A Music Teaching Model Combining Deep Learning in the Perspective of Ecological Aesthetic Education: The Integration of Traditional Music Culture

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Abstract

In the contemporary educational environment, the protection and inheritance of traditional music culture faces challenges. The current diverse needs of music education urgently require innovative teaching models to integrate traditional music culture and enhance students' aesthetic and cultural literacy. The eco-beauty perspective provides a new educational idea that emphasizes the harmonious coexistence with nature and promotes all-around development of students. Combining traditional music culture and modern education technology effectively can be achieved by combining deep learning technology and new paths in music education. This study explores the music teaching model that integrates traditional music culture with deep learning technology, under the perspective of ecological aesthetic education. The study utilizes a mixed methodology, combines quantitative and qualitative Analysis, and compares the experimental design to verify the effectiveness of the teaching model. In this paper, implementing the music teaching model under the perspective of ecological aesthetic education has improved students’ performance in music perception ability, music emotion expression, music composition and performance, and music knowledge theory. The average increase in music perception ability of the experimental class students is 5.18 points, and the average increase in music composition and performance ability is 11.57 points, showing the impact of this teaching mode on the overall improvement of students’ music ability. In this paper, the music teaching mode combining deep learning under the perspective of ecological aesthetic education can effectively integrate traditional music culture, promote the improvement of students’ music literacy, and provide a new teaching strategy for the inheritance and development of traditional music culture.

Keywords: Eco-beauty; Deep Learning; Music Teaching Model; Traditional Music Culture.

AMS 2010 codes: 00A66
1 Introduction

The music teaching model, in terms of its nature, is a music teaching theory based on a certain combination of practice, a framework of relatively stable, specific, and operable procedures of teaching activities constructed to accomplish specific teaching tasks, and the application of teaching models in music teaching [1-2]. In terms of the content and principles of the model itself, it is operational, targeted, holistic, and open [3]. The transformation of the traditional music teaching mode can help us, as a whole, to explore and comprehensive cognition in the new era under the background of the new music teaching process of the integrated relationship between various factors and their colorful forms of artistic expression, in order to improve the music teacher’s foresight of the results of the teaching and the traditional music teaching design of the scientific, sustainable transformation of the traditional music teaching mode [4-6]. The success or failure of the change of the music education model lies in the construction of an excellent music teacher team [7]. Without a high-quality new music teacher team, it is difficult to fully implement any good teaching ideas, educational reform programs, and educational models, so the cultivation of good teaching faculty is of great significance for the development of new music education [8-9]. As we all know, Germany’s music education, both in teaching and practice in the world, has a strong strength, which is inseparable from its consistently high standards and strict requirements for teacher training [10-11]. In the exploration of traditional music teaching mode and teacher training, we should not only explore the new music teaching mode suitable for China’s national conditions but also actively learn from foreign advanced teaching experience, which has a far-reaching impact on the transformation of the traditional music teaching mode and the construction of music education suitable for the development of new music in China.

We have designed a new music teaching mode by integrating ecological, aesthetic education, and deep learning technology to promote the inheritance and development of traditional music culture. The study optimizes the music teaching objectives based on the theory of ecological aesthetic education, designs the teaching content and evaluation system using deep learning technology, and tests the effectiveness of the teaching model through empirical research. The research process focuses on integrating theory and practice and exploring a new path for integrating traditional music education with modern technology.

2 Path to realize the music teaching mode under the perspective of ecological aesthetic education

2.1 Optimization of music teaching objectives in the view of ecological, aesthetic education

Ecological aesthetic education is a product of the fusion of contemporary demands for the development of aesthetic education in China, with the international perspective of environmental education and Chinese ecological aesthetics research. It is also an ecological paradigm for the study of aesthetic education in China. The development of ecological aesthetic education includes ecological art education, ecological aesthetics of aesthetic education, and ecological existential aesthetic education. Ecological and aesthetic education is both a concept and an approach to education. The original intention of aesthetic education is to educate students to develop positive aesthetic concepts, which can be keenly discovered and gained in life through the experience of beauty, internalized in the heart, and created beauty with the practice of action.

