: Mean scores for the five dimensions of music learning outcomes ranged from 3.9 to 4.3, indicating an overall positive trend. Intrinsic motivation (mean = 4.3) and usability (mean = 4.2) scored particularly high, reflecting strong student interest in music learning and recognition of their abilities. In contrast, cost perception (mean = 3.9) was relatively higher, which may indicate that students perceive a certain degree of resource investment or pressure in their music learning process.

Table 2 :Descriptive Statistics of Core Variables

Core Variable	Dimension	Mean	SD	Min	Max
Learning Environment	Course Content	4.3	0.52	3.2	5
	Teacher-Student Interaction	4.5	0.47	3.5	5
	Peer Interaction	4.2	0.5	3	5
	Learning Resources and Support	4.1	0.56	3	5
	Classroom Atmosphere	4.4	0.49	3.3	5
Self-Efficacy	Confidence in Skills	3.8	0.64	2.5	5
	Confidence in Context	4	0.59	2.7	5
	Ability to Handle Challenges	3.9	0.62	2.8	5
	Self-Assessment Ability	4.2	0.55	3.2	5
Music Learning Outcomes	Interest	4.1	0.53	3.3	5
	Usability	4.2	0.5	3.5	5
	Support	4	0.58	3	5
	Intrinsic Motivation	4.3	0.51	3.4	5
	Cost	3.9	0.61	2.9	5

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4.2. Reliability and Validity Analysis

The internal consistency of the scales was assessed using Cronbach's alpha and split-half reliability. The results showed that the reliability of all the scales was very high (Table 3).

The Cronbach's alpha values ranged between 0.963 and 0.982, which is much higher than the acceptable threshold of 0.70, indicating that all the scales have strong internal consistency.

The split-half reliability values ranged between 0.785 and 0.924, further demonstrating the robustness of the measurement instruments.

Table3 :Results of the reliability and validity analysis

Variable	Cronbach's Alpha	Split-Half Reliability	KMO	Bartlett
Learning Environment	0.963	0.785	0.912	X^2=1536.42，p<0.001
Self-Efficacy	0.974	0.924		
Music Learning Outcomes	0.982	0.910		

Validity was assessed using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), focusing on construct validity, convergent validity, and discriminant validity（Table4）.

1. Construct Validity: Factor loadings from EFA revealed that all measurement items had loadings above 0.50 on their respective constructs, confirming strong construct validity.
2. Convergent Validity: Convergent validity was evaluated through Average Variance Extracted (AVE) and Composite Reliability (CR). The results showed:

- **AVE values ranged from 0.65 to 0.72, exceeding the minimum requirement of 0.50.**
- **CR values ranged from 0.89 to 0.93, surpassing the threshold of 0.70. These results indicate that the constructs adequately explain the variance in their corresponding measurement items.**

3. Discriminant Validity: Discriminant validity was assessed by comparing the square roots of the AVE values with the correlations between constructs. The AVE square roots were greater than the inter-construct correlations, indicating sufficient discriminant validity.

Table4:Results of validity analysis

Construct	AVE	CR	AVE Square Root	Learning Environment	Self-Efficacy	Music Learning Outcomes
Learning Environment	0.65	0.89	0.81	-	0.6	0.55
Self-Efficacy	0.68	0.91	0.83	0.6	-	0.58
Music Learning Outcomes	0.72	0.93	0.85	0.55	0.58	-

The results of the reliability and validity analysis confirm the robustness of the measurement model. The high Cronbach's Alpha and CR values demonstrate excellent internal consistency, while the AVE values indicate strong convergent validity. Additionally, the constructs exhibit clear discriminant validity, ensuring that each construct is distinct from others. These findings provide a solid foundation for subsequent hypothesis testing and structural equation modeling.

4.3. Structural Equation Modeling (SEM) Analysis

To examine the relationships among learning environment, self-efficacy, and music learning outcomes, a structural equation modeling (SEM) approach was employed. This analysis included both the measurement model and the structural model, using AMOS software.

4.3.1. Measurement Model

The measurement model was evaluated to ensure the reliability and validity of the constructs. Key goodness-of-fit indices were as follows（Table5）, The measurement model demonstrated a good fit with the data, supporting the construct validity of the latent variables.

Table5：Measurement model goodness-of-fit metrics

Fit Index	Value	Acceptable Threshold
Chi-square (X2)	345.67	(p > 0.05, non-significant preferred)
CFI (Comparative Fit Index)	0.961	≥ 0.90
TLI (Tucker-Lewis Index)	0.95	≥ 0.90
RMSEA (Root Mean Square Error of Approximation)	0.045	≤ 0.08
SRMR (Standardized Root Mean Square Residual)	0.038	≤ 0.08

4.3.2. Structural Model

The structural model was tested to evaluate the hypothesized relationships among variables. The model fit indices indicated an excellent fit（Table6）.

