

Research and Practice of Music Teaching Mode in Higher Vocational Colleges Based on Computer Technology

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The aim of this study is to determine the effectiveness of a music teaching model based on computer technology in higher vocational colleges. Two classes (Class A and Class B) of students undertaking a music major at DF vocational college were selected as the research subjects. Class A were taught using computer-aided mode, while traditional teaching methods were used for Class B. The results showed that the average score for class A in music theory knowledge increased from 78.5 points to 90.4 points, an increase of 11.9 points; the average score for playing skills increased from 80.3 points to 91.2 points, an increase of 10.9 points; the average score for interest in learning increased from 75.2 to 88.7, an increase of 13.5 points. Conversely, Class B's improvement according to the above indicators was 7.4, 5.9 and 7.7 points respectively. Music creation skills, teamwork ability, performance independent learning ability and creative expression ability had significant positive effects on students' music learning outcomes ($p < 0.05$). The conclusion shows that computer-aided instruction has significant advantages in improving students' music knowledge, skills, learning interest and overall learning quality. It is suggested that computer technology should be widely applied in music education in higher vocational colleges to improve students' academic outcomes.

Keywords: music teaching; computer technology; teaching mode; controlled experiment

1. INTRODUCTION

In China, higher vocational education institutions have the important responsibility of cultivating high quality skilled talents. With the rapid development of information technology, the application of computer technology in the field of education is becoming increasingly widespread, providing new opportunities for the innovation of education and teaching practice. In higher vocational education, the teaching of music courses need to adapt to and align with modern educational technology. The traditional music teaching mode has many

limitations, such as limited teaching resources, single teaching means and low interest of students, which cannot fully meet the needs of modern music education. The introduction of computer technology can enrich teaching resources, broaden the range of teaching practices, improve students' learning interest and participation, ultimately improving the quality and outcomes of music teaching. Studies on the application of computer technology in the teaching of music in higher vocational colleges have important practical significance and theoretical value as they explore the role of technology in improving teaching and learning outcomes.

In China and abroad, much progress has been made in regard to the utilization of computer technology for the teaching of music. Dou and Gao (2019) discussed the

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interactive teaching mode in the teaching of vocal music in colleges, pointing out that computer-assisted teaching can effectively enhance students' participation and interest in learning [1]. Zhang and Wang (2018) studied the organic combination of classical music and pop music in college music teaching and found that computer technology can help to integrate different music styles [2]. According to Li's (2021) strategic research based on educational psychology, computer technology can improve students' learning of instrumental music [3]. Dai (2018) studied the application of experiential teaching in college music education and found that computer technology can enhance students' music perception and experience [4].

Research conducted in countries other than China also attaches importance to the application of computer technology in music teaching. Wei et al. (2022)'s research on college music education based on artificial intelligence technology shows that AI technology can significantly improve the effect of music teaching, especially in terms of personalized teaching [5]. Zhou et al. (2021) designed a visual auditory music teaching system based on mobile augmented reality and proposed that computer technology can provide a new sensory experience for students of music [6]. Zuo (2018) designed a traditional music teaching approach from a multicultural perspective and emphasized the importance of computer technology in multicultural music education [7]. Li (2020) studied the application of micro-courses in college music teaching, pointing out that computer technology can improve teaching efficiency and students' learning outcomes [8].

Chinese research on the innovation of music teaching is increasing. Wang (2022) proposed a model that integrates college music teaching and ideological and political education based on deep learning, finding that computer technology can facilitate this integration [9]. Song (2018) discussed the importance of art practice in college music education and teaching, and proposes that computer technology can provide more resources and support for music practice [10]. Wang (2022) analyzed the effect of an innovative approach to the teaching of bel canto on college students' confidence, pointing out that computer technology can effectively reduce pressure on students, and their anxiety [11]. Zheng (2022) constructed and optimized an AI-assisted college music performance teaching system, believing that computer technology can improve the interaction and effectiveness of music performance teaching [12].

In the context of research and practice concerning music teaching modes in higher vocational colleges, the role of computer technology is becoming increasingly significant. Several studies have explored the integration of digital tools to enhance music education. For example, Crowther et al. (2023) examined how music, as a universal language, can be aligned with the Universal Design for Learning framework to make science teaching more accessible, emphasizing the potential for cross-disciplinary applications in vocational education [13]. Manternach and Schloneger (2021) explored the vocal dose of preservice music therapists and music teachers, shedding light on how vocal training is a key aspect in preparing future educators in the music field, which is also influenced by technological advancements [14]. Furthermore,