The optimization of ecological, aesthetic education music teaching objectives is shown in Figure 1; the upper objective is the basis for setting the lower teaching objectives, and the lower objective is the basis for reaching the upper objective. Music teaching design must be centered around the
curriculum standards. This paper optimizes the music teaching objectives based on ecological, aesthetic education through the concept and method of ecological, aesthetic education, according to the needs of the actual teaching situation, according to the music curriculum teaching and teaching design, optimize the music teaching objectives in terms of emotion, concept, and attitude. There is a certain degree of independence and a progressive relationship between the three, and together, they construct an optimization plan for the overall objectives of music teaching.

Figure 1. The goal optimization of ecological aesthetic education music

2.2 Music teaching system based on the perspective of ecological aesthetic education

The music teaching system is based on ecological and aesthetic education, as shown in Figure 2. An organic whole with specific functions is known as a system, and it consists of a number of elements that interact and are interconnected. For music teaching, it is a complex system that contains several elements such as teachers, students, music teaching content, music teaching means, and so on. These factors interact with each other, influence each other, and play a specific role in achieving the goal of teaching. Music teaching activities have two main subjects, namely, teachers and students, both of which are linked together through the means of communication; teachers are mainly responsible for teaching and counseling, while students are responsible for asking questions and giving feedback. The object of teaching is the teaching content. Music teaching content is set around the teaching objectives. The teaching objectives are the core elements of the object, generally the students’ cognitive level, quality, ability, and other final dimensions.

Figure 2. The music teaching system elements schematic
2.3 Music teaching mode based on the integration of traditional culture

The composition of the music teaching model based on the integration of traditional culture is shown in Figure 3. The music teaching model based on the integration of traditional culture is a set of structured and systematic frameworks and strategy systems built according to the teaching theory under the guidance of the ecological and aesthetic education teaching concept. The composition is comprised of the ecological, aesthetic teaching concept, optimized music teaching objectives, music teaching theory, activity framework, implementation conditions, operation procedures, and effect evaluation. Among them, the ecological and aesthetic teaching concept is a guiding tendency with purpose, which grasps the direction and uniqueness of the teaching mode and is the essence and soul of the music teaching mode in this paper. The teaching goal is to cultivate talent with the middle tendency, which is the core element of the teaching method. The music teaching objectives are optimized based on the requirements of ecological and aesthetic education and the real situation. It is the key to building the teaching mode, the optimization of teaching objectives based on the concept of eco-beauty education determines the different teaching modes, based on which the traditional culture is integrated, and determines that the curriculum, the arrangement of teaching content, the design of teaching strategies and other teaching processes in the music teaching activities will be centered on the concept of eco-beauty education. The teaching objectives are the benchmark for teaching evaluation, and they must be centered on them. The activity framework is the main content of the teaching mode, which integrates traditional culture into the teaching content to achieve an effective combination of traditional culture and music teaching. The essence of the teaching activity framework is that, according to the setting of teaching objectives, under the guidance of certain teaching theories, the teaching implementation process is reasonably planned and arranged for each teaching element so as to realize the optimization of the teaching process. The implementation conditions refer to the implementation of the teaching mode and can play a role in a variety of conditions to protect, mainly for the implementation of music teaching, as well as a variety of teaching hardware and software support. Specific instructions for the implementation of the teaching mode can be found in the operation program, which is the scientific program arrangement for the operation of the teaching mode. Teaching activities are an interactive and complex process that requires a lot of skills. A good set of operating procedures is essential. Teaching evaluation is in accordance with the specific teaching objectives, the teaching process, and teaching results of a judgment, is to test whether the teacher completes the teaching task, whether the students complete the teaching process, to achieve the expected teaching effect of a method, while teaching evaluation is also an effective means to test the success of the teaching mode.
3 Music teaching model based on deep learning