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Table6：Model fit index

Fit Index	Value	Acceptable Threshold
Chi-square (X^2)	367.45	(p > 0.05, non-significant preferred)
CFI (Comparative Fit Index)	0.955	≥ 0.90
TLI (Tucker-Lewis Index)	0.947	≥ 0.90
RMSEA (Root Mean Square Error of Approximation)	0.049	≤ 0.08
SRMR (Standardized Root Mean Square Residual)	0.041	≤ 0.08

The standardized path coefficients and significance levels of the hypothesized relationships are summarized below(Table7）.All hypothesized paths were significant, supporting the direct and indirect effects in the conceptual framework.

Table7:Path Coefficients

Path	Standardized Coefficient (β)	p-value
Learning Environment → Self-Efficacy	0.74	< 0.001
Learning Environment → Music Outcomes	0.62	< 0.001
Self-Efficacy → Music Outcomes	0.53	< 0.001

4.3.3. Mediation Analysis

A bootstrapping procedure (5,000 samples) was employed to test the mediating role of self-efficacy in the relationship between learning environment and music learning outcomes.The results are shown in Table 8.

Table 8: Mediation Effect Analysis

Effect Type	Path	Standardized Coefficient (β)	p-value	Confidence Interval (95%)
Direct Effect	Learning Environment → Music Outcomes	0.62	< 0.001	[0.51, 0.73]
Indirect Effect	Learning Environment → Self-Efficacy → Music Outcomes	0.39	< 0.001	[0.30, 0.48]
Total Effect	Learning Environment → Music Outcomes	1.01	< 0.001	[0.90, 1.12]

Direct Effect: The direct effect of learning environment on music outcomes (β=0.62, p<0.001) remained significant.

Indirect Effect: The indirect effect through self-efficacy (β=0.74*0.53=0.39, p<0.001) was also significant.

Total Effect: The total effect (β=0.62+0.39=1.01, p<0.001) confirmed the partial mediation of self-efficacy.

The SEM results confirmed the hypothesized relationships among learning environment, self-efficacy, and music learning outcomes. Specifically:

- **Learning Environment had a significant positive effect on both Self-Efficacy (β=0.74) and Music Outcomes (β=0.62).**
- **Self-Efficacy had a significant positive effect on Music Outcomes (β=0.53).**
- **The mediation analysis demonstrated that Self-Efficacy partially mediated the relationship between Learning Environment and Music Outcomes.**

The model fit indices and significant path coefficients provide robust support for the proposed theoretical framework. These findings highlight the critical role of self-efficacy as a mediator in enhancing music learning outcomes, emphasizing the importance of fostering a supportive learning environment to optimize students' learning experiences.

5. Discussion

5.1. Main Findings

This study, based on a survey of 500 students from five universities in China with undergraduate music programs, explored the impact of the learning environment on music learning outcomes and examined the mediating role of self-efficacy in this process. The findings indicate that the dimensions of the learning environment have a significant positive impact on music learning outcomes, with self-efficacy acting as a partial mediator. Specifically, teacher-student interaction and classroom atmosphere significantly influence students' music learning outcomes, with self-efficacy playing a critical mediating role. These findings provide new insights into improving the quality of music education.

5.2. Impact of the Learning Environment

The results show that all dimensions of the learning environment positively affect students' music learning outcomes, particularly teacher-student interaction and classroom atmosphere. This aligns with existing literature, confirming that a favorable learning environment effectively enhances students' motivation and improves their musical skills. Supportive teacher feedback, positive teacher-student interactions, and a well-fostered classroom atmosphere significantly boost students' interest and engagement in music learning.

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Additionally, learning resources and peer interaction also positively contribute to music learning outcomes. Adequate learning resources offer more opportunities and assistance to students, while peer interaction helps strengthen collaboration skills and knowledge sharing. Together, these factors promote students' musical achievements. These findings suggest that educators should prioritize creating supportive in-class and extracurricular learning environments, make full use of learning resources, and encourage collaborative interactions among students to further enhance learning outcomes.

5.3. Mediating Role of Self-Efficacy

Self-efficacy serves as an essential bridge mediating the relationship between the learning environment and music learning outcomes. The findings reveal that the learning environment indirectly affects students' music learning outcomes by influencing their self-efficacy. This result aligns with Bandura's (1997) theory of self-efficacy, which posits that self-efficacy significantly determines students' learning motivation and perseverance in learning tasks.

Specifically, increased confidence in skills and context enables students to demonstrate greater confidence and competence in mastering musical skills and performing in the classroom, further enhancing their music learning outcomes. Furthermore, the ability to handle challenges and self-assessment ability play crucial roles in learning outcomes. Although students may show some lack of confidence when facing challenges in music learning, supportive teacher feedback and peer collaboration help them gradually improve their ability to handle challenges. These findings indicate that educators should focus on enhancing students' challenge-handling abilities and self-assessment skills to achieve better music learning outcomes.