Taheri et al. (2019) investigated the application of social robotics for teaching music to children with autism, a study that highlights the potential of technology to cater to diverse educational needs [15]. In a similar vein, Vieira and Morais (2022) used a marching band analogy to bridge the gap between music and chemistry education, demonstrating the creative use of technology to teach complex scientific concepts through music [16]. Additionally, Otondo (2024) applied fundamental soundscape concepts to acoustical engineering and music courses, suggesting the incorporation of environmental sounds into music education to enhance learning experiences in vocational settings [17]. Bolívar-Chávez et al. (2021) conducted an action-research study in an Ecuadorian university, focusing on educational technologies' application to music education, which provides valuable insights into how digital tools can improve music teaching outcomes [18]. Heinsen (2024) explored gaze behavior during music teaching and observing, contributing to the understanding of attention allocation in the learning process, which can be optimized using technology [19]. Zendel and Alexander (2020) studied auditory processing advantages in self-taught musicians, providing a comparative view that could inform technology-driven teaching strategies in vocational music education [20]. Moreover, Váradi et al. (2023) investigated music teachers' ICT skills during the COVID-19 pandemic, offering insights into how online education tools can be further utilized in music teaching [21]. Chao-Fernández et al. (2020) emphasized the role of computer-game-based music therapy in secondary education, highlighting how technology can address behavioral issues and promote emotional development, a key aspect in vocational training [22]. Yancey (2020) explored the harmonious relationship between music and nursing education, underscoring the benefits of music-based teaching approaches in vocational settings, which can also be facilitated through technological tools [23]. Finally, Domínguez-Lloria et al. (2023) evaluated mobile device applications for teaching music, focusing on elementary education, but their findings are highly relevant for understanding the applicability of mobile technology in higher vocational colleges as well [24]. These studies collectively underline the growing importance of integrating computer technology into music education, shaping more interactive and adaptable teaching modes in higher vocational institutions.

The research on the application of computer technology in music teaching in China and abroad has been widespread and comprehensive. Previous studies show that computer technology has significant advantages in enriching teaching resources, optimizing teaching methods and improving teaching and learning outcomes. However, most of the current research focuses on the application of computer technology in music teaching, and there are few systematic evaluation and empirical studies on its specific and overall outcomes. Future research needs to further explore the outcomes of computer technology in different teaching environments to provide more theoretical support and practical guidance for the innovation of music teaching practices.

The purpose of this study is to explore the music teaching model based on computer technology in higher vocational