3.1 A deep learning-based model of music instructional design

The model of teaching practice based on deep learning is shown in Figure 4 in order to cultivate students’ core literacy in the music discipline during the learning process. After clarifying the design principles of deep learning, an instructional design model for promoting deep learning in music appreciation classes in high school is constructed. The development of students’ core literacy can be highlighted through the structurization and contextualization of music concepts. The unit’s form is a significant expression of knowledge structuring, and the learning form of the unit can improve students’ deep learning. Unit-based music teaching consists of four important steps: selecting the theme of the unit, determining the objectives of the unit, designing the unit learning activities, continuous teaching and learning evaluation, and finally, forming a unit practice model based on in-depth learning.
3.2 Evaluation model of music teaching based on deep learning

3.2.1 AVI structure based on deep learning and signal processing

The music teaching evaluation model is not only the traditional sense of data evaluation. Its teaching composition is relatively complex. This paper builds the evaluation model input data for music teaching video, which contains visual information and music audio information, so we need to integrate these two parts of the information before inputting the evaluation model to build an evaluation model with the ability of temporal feature extraction, so as to make the model evaluation results more accurate. The framework of the music teaching evaluation model with audio-visual information fusion is shown in Figure 5, which is based on visual feature extraction, auditory features, and audio-visual fusion so that the evaluation model can pay attention to both visual and audio information, followed by the construction of a model with temporal perception ability, which makes the model more accurate and stable in evaluating the music teaching effect.

3.2.2 VMD-based auditory feature extraction

In the evaluation model of audiovisual integration, the combination of sound and visual features is crucial for expressive evaluation. Sound feature processing is a form of signal processing that involves a sequence of temporally expressed digital vectors that can be directly employed as feature input. Speech is often confronted with various noise disturbances in practical situations. Using only
one sound signal feature as a direct input to the model may not result in desirable outcomes. Sound features must be processed for this reason to create more feature information.

Variational mode decomposition methods, Fourier transform, wavelet transform, EMD, and others are all included in signal processing work. Are frequently employed. For the latter, there are more or less disadvantages, such as insufficient non-smooth signal processing capability, the need for human selection, and the existence of mode aliasing.

VMD uses a recursive loop to disassemble the signal to achieve adaptive segmentation of each component in the frequency domain of the signal. This approach largely solves the problem of EMD generating modal aliasing in the near-frequency part. The core idea of VMD is to realize signal decomposition by creating and iteratively solving the optimal solution of the variational problem. In the implementation of VMD, the input signal \( x(t) \) is processed to output multiple components with different center frequencies and finite bandwidth. This process is viewed as one of creation. Subsequently, by solving the optimal solution with minimal bandwidth and constraints, multiple signal components with different center frequencies are finally obtained as outputs. Its expression is shown in (1):

\[
\min_{\{u_i\},\{\omega_i\}} = \left\{ \sum_{i=1}^{K} \left| \partial_i^t \left[ \left( \delta(t) + \frac{j}{\pi t} \right) \times u_i(t) \right] e^{-j\omega_i t} \right|_2^2 \right\} \\
\text{s.t.} \quad x(t) = \sum_{i=1}^{K} u_i(t)
\]

In Eq. (1), \( x(t) \) denotes the signal input at time \( t \), \( \partial_i^t \) denotes the gradient operator function, \( K \) denotes the number of modal components for the setup, \( \{u_i\} \) denotes the \( i \)th modal component out of \( K \) modal components, \( \delta(t) \) denotes the real part of \( u_i(t) \), and \( \{\omega_i\} \) denotes the center frequency. After solving Eq. (1), \( K \) modal components are output.

In order to solve Eq. (1), two parameters, the quadratic penalty term \( a \) as well as the Lagrange multiplier operator \( \lambda \) are introduced to obtain the augmented Lagrange function, and the expression of the function is shown in Eq. (2):

\[
L\left(\{u_i\},\{\omega_i\},\lambda\right) = a \sum_{i=1}^{K} \left| \partial_i^t \left[ \left( \delta(t) + \frac{j}{\pi t} \right) \times u_i(t) \right] e^{-j\omega_i t} \right|_2^2 \\
+ \left| x(t) - \sum_{i=1}^{K} u_i(t) \right|_2^2 + \left\langle \lambda(t), x(t) - \sum_{i=1}^{K} u_i(t) \right\rangle
\]