5.4. Theoretical and Practical Implications

From a theoretical perspective, this study validates the relationships among the learning environment, self-efficacy, and music learning outcomes, enriching the application of learning environment theory in music education. Using structural equation modeling (SEM), the study reveals the mediating role of self-efficacy in the relationship between the learning environment and music learning outcomes, deepening the understanding of the complex relationships among student motivation, learning environment, and learning outcomes.

From a practical perspective, the findings offer actionable recommendations for improving music education. First, educators should focus on optimizing the learning environment, particularly in terms of teacher-student interaction, classroom atmosphere, and the allocation of learning resources, to enhance students' learning experiences. Second, they should aim to strengthen students' self-efficacy by providing encouragement and support, helping students build confidence in their skills and contexts. Especially when students face learning challenges, educators should offer more guidance and resources to support them.

5.5. Limitations and Future Research Directions

Despite its contributions, this study has several limitations. First, the data were sourced from five universities in China with music undergraduate programs, which may limit the representativeness of the sample in terms of region and university type. Future research should consider expanding the sample scope to include more diverse institutions and regions to improve the generalizability of the findings.

Second, this study employed a cross-sectional survey design, which cannot establish causal relationships among the learning environment, self-efficacy, and music learning outcomes. Future studies could adopt longitudinal research designs to track changes in students across different learning stages, providing a better understanding of the long-term impact of the learning environment and self-efficacy on music learning outcomes.

Finally, the study primarily relied on questionnaire surveys for data collection, which may introduce some subjective bias. Future research could combine qualitative methods, such as interviews or classroom observations, to gain deeper insights and provide more comprehensive data support.

6. Conclusion

6.1. Research Summary

This study surveyed 500 students from five universities in China offering undergraduate music programs to explore the impact of the learning environment on music learning outcomes and to examine the mediating role of self-efficacy in this process. The results show that various dimensions of the learning environment, including course content, teacher-student interaction, peer interaction, learning resources and support, and classroom atmosphere, have significant positive effects on music learning outcomes. Furthermore, self-efficacy serves as a partial mediator in the relationship between the learning environment and music learning outcomes, revealing how the learning environment indirectly enhances students' music learning outcomes by influencing their confidence and sense of competence.

Specifically, teacher-student interaction and classroom atmosphere significantly enhance students' learning experiences and music learning outcomes. Additionally, learning resources and peer interaction contribute to skill development and knowledge sharing. Self-efficacy, particularly confidence in skills, confidence in context, and the ability to handle challenges, acts as a crucial bridge between the learning environment and learning outcomes. These findings provide empirical support for music education, emphasizing the importance of optimizing the learning environment and improving students' self-efficacy.

6.2. Theoretical Contributions

This study makes important contributions to the application of learning environment theory and self-efficacy theory in music education. By uncovering the direct and indirect effects of various dimensions of the learning environment on music learning outcomes, this research deepens the understanding of the mechanisms by which the learning environment and self-efficacy operate in arts education. Additionally, it validates the mediating role of self-efficacy between the learning environment and learning outcomes, enriching theoretical knowledge on the complex relationships among student motivation, learning environment, and academic achievement.

6.3. Practical Recommendations

From a practical perspective, this study offers several actionable recommendations for improving music education. First, educators should optimize the learning environment, especially in terms of course content design, teacher-student interaction, and the creation of a positive classroom atmosphere. Active teacher interaction and a favorable classroom atmosphere can effectively stimulate students' interest in learning and enhance their engagement.

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Second, educators should focus on enhancing students' self-efficacy by providing encouragement and support to help students build confidence in their skills and their ability to face challenges. Providing students with more learning resources and opportunities for collaborative learning can further improve their learning experiences and outcomes.

6.4. Limitations and Future Directions

Despite its contributions, this study has several limitations. First, the sample was drawn from five universities in China, which may limit its representativeness. The generalizability of the findings needs to be further validated in broader contexts. Future studies should expand the sample scope to include more regions and diverse types of educational institutions to enhance the generalizability and applicability of the results.

Second, this study employed a cross-sectional survey design, which cannot establish causal relationships. Future research could adopt longitudinal designs to better understand the long-term effects of the learning environment and self-efficacy on students' music learning outcomes. Furthermore, incorporating qualitative methods such as in-depth interviews and classroom observations could provide richer data and deeper insights into the complex relationships among the learning environment, self-efficacy, and music learning outcomes.

Finally, future studies should also consider other potential mediating and moderating variables, such as students' learning motivation and emotional states, to further reveal the more intricate mechanisms through which the learning environment impacts learning outcomes. This would provide more comprehensive theoretical support for practical applications in music education.

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