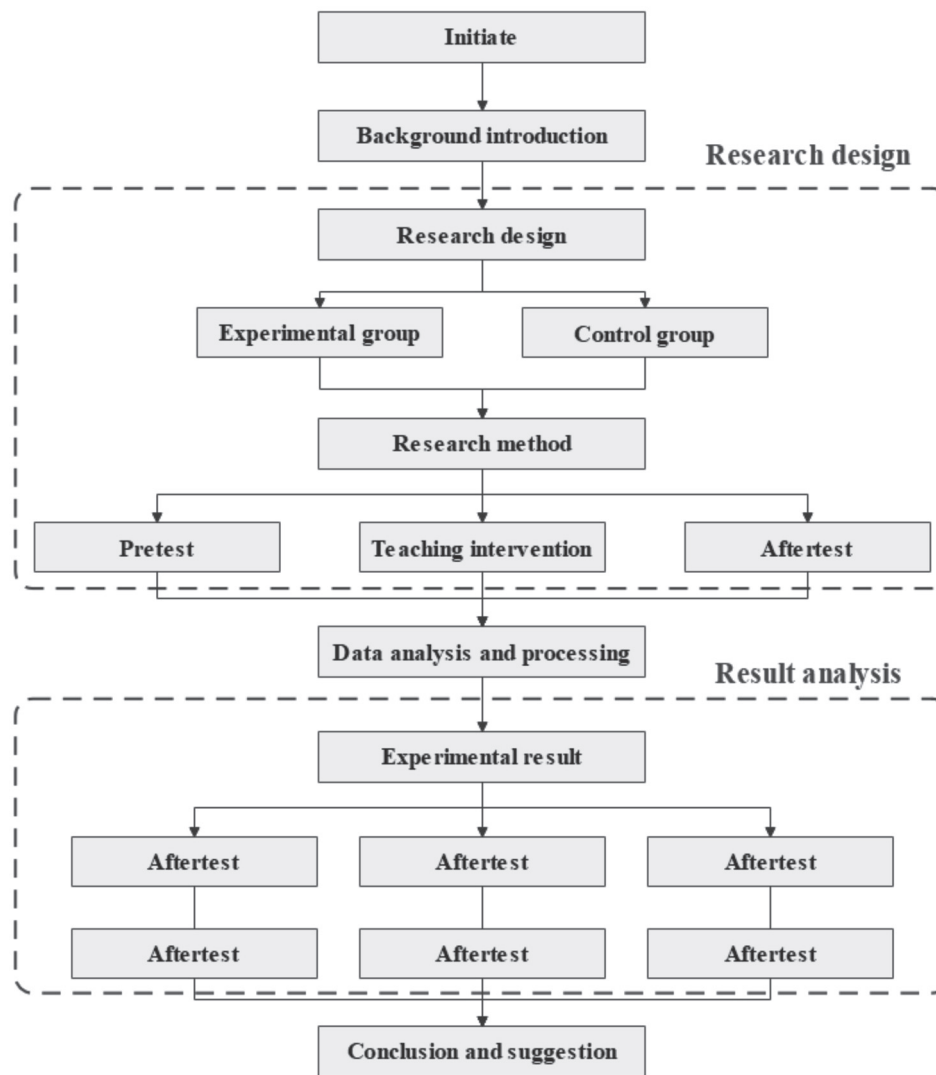


Figure 1 Research framework.

colleges, and determine the role of computer technology in improving the quality and outcomes of music teaching by comparing the learning outcomes of computer-assisted teaching with those obtained by traditional teaching. In this current study, we design an experiment to determine and analyze the extent to which the application of computer technology influences students' mastery of music knowledge, music performance skill, music creation ability, learning interest and participation, independent learning ability and comprehensive quality improvement. The research will provide empirical data on the music teaching model based on computer technology, and offer theoretical support and practical guidance for educators [25, 26].

The research framework is shown in Figure 1.

2. RESEARCH DESIGN AND METHOD

2.1 Research Objects and Groups

Two classes, A and B, of students undertaking a music major in DF Vocational College were selected as the research subjects.

Class A comprised 22 boys, and 24 boys were in class B, totaling 46. Class A was the experimental group and students were taught music with the aid of computers. Class B was the control group, and the traditional music teaching mode was adopted for teaching. Through the comparative analysis of the learning outcomes of students in these two groups, the effect of using computer technology to teach music in a higher vocational college is determined.

2.2 Research Tools and Materials

2.2.1 Teaching Software and Computer Equipment

The teaching software and computer equipment used in the study are shown in Table 1.

The teaching software includes Musition, Auralia, Finale, SmartMusic and GarageBand for the teaching of music theory, listening training, music creation and arrangement, interactive practice and evaluation, and multi-track recording and editing, respectively. Computer hardware includes Apple iMac, MIDI keyboard, hi-fi headphones and external microphones to support all aspects of computer-aided music instruction. The

Table 1 Educational software and computer equipment.

Category	Specific Items
Educational Software	Musition (music theory teaching software) Auralia (ear training software) Finale (music composition and arrangement software) SmartMusic (interactive practice and assessment software) GarageBand (multitrack recording and editing software)
Computer Equipment	Apple iMac (27-inch display with high-performance processor) MIDI Keyboard (used for music input and control) High-fidelity headphones (used for accurate audio playback and monitoring) External microphone (used for recording and real-time feedback)

Table 2 Resources for traditional music teaching.

Category	Specific Items
Textbooks	“Fundamentals of Music Theory” (Edited by Li Siguang) “Sight-Singing and Ear Training Course” (Edited by Zhang Xiaoming)
Instruments	Piano (used for classroom teaching and student practice) Violin (used for classroom teaching and student practice) Flute (used for classroom teaching and student practice)
Musical Works	“Complete Piano Sonatas by Beethoven” “Well-Tempered Clavier by Bach” “Selections of Chinese Folk Songs”
Teaching Methods	Traditional Lecture Method (teacher explains music theory and knowledge) Sight-Singing and Ear Training (training students’ listening and sight-singing abilities) Ensemble and Solo Practice (develop students’ performance skills)
Evaluation Methods	Classroom Tests (regular tests on music theory and skills) Performance Assessment (assessing students’ practical musical performances) Homework Feedback (teachers evaluate and provide feedback on student assignments)

combination of software and hardware provides efficient and rich music teaching resources and an innovative means of improving the learning outcomes of students.

2.2.2 Traditional Music Teaching Resources

The traditional music teaching resources used in the study are shown in Table 2.

Traditional music teaching resources include Basic Music Theory and solfeggio Training Course, which are used for students to learn music theory and listening training. Instruments such as piano, violin and flute for classroom teaching and student practice. Music works such as Beethoven’s Complete Piano Sonatas, Bach’s Equal-Rhythm Piano Pieces and Chinese Folk Songs are used to enrich students’ learning of music. The classroom teaching method is the traditional teaching mode and involves solfeggio training, ensemble and solo practice, aiming at cultivating students’ music knowledge, listening ability, playing skills and cooperation ability. The students’ learning outcomes are assessed by means of classroom tests, performance, and homework tasks.