The iterative expressions for modal component \( \hat{u}_i^{n+1}(\omega) \) and center frequency \( \omega_i^{n+1} \) in the frequency domain are shown in (3), (4):

\[
\hat{u}_i^{n+1}(\omega) = \frac{\hat{\lambda}(\omega) - \sum_{j \neq i} \hat{u}_j(\omega) + \frac{\hat{\lambda}(\omega)}{2}}{1 + 2a(\omega - \omega_i)^2}
\]
\[
\omega_{i+1}^{n} = \frac{\int_{0}^{\infty} \omega |\hat{u}_i(\omega)|^2 d\omega}{\int_{0}^{\infty} |\hat{u}_i(\omega)|^2 d\omega}
\]  

(4)

Where \( \hat{u}_i \) and \( \hat{\dot{x}} \) denote the Fourier transform of \( u_i \) and \( \ddot{x} \), respectively.

The convergence threshold \( \varepsilon \) is set in advance, and the values \( \{u_i\}, \{\omega_i\}, \) and \( \lambda \) in the new generalized Lagrangian expression are added through continuous iteration until the condition is established and the optimal solution is obtained, the expression is shown in Equation (5):

\[
\sum_{i=1}^{K} \frac{\|u_{i+1}^n - u_i^n\|^2}{\|u_i^n\|^2} < \varepsilon
\]  

(5)

3.2.3 Evaluation model based on TCN-GRU

TCN is a simple and generalized convolutional neural network architecture for solving time series problems. TCN model consists of a set of residual units, each of which is a small neural network with residual connections, which can accelerate the feedback and convergence of the deeper network and solve the "degradation phenomenon" caused by the increase of the network level.

The residual unit of TCN is shown in Fig. 6. The residual connection is to add the input \( x \) of the residual unit to the output \( f(x) \). The residual unit contains 2 convolution units and nonlinear mapping. In the convolution unit, one-dimensional dilation causal convolution is performed first, and the sampling interval is adjusted by the dilation coefficient to achieve a larger sensory field \( RF \), i.e., the range of the region that can be seen by the features on the convolutional layer, so that the network can memorize the long enough historical information, and only the inputs before the moment of \( t \) are convolved in order to get the outputs of the moment of \( t \), which ensures that no future information is leaked, and then the weights are normalized and the weights are used as the activation function. The ReLU function acts as the activation function. To prevent overfitting and accelerate the training speed of the model, the Dropout operation is used to randomly discard neurons based on a certain probability. Nonlinear mapping is the reduction of dimensionality of high-dimensional data when the inputs and outputs of the residual units have different dimensions.

\[\text{Figure 6. TCN residual unit}\]
The arithmetic formula for the one-dimensional dilation causal convolution is:

$$F(s) = \sum_{i=0}^{k-d_i} f(i)x_{s-d_i}$$  \hspace{1cm} (6)

In equation (6), \(x\) is the input, \(f\) is the filter, \(d_i\) is the dilation factor, \(k\) is the convolution kernel size, and \(s-d_i\) ensures that only past inputs can be subjected to convolution operations.

For the recurrent neural network RNN, which is capable of processing time series data, the network structure can achieve human-like memory functions. However, RNNs can only “memorize” short-term information in-memory processing, so a variant of the RNN structure, the LSTM structure, has emerged, which introduces the concept of “gates” to “remember” more valid information. Memorize more effective information.

The computational process is defined by equations (7) to (12):

$$f_i = \sigma\left([h_{t-1}, x_t] \times W_f + b_f\right)$$  \hspace{1cm} (7)

$$i_t = \sigma\left([h_{t-1}, x_t] 2 \times W_i + b_i\right)$$  \hspace{1cm} (8)

$$\hat{C}_t = \tanh\left([h_{t-1}, x_t] \times W_i + b_i\right)$$  \hspace{1cm} (9)

$$C_t = f_i \times C_{t-1} + i_t \times \hat{C}_t$$  \hspace{1cm} (10)

$$o_t = \sigma\left([h_{t-1}, x_t] \times W_o + b_o\right)$$  \hspace{1cm} (11)

$$h_t = o_t \times \tanh(C_t)$$  \hspace{1cm} (12)

In the structure diagram, \(f_i\) is the forgetting gate, \(i_t\) is the input gate, \(o_t\) is the output gate, \(h_t\) is the output gate, and \(C_t\) is the intermediate state value in the transfer process. In Eq. \(\sigma\) is the sigmoid nonlinear activation function that maps the output to a distribution of 0 to 1 for easy convergence. \(W\) represents the weights between the connected neurons, \(b\) represents the bias of the neurons, and \(C_t\) is the need for more recent information. Compared with RNN, LSTM structure realizes long-term memory, which can consider more previous information more in sequence data. When dealing with a large amount of data, reducing the gates and outputs of the LSTM structure can make the number of parameters and the amount of computation greatly reduced, therefore, GRU is a simplified version of LSTM, and in terms of performance, so far, there is no conclusion on the superiority of LSTM and GRU, but GRU has the advantage of this low parameter, and in the practical application and production, it can greatly reduce the power consumption and the cost of time, therefore, this paper Therefore, we choose to use the GRU structure in this paper.

The structure of the GRU unit is shown in Fig. 7, which integrates the input and forgetting gates of the LSTM into a more recent gate without an output gate but adds a reset gate. The more recent gate controls the degree of retention of the previous moment state information. The larger value of the more recent gate indicates that the previous moment state information has more influence on the
current state. The reset gate controls the degree to which the current state is combined with previous information. The smaller the value, the more information is ignored.

![Figure 7. Grunit structure](image)

The formula for $h(t)$ in the cell is shown in equations (8) to (16):

$$z_t = \sigma(w^{T}_{(x,z)}x_t + w^{T}_{(h,z)}h_{t-1})$$  \hspace{1cm} (13)

$$r_t = \sigma(w^{T}_{(x,r)}T^{T}_{(h,r)} - 1)$$ \hspace{1cm} (14)

$$g_t = \tanh\left[w^{T}_{(x,z)}x_t + w^{T}_{(h,z)}r \otimes h_{t-1}\right]$$ \hspace{1cm} (15)

$$h_t = (-z_t) \otimes h_{t-1} + z_t \otimes g_t$$ \hspace{1cm} (16)

Where $x_t$ is the input at moment $t$, $h_t$ is the output or state at moment $t$, $x_t$ is the state at moment $t-1$, $w$ is the weight, $\sigma$ is the sigmoid activation function, and $\tanh$ is the activation function.

4 Empirical Analysis of Music Teaching Combining Ecological Aesthetic Education and Deep Learning

4.1 Analysis of the evaluation system for teaching deep learning music

In order to verify the effectiveness of the deep learning-based music teaching evaluation model in this paper, its performance was empirically tested, and the experimental task was to intelligently perceive the three kinds of music sound frequency, content explanation, and teaching images in the music teaching scene. The experimental data was obtained through field collection in the music teaching scene. The image data was obtained from the video, and the audio signal was obtained from the recording equipment. The extracted square foreground images have complex and varied backgrounds with different lighting conditions, and their shooting angles and heights vary. The manual selection of images with greater variability in the image set will reflect the variability of the samples. The samples are selected from 1200 instructional video samples. The training set is selected by 70%, while the test set is selected by 30%. Based on the fusion method of audio-visual features, the input of visual information is square pictures, and the size will be uniformly reduced to $256 \times 256$ before extracting the CNN features. The input to the network is a randomly selected $250 \times 250$ block,
and the features are extracted based on the trained model, and the CNN features are taken from the output of the network’s fully connected layer FC6. The experiment was tuned, the number of nodes was changed to 900, and the remaining parameters of the network structure were unchanged. The number of model training iterations is 11,000. The auditory information is the features extracted from a randomly extracted frame of the speech signal. A new fusion feature vector is created by concatenating the auditory and visual feature vectors and feeding them into the deep neural network for training and testing. To validate the effectiveness and feasibility of the method in this paper, it is compared with traditional algorithmic models, MRCGs, and MSFs.