2.2.3 Evaluation Index of Music Teaching Effect

The evaluation indicators used to determine teaching and learning outcomes are shown in Table 3.

The music knowledge index was assessed by the Music Theory Knowledge Test score (MTK). Musical skill per-

formance indicators include performance skill assessment (PE) and singing performance assessment (SE). Musical ability is assessed by the Quality of Writing and Arranging Work (CCA). The indicators of learning interest and engagement are classroom engagement (CI) and Student Learning Interest Questionnaire (SIQ). Self-directed learning ability was measured by self-directed practice frequency (SLF) and self-directed Learning Outcome assessment (SLE). Overall quality improvement is assessed by the Overall Music Quality Test Score (CST). Teacher evaluations and feedback are collected and analyzed through teacher assessment of student performance (TFE).

2.3 Research Methods

2.3.1 Pre-Test

Before the experiment, the two groups of students (Class A and Class B) were pre-tested on music fundamentals such as knowledge of music theory and basic playing skills. The performance of the two groups of students on the basic music test was relatively similar; there was no significant difference between the two groups initially. Therefore, the experiment could proceed without pre-test results influencing the credibility and validity of the results obtained from the experiment. By means of further teaching intervention and a follow-up test, we objectively determined whether

Table 3 Evaluation indicators.

Indicator Category	Abbreviation	Indicator
Music Knowledge Mastery	MTK	Music Theory Knowledge Test Score
Music Skill Performance	PE	Performance Skill Assessment
	SE	Singing Performance Evaluation
Music Composition Ability	CCA	Quality of Composition and Arrangement
Learning Interest and Engagement	CI	Classroom Participation
	SIQ	Student Interest Questionnaire
Self-Directed Learning Ability	SLF	Frequency of Self-Practice
	SLE	Evaluation of Self-Directed Learning Outcomes
Comprehensive Quality Improvement	CST	Comprehensive Music Quality Test Score
Teacher Evaluation and Feedback	TFE	Teacher Evaluation of Student Performance

the difference between computer-aided music teaching and traditional teaching mode played a role in improving students' music learning outcomes.

2.3.2 Teaching Intervention

In the teaching intervention stage, Class A (the experimental group) were taught by means of computer-aided instruction. This included the learning of music theory using Musition, listening training with Auralia, music creation and arrangement with Finale, interactive practice and evaluation with SmartMusic, and multi-track recording and editing with GarageBand. During the lessons, teachers used this software to provide students with rich learning resources and interactive exercises, and enhance their learning experience and participation.

On the other hand, the traditional music teaching mode was used for Class B (the control group). This mode involved teachers teaching music theory knowledge, using the textbooks "Basic Music Theory" and "Solfeggio Training Course"; Training on instruments such as piano, violin and flute. The class teaching and performance practice was carried out with music works such as Beethoven's Complete Piano Sonatas, Bach's Equal-Rhythm Piano Compositions and Chinese Folk Songs. Classroom teaching methods included traditional instruction mode, solfeggio training and ensemble and solo exercises [27, 28].

The experiment involving the two groups of students and the two teaching modes was conducted over a three-month period. After the end of the teaching intervention, students were given a post-experiment test to determine the learning outcomes resulting from the two teaching modes. Data were collected and analyzed to examine the differences between computer-aided music teaching and traditional teaching in improving students' music knowledge, skills, creative ability, learning interest and participation, independent learning ability and overall quality of learning.

2.3.3 Post-Test

After the teaching intervention, the students of Class A and Class B were tested to determine the influence of different teaching modes on the students' learning outcomes. The post-experiment test consisted of a test on music theory knowledge, basic performance skill assessment, music

creation ability test, learning interest and participation survey, independent learning ability assessment and overall music proficiency evaluation test. For the test on music theory knowledge, the same pre-test paper was used. To assess students' basic performance skills, the teacher observed and rated each individual performance according to its accuracy, expressiveness, and skill level. The Music Creation Ability test was based on the composition and arrangement works submitted by students, which were assessed by professional judges. The students' survey questionnaire collected data on their level of engagement and interest in their studies. The assessment of self-directed learning ability was measured by the frequency and outcomes of students' independent practice outside of class. The comprehensive music quality test is an overall assessment of students' music quality by combining music theory knowledge, playing skills, creative ability, and other indicators. The results of the post-test were analyzed and compared to determine whether the two different learning and teaching modes had a significant impact on students' learning outcomes.

2.4 Data Collection and Processing

2.4.1 Data Collection

The collected data comprised pre-test data and post-test data. In the pre-test stage, the students of class A and Class B were tested on their music fundamentals, and the scores for their music theory knowledge and basic playing skills were collected. In the post-test stage, the two groups of students were evaluated comprehensively after the teaching intervention.