The experimental results of the four methods are shown in Fig. 8, and it can be observed that the correct rate of the deep learning music teaching evaluation model based on audio-visual fusion proposed in this paper has reached 94.45% in the music teaching evaluation problem, while the correct rate of traditional algorithmic models, MRCGs, and MSFs are 84.85%, 82.42, and 83.94, respectively, and the correct rate of the testing of this paper’s method is better compared to the other methods.

![Figure 8. Experimental results of four methods](image)

4.2 Experimental Analysis of ecological and aesthetic music teaching

4.2.1 Analysis of music level before the ecological and aesthetic teaching experiment

In order to verify the practical effect and feasibility of the ecological, aesthetic music teaching mode in this paper, this study takes 100 students with comparable musical ability levels in music classes of S college as the experimental objects and divides the 100 students into 50 experimental and control classes according to the experimental demand, and carries out the ecological, aesthetic music teaching mode proposed in this paper in the experimental class, and carries out music teaching in the traditional class with the traditional music teaching mode for 8 weeks. In the experimental class, the proposed ecological, aesthetic music teaching mode was carried out, and the traditional class was taught in the traditional music teaching mode. Both classes were given music teaching for a period of 8 weeks, and a comparative analysis was made on the changes in the music ability level of the experimental class and the control class before and after the experiment in order to compare the ability level of the two classes in a more specific way, an ability test was organized once a week during the experimental teaching period, and a total of 8 tests on the level of music ability were carried out. Music perception ability, emotional expression through music, music creation and performance, music theory theory, and more. They were used as evaluation criteria for comparative Analysis, and the results of the music proficiency test before the experimental teaching of the two classes are shown in Table 1. Before
carrying out the t-test of the data, the test results of the four indexes of the dependent variable of music ability of the control class of the experimental class, i.e., Music perception ability, music emotion expression, music creation and performance, and music knowledge theory were tested before the experiment. Before the t-test, the test of normality was conducted on the four indicators of music ability, music perception ability, music expression, music creation and performance, and music knowledge and theory before the experiment, and the statistical values of music perception ability of the experimental group and the control group before the experiment were 0.951 and 0.939, respectively, and the values of music emotion expression were 0.961 and 0.964, respectively. Physical index test scores follow a normal distribution, verifying the rationality and scientificity of the teaching experiment.

### Table 1. Test results of music level before experiment teaching

<table>
<thead>
<tr>
<th>Index</th>
<th>Experimental group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>df</td>
</tr>
<tr>
<td>Music awareness</td>
<td>0.951</td>
<td>50</td>
</tr>
<tr>
<td>Musical expression</td>
<td>0.961</td>
<td>50</td>
</tr>
<tr>
<td>Music creation and performance</td>
<td>0.942</td>
<td>50</td>
</tr>
<tr>
<td>Music knowledge theory</td>
<td>0.956</td>
<td>50</td>
</tr>
</tbody>
</table>

A comparison of the performance of each index before the music teaching experiment is shown in Table 2. Through the Comparative Analysis of the performance of each index of music ability before the experiment of the experimental class control class, it can be seen that, in the four music ability level items of music perception ability, music emotion expression, music creation, and performance, and music knowledge and theory, the P-value is > 0.05, and there is no significant difference between the experimental class and the control class in each music ability. It shows that the test indexes of the experimental class and the control class before the experiment are at the same level, and the experimental grouping is reasonable, which further verifies the rationality of the music teaching experiment in this paper.