The specific steps are as follows:

- (1) A music theory knowledge test was conducted to collect students' mastery of theoretical knowledge;
- (2) Data on students' performance in terms of basic playing skills was collected by means teacher observation and assessment;
- (3) Students were given a music creation ability test; students' creation and arrangement works were collected and assessed by professionals;

- (4) Data on students' learning interest and participation were collected by means of a questionnaire survey in order to understand students' subjective feelings and changes in attitude to their learning experience;
- (5) The frequency and results of students' independent practice after class were recorded in order to assess their independent learning ability;
- (6) A comprehensive music quality test was conducted to collect comprehensive evaluation data including music theoretical knowledge, playing skills, creative ability and other aspects.

2.4.2 Data Processing

The statistical analysis method was adopted for a comparative analysis of the two groups of data. The specific steps are as follows:

- (1) Descriptive statistical analysis: Descriptive statistical analysis was carried out on the pre-test and post-test data, and Mean (Mean) and Standard Deviation (SD) were calculated to understand the basic characteristics of the data. Formula (1) and formula (2) are [29, 30]:

$$\text{Mean value } (\bar{X}) = \frac{1}{N} \sum_{i=1}^N X_i \quad (1)$$

$$\text{Standard deviation } (SD) = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (X_i - \bar{X})^2} \quad (2)$$

- (2) Paired sample t test: The paired sample t test was conducted on the pre-test and post-test data to test whether the changes in music knowledge and skill level of the two groups of students before and after the intervention were statistically significant. Formula (3) is:

$$t = \frac{\bar{D}}{S_D / \sqrt{n}} \quad (3)$$

where, \bar{D} is the average value of the pairing difference, S_D is the standard deviation of the pairing difference, and n is the number of samples.

- (3) Independent sample t test: An independent sample t test was conducted on the post-test data of the experimental group and the control group to compare the differences between the two groups in music knowledge, skills, creative ability and other aspects. Formula (4) is:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad (4)$$

Where, \bar{X}_1, \bar{X}_2 is the average value of the two groups, s_1^2, s_2^2 is the variance of the two groups, and n_1, n_2 is the sample number of the two groups.

- (4) Correlation analysis: Conduct correlation analysis on students' learning interest, participation, independent learning ability and comprehensive quality improvement, and explore the relationship between various indicators. Formula (5) is:

$$r = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum (X_i - \bar{X})^2 \sum (Y_i - \bar{Y})^2}} \quad (5)$$

Where, X and Y are two variables respectively, and \bar{X}, \bar{Y} are the average values of the variables respectively.

- (5) Regression analysis: The regression analysis is carried out on the improvement of comprehensive quality, and the main factors affecting the improvement of students' comprehensive quality are assessed. Formula (6) is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \epsilon \quad (6)$$

where, Y is the dependent variable, X_1, X_2, \dots, X_n is the independent variable, β_0 is the constant term, $\beta_1, \beta_2, \dots, \beta_n$ is the regression coefficient, and ϵ is the error term.

3. EXPERIMENTAL RESULTS AND ANALYSIS

3.1 Students' Mastery of Music Knowledge

The results for both groups' mastery of music knowledge are shown in Table 4.

There were significant differences between class A and Class B according to the indicators of musical knowledge. The average score of each index of class A on the post-test was significantly higher than that on the pre-test. The score for music theory knowledge increased from 78.5 to 90.4, the score of music history knowledge increased from 75.3 to 87.2, and the score of music theory and harmony knowledge increased from 80.0 to 92.1. Work analysis improved from 76.8 points to 88.5 points. On the other hand, the improvement of Class B was relatively small, with music theory knowledge improving from 77.8 points to 85.2 points, music history knowledge from 74.5 points to 82.6 points, music theory and harmony knowledge from 79.7 points to 86.5 points, and composition analysis ability from 76.2 points to 83.8 points.

3.2 Comparison of Music Skill Performance

The comparison of the musical skill performance of the two groups is shown in Table 5.

The average score for the various indicators in the post-test of class A was significantly higher than that for the pre-test, and the performance skills increased from 80.3 points to 91.2 points, singing skills increased from 78.9 points to 89.7 points, solfeggio training points increased from 82.0 points to 92.4 points, improvisation points increased from 79.5 points to 88.3 points. In contrast, the improvement of Class B was relatively

Table 4 Music knowledge of the two groups of students.

Group	Test Item	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Improvement
A	Music Theory	78.5	5.2	90.4	4.8	11.9
	Music History	75.3	5.6	87.2	5.0	11.9
	Harmony	80.0	5.1	92.1	4.6	12.1
	Work Analysis Ability	76.8	5.4	88.5	5.1	11.7
B	Music Theory	77.8	5.4	85.2	5.3	7.4
	Music History	74.5	5.7	82.6	5.5	8.1
	Harmony	79.7	5.3	86.5	5.2	6.8
	Work Analysis Ability	76.2	5.5	83.8	5.4	7.6

Table 5 Comparison of music skill performance of two groups.

Group	Test Item	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Improvement
A	Performance Skills	80.3	6.1	91.2	5.5	10.9
	Vocal Skills	78.9	6.3	89.7	5.9	10.8
	Sight Singing	82.0	5.8	92.4	5.3	10.4
	Improvisation	79.5	6.0	88.3	5.7	8.8
B	Performance Skills	79.7	6.4	85.6	6.2	5.9
	Vocal Skills	77.5	6.5	83.7	6.3	6.2
	Sight Singing	81.2	5.9	86.9	6.0	5.7
	Improvisation	78.8	6.2	85.4	6.1	6.6

Table 6 Comparison of learning interest and participation of two groups.

Group	Test Item	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Improvement
A	Interest	75.2	6.0	88.7	5.7	13.5
	Classroom Participation	78.1	5.8	90.4	5.5	12.3
	Self-Study Frequency	72.5	6.4	85.9	6.0	13.4
	Homework Completion	77.3	5.7	87.6	5.6	10.3
B	Interest	74.8	6.2	82.5	5.9	7.7
	Classroom Participation	77.6	6.1	84.8	6.0	7.2
	Self-Study Frequency	71.9	6.5	80.4	6.3	8.5
	Homework Completion	76.8	5.9	84.3	5.8	7.5

small, with playing skills improving from 79.7 points to 85.6 points, singing skills from 77.5 points to 83.7 points, solfeggio training from 81.2 points to 86.9 points, and improvisation from 78.8 points to 85.4 points.

3.3 Comparison of Students' Learning Interest and Participation

The comparison of learning interest and participation of the two groups of students is shown in Table 6.

The average score for various indicators in the post-test of class A was significantly higher than that of the pre-test, the learning interest increased from 75.2 points to 88.7 points, the class participation increased from 78.1 points to 90.4 points, the frequency of independent learning increased from 72.5 points to 85.9 points, and the completion of homework increased from 77.3 to 87.6 points. In contrast, the improvement of class B was relatively small, with learning interest rising from 74.8 to 82.5 points, class participation from 77.6 to 84.8 points, frequency of independent learning from 71.9 to 80.4 points, and homework completion from 76.8 to 84.3 points.

3.4 Teacher Evaluation and Feedback Analysis

The analysis of teacher evaluation and feedback is shown in Table 7.

The average score for various indicators in the post-test of class A was significantly higher than that for the pre-test, and the class performance increased from 76.8 to 88.9, the learning attitude from 77.5 to 89.1, the cooperation ability from 75.3 to 86.7, and the task completion quality from 78.2 to 89.5. In contrast, the improvement of class B was relatively small, with class performance improving from 75.9 to 82.6, learning attitude from 76.3 to 83.5, cooperation ability from 74.8 to 82.1, and task completion quality from 77.1 to 83.8.

3.5 Comparison of the Improvement of Students' Comprehensive Quality

The comparison of the improvement of students' comprehensive quality is shown in Table 8.

The average score for various indicators in the post-test of class A was significantly higher than that for the pre-test. The ability of music creation increased from 74.6 to 88.5,

Table 7 Analysis of teacher evaluation and feedback.

Group	Test Item	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Improvement
A	Classroom Performance	76.8	6.2	88.9	5.8	12.1
	Learning Attitude	77.5	6.0	89.1	5.7	11.6
	Collaboration Skills	75.3	6.3	86.7	5.9	11.4
	Task Completion Quality	78.2	6.1	89.5	5.6	11.3
B	Classroom Performance	75.9	6.4	82.6	6.2	6.7
	Learning Attitude	76.3	6.2	83.5	6.1	7.2
	Collaboration Skills	74.8	6.5	82.1	6.3	7.3
	Task Completion Quality	77.1	6.3	83.8	6.2	6.7

Table 8 Comparison of students' comprehensive quality improvement.

Group	Test Item	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Improvement
A	Music Composition Ability	74.6	6.2	88.5	5.8	13.9
	Teamwork Ability	76.3	6.1	89.7	5.9	13.4
	Performance Skills	78.4	5.9	90.2	5.6	11.8
	Self-learning Ability	73.9	6.3	86.4	5.7	12.5
	Creative Expression Ability	75.8	6.4	87.6	5.9	11.8
B	Music Composition Ability	73.8	6.4	81.7	6.2	7.9
	Teamwork Ability	75.5	6.3	83.2	6.1	7.7
	Performance Skills	77.6	6.2	84.5	6.0	6.9
	Self-learning Ability	73.2	6.5	80.9	6.3	7.7
	Creative Expression Ability	75.1	6.3	82.6	6.1	7.5

Table 9 Regression analysis.