### Table 2. The comparison of the previous indicators of music teaching experiment

<table>
<thead>
<tr>
<th>Index</th>
<th>Gender</th>
<th>Experimental group</th>
<th>Control group</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Man</td>
<td>12.39±1.15</td>
<td>13.28±1.14</td>
<td>-0.314</td>
<td>0.753</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>11.76±1.21</td>
<td>12.35±1.10</td>
<td>-1.554</td>
<td>0.123</td>
</tr>
<tr>
<td>Musical expression</td>
<td>Man</td>
<td>11.61±4.48</td>
<td>13.68±5.21</td>
<td>-1.304</td>
<td>0.196</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>15.89±5.05</td>
<td>17.57±4.13</td>
<td>-1.134</td>
<td>0.261</td>
</tr>
<tr>
<td>Music creation and performance</td>
<td>Man</td>
<td>111.11±29.75</td>
<td>113.79±24.27</td>
<td>-0.314</td>
<td>0.755</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>122.40±26.71</td>
<td>115.48±24.61</td>
<td>0.796</td>
<td>0.426</td>
</tr>
<tr>
<td>Music knowledge theory</td>
<td>Man</td>
<td>25.56±7.41</td>
<td>26.47±8.53</td>
<td>-0.224</td>
<td>0.818</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>29.71±5.14</td>
<td>30.20±7.14</td>
<td>-1.062</td>
<td>0.292</td>
</tr>
</tbody>
</table>

### 4.2.2 Analysis of music level after the ecological and aesthetic teaching experiment

A comparison of various achievements after the music teaching experiment is shown in Table 3, which shows that the four post-test indicators of music perception ability, music emotion expression, music composition and performance, and music knowledge theory of the experimental class and the control class obeyed a normal distribution through the 8-week teaching experiment for the experimental class and the control class. The t-test of each index of musical ability level of students in the experimental
class and the control class after the experiment found that the scores of music perception ability, music emotion expression, and music knowledge theory of the experimental class and the control class were $P<0.05$, and there was a significant difference. The P-value of music composition and performance scores of girls in the experimental and control classes after the experiment is $<0.05$, and there is a significant difference, while the P-value of boys’ scores is $>0.05$, and there is no significant difference. Comparing the mean scores of music perception ability of the experimental and control classes, there is a difference of 5.18 between the two classes for boys and 7.47 for girls, and the experimental class outperforms the control class. Comparing the mean scores of music composition and performance of students in the experimental and control classes, there is a difference of 11.57 between boys and 16.16 between girls in the experimental and control classes, and the experimental class outperforms the control class. On the whole, the ecological, aesthetic music teaching mode proposed in this paper is more helpful to the improvement of students’ musical ability than the traditional teaching mode of music, and the teaching effect is more advantageous, which verifies the effectiveness and feasibility of the ecological, aesthetic teaching mode in this paper.

| Table 3. Comparison of achievements in music teaching experiment |
|---------------------------------|-----------------|-----------------|------|------|
| Index                           | Gender          | Experimental group | Control group | $T$  | $P$  |
| Music awareness                 | Man             | 15.97±1.55        | 10.79±0.88    | -2.218 | 0.035* |
|                                 | Female          | 18.98±0.89        | 11.51±0.89    | -3.698 | 0.001** |
| Musical expression              | Man             | 16.78±2.47        | 13.84±3.82    | 2.832  | 0.009** |
|                                 | Female          | 19.51±4.89        | 14.45±3.78    | 3.402  | 0.003** |
| Music creation and performance  | Man             | 128.88±35.71      | 117.31±24.96  | 1.112  | 0.269 |
|                                 | Female          | 138.90±18.98      | 122.74±23.81  | 2.122  | 0.038* |
| Music knowledge theory          | Man             | 32.54±5.25        | 28.84±5.23    | 2.242  | 0.029* |
|                                 | Female          | 39.10±6.95        | 31.30±1.42    | 2.302  | 0.025* |

5 Conclusion

In this paper, we explore a novel music teaching strategy that integrates ecological aesthetic education with deep learning technologies. Our findings validate the approach’s success in blending traditional music culture with contemporary educational practices, significantly enhancing student musical literacy. Students participating in the experimental class demonstrated remarkable progress, with increases of 5.18 points in music perception, 7.47 points in emotional expression, and a leap of 11.57 to 16.16 points in composition and performance skills. These improvements highlight the benefits of incorporating ecological and aesthetic principles and deep learning into music education. The approach not only enriches the curriculum and diversifies teaching methods but also sparks student interest and creativity. By bridging traditional music culture with cutting-edge technology, our teaching model elevates musical literacy and fosters the continuation and growth of traditional music heritage.

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References