Variable	Regression Coefficient (β)	t Statistics
Music Composition Ability (X1)	0.35	(3.52)***
Teamwork Ability (X2)	0.28	(2.84)**
Performance Skills (X3)	0.22	(2.15)**
Self-learning Ability (X4)	0.30	(3.01)***
Creative Expression Ability (X5)	0.25	(2.45)**
Intercept	15.24	(2.87)**
R ²	0.68	
Adjusted R ²	0.65	

Note: t statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

the ability of teamwork increased from 76.3 to 89.7, the performance increased from 78.4 to 90.2, and the ability of independent learning increased from 73.9 to 86.4. Creative expression improved from 75.8 to 87.6. In contrast, the improvement of Class B was relatively small, with music creation ability improving from 73.8 points to 81.7 points, teamwork ability from 75.5 points to 83.2 points, performance from 77.6 points to 84.5 points, independent learning ability from 73.2 points to 80.9 points, and creative expression ability from 75.1 points to 82.6 points.

3.6 Regression Analysis

In order to further explore the influence of various factors on students' music learning effect, multiple regression analysis was carried out. The regression model takes students' music learning effect (Y) as the dependent variable, and the independent variables include music creation ability (X1), teamwork ability (X2), performance (X3), independent learning ability (X4) and creative expression ability (X5). The results of regression analysis are shown in Table 9.

Music creation ability, teamwork ability, performance, independent learning ability and creative expression ability have significant positive effects on students' music learning effect. Specifically, the regression coefficient of music creation ability was 0.35, the t statistic was 3.52, and the significance level was $p < 0.01$. The regression coefficient of teamwork ability was 0.28, the t statistic was 2.84, and the significance level was $p < 0.05$. The regression coefficient of performance was 0.22, the t statistic was 2.15, and the significance level was $p < 0.05$. The regression coefficient of autonomous learning ability was 0.30, the t statistic was 3.01, and the significance level was $p < 0.01$. The regression coefficient of creative expression ability was 0.25, the t statistic was 2.45, and the significance level was $p < 0.05$.

The regression model had an R² value of 0.68 and the adjusted R² value of 0.65, indicating that the model explained 68% of the variation in the dependent variable. These results show that computer-aided music teaching can significantly improve students' music learning outcomes, especially in regard to music creation and independent learning.

4. CONCLUSIONS AND SUGGESTIONS

4.1 Research Conclusion

Through the systematic analysis of the students' musical knowledge, musical skill performance, learning interest and participation, teacher evaluation and feedback, and comprehensive quality improvement of class A and Class B, the following conclusions can be drawn:

- (1) **Mastery of music knowledge:** computer-aided music teaching has significantly improved students' mastery of music theory and related knowledge. Class A's average score for music theory increased from 78.5 to 90.4, an increase of 11.9 points, while Class B increased from 77.8 to 85.2 only, an increase of 7.4 points.
- (2) **Performance of music skills:** in terms of performance and display of music skills, the effect of computer-assisted instruction is better than that of traditional teaching. The average score of Class A for playing skills increased from 80.3 to 91.2, an improvement of 10.9 points, while Class B increased from 79.7 to 85.6, an improvement of 5.9 points.
- (3) **Learning interest and participation:** computer-aided instruction significantly improves students' interest in learning and their classroom participation. Class A students' interest in learning increased from 75.2 to 88.7 points, an increase of 13.5 points, while Class B students' interest increased from 74.8 to 82.5 points, an increase of 7.7 points.
- (4) **Teacher evaluation and feedback:** teachers have a higher evaluation of students in computer-assisted instruction classes. Class A's average score for classroom performance increased from 76.8 to 88.9, an improvement of 12.1 points, while Class B improved from 75.9 to 82.6, an improvement of 6.7 points.
- (5) **Improvement of comprehensive quality:** in terms of improvement of comprehensive quality, computer-assisted teaching also shows significant advantages. The average score of Class A in music creation ability increased from 74.6 to 88.5 (13.9 points), while Class B increased from 73.8 to 81.7 (7.9 points).

The results show that the application of computer technology in music teaching in higher vocational colleges can substantially improve students' learning outcomes, especially in regard to music knowledge, practical skills, interest, participation and comprehensive quality. The conclusion of the study provides an empirical basis for optimizing the music teaching mode in higher vocational colleges, and suggests that computer technology should be widely used in music teaching to improve teaching quality and students' overall abilities, including their musical knowledge, performance skills, and creative potential.

4.2 Suggestions on Teaching Practice

Based on the research results, the application of computer technology in music teaching in higher vocational colleges has proven to have several remarkable advantages, providing an important reference for optimizing the teaching mode and improving students' learning outcomes. In order to further improve the quality of music teaching in higher vocational colleges, this study offers the following suggestions for teaching practice:

- (1) **Computer-aided instruction software** should be fully integrated into music teaching. The use of Musition, Auralia, Finale and other software can significantly improve students' knowledge of music theory, listening ability and creative skills. By utilizing this software, teachers can provide students with more abundant and diversified learning resources, and enhance students' interest in and interaction with the course content. For example, Musition helps students master music theory through entertaining and interactive exercises, while Auralia improves hearing recognition through a variety of listening exercises. In addition, creative software such as Finale and GarageBand can stimulate students' interest in music creation and improve their arrangement and creative skills. It is suggested that computer-aided teaching software should be popularized and applied in music education in higher vocational colleges to improve the teaching and learning outcomes.
- (2) **Teachers** should be trained to use computer technology efficiently and effectively, enabling them to apply innovative computer-aided teaching methods. Teachers' proficiency and judicious application of computer technology is the key to the success of computer-aided instruction. Therefore, higher vocational colleges and universities should offer regular and relevant training courses to teachers to improve their ability to use computer technology in teaching. For example, we can help teachers master the use of various music teaching software through special lectures, workshops and practical operations, and explore how to integrate these technologies into classroom teaching effectively in combination with actual teaching cases. In addition, teachers should be encouraged to actively explore innovative and other modes of teaching, try different computer-assisted teaching methods, accumulate experience and share successful teaching cases, so as to continuously improve the outcomes of computer-assisted teaching.
- (3) **A sound evaluation system** should be established to evaluate scientifically the outcomes of computer-aided instruction. Computer-aided instruction can significantly improve students' music knowledge, skills, learning interest and participation; however, a scientific evaluation system is needed to ascertain the impact of different teaching modes and practices. Therefore, higher vocational colleges and universities should establish a comprehensive teaching evaluation system comprising pre-test and post-test, teacher evaluation,

student feedback and other evaluation methods, to determine the actual effect of computer-aided instruction. For example, students' learning results under different teaching modes can be quantified by means of music theory knowledge test, performance skill assessment and music creation ability test. Through questionnaire surveys and interviews, the opinions and suggestions of students and teachers in regard to computer-assisted instruction can be collected to understand its advantages and disadvantages in practical application. Through these evaluation methods, we can optimize and improve the computer-aided teaching mode and improve the quality of teaching.

4.3 Limitations of the Study

This study has explored the music teaching mode based on computer technology and drawn valuable conclusions. However, like most studies, it has several limitations. First of all, the sample size is limited to two classes of students undertaking music majors in DF vocational college, and the geographical and professional limitations affect the generalizability of the results. Future studies should expand the sample to include more schools and majors to verify the broad applicability of the findings.

Second, the study conducted only a three-month teaching intervention, which was too short a period to enable a comprehensive assessment of the impact of computer-assisted instruction on students' long-term learning outcomes and music literacy. Future research should extend the experimental period and conduct long-term follow-up investigations to observe the continuous impact of computer-assisted instruction in different learning stages and different musical fields. In addition, future research should be combined with qualitative research methods, through in-depth interviews and classroom observation, to obtain an in-depth understanding of the actual experiences and views of students and teachers regarding computer-assisted instruction, and further enrich the connotation of research results.

Third, the research takes a quantitative data analysis approach. Although it provides objective data support, it is still insufficient as it does not facilitate specific teaching strategies and methods in the teaching process. Future research should pay more attention to the specific teaching practice and explore the specific applications and effects of computer-assisted instruction in different teaching situations. For example, we can study the effect of different types of music teaching software in different teaching links or explore the best combination of computer-assisted teaching and traditional teaching methods.

Finally, the evaluation indicators used in the research pertain mainly to students' knowledge mastery and skill performance and do not take into account other factors that affect students' music learning outcomes. Future research should consider other influencing factors such as students' mental state, learning motivation, teachers' teaching style and classroom management, etc., to build a more comprehensive evaluation system, to evaluate the effect of computer-assisted instruction more comprehensively.

Future studies should expand the sample range, extend the research period, combine quantitative and qualitative research methods, explore specific teaching strategies and methods in depth, and construct a more comprehensive evaluation system to further verify and improve the music teaching model based on computer technology in higher vocational colleges. Through continuous optimization and improvement, the extensive application of computer technology in music teaching is promoted as a means of improving the overall level of music education in higher vocational colleges.

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