An Innovative Exploration of Music Integration into Art Education Teaching in the Context of Big Data

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Abstract

The interdisciplinary integration of art and music into education majors is a significant reform effort that benefits students’ overall artistic literacy. This study focuses on integrating music into art education teaching, with the goal of teaching concepts and empowering music applications. It uses k-means clustering to analyze the group profile of art teachers’ integration literacy. Then, we selected the influencing factors for music integration in art teaching, explored the relationship between them and the effects of art teaching, and proposed an effective way to integrate music into art education teaching. The results show that the group of teachers’ integration literacy can be divided into four categories: conservative (27.19%), ambivalent (47.50%), balanced (10.31%), and transformational (15.00%), and transformational teachers have the most vital ability to teach music integration. There was a significant positive correlation between the five dimensions of music integration in art teaching and art teaching effectiveness. The most essential effects on teaching effectiveness were found in creating a teaching context (0.217) and guiding the learning of art knowledge (0.154). The study can provide a basis for teaching music and art integration and individualized development of teachers’ integration literacy.

Keywords: K-means clustering; Multiple regression analysis; Evaluation indicators; Correlation; Art education teaching.

AMS 2010 codes: 97P10
1 Introduction

Both music and art are essentially influenced by physiology as well as emotion, so there is an apparent intrinsic connection between the two, and the most significant difference is also manifested in the form of artistic expression [1-3]. Music is mainly manifested in its rhythm, tone, melody pitch, and other aspects [4]. Art is different. Art is primarily on composition, line, and color situations to directly shape its artistic image and thus render the artistic infectious force [5]. Although there are some differences in the expression of the two, both have human emotional values as their main driving force so as to realize the effective communication of their aesthetic mood, prompting the spiritual world to really get sublimated [6-8]. In the process of Western family education, the most basic music and art subjects are included [9]. Especially in the development of modern art education, art education began to seek more development, so the integration of music into the road of art education directly resonates with the pursuit of the artistic situation, and this is also an inevitable requirement to expand the comprehensive development of subject education [10-13].

The timely integration of music into art education and teaching belongs to the issue of discipline synthesis, music into art education connotation that under the guidance of comprehensive interdisciplinary theory, centered on the art discipline, incorporating the relevant basic knowledge and skills of music as the enrichment of art curriculum resources and art teaching situation rendering [14-16]. So that students, through the art curriculum integrated with music, strengthen the aesthetic feeling and experience, with imagination association as the center of the guiding way, as well as listening, watching, singing, drawing, designing, and other methods of art learning, to improve the students’ art appreciation and evaluation ability. Through experiencing the process of art creation, students’ innovative ability and practical abilities are cultivated [17-19]. At the same time, it also enables students to grasp the direction of diversified art and culture with a macroscopic artistic vision, establish a healthy and noble aesthetic outlook, and comprehensively improve their artistic quality [20-21].

Although the integration of music into art education is the beginning of the exploration of integrated art disciplines, we must grasp the core position of art education must not be shaken because of the participation of music in the leading position of art education, discipline-centered to facilitate the students’ clear grasp of the art discipline [22-24]. If not divided into primary and secondary, students are prone to confusion and learning confusion, not only damaging the students’ learning interest and learning ability at the same time contrary to the purpose and goals of art education as well as comprehensive subject education [25].

In this study, firstly, the improvement of k-means clustering is realized by dividing the categories through the clustering criterion function, and it is combined with the multiple regression analysis method to construct the research model of music integration into art education teaching. Secondly, the evaluation indexes of teachers’ integration literacy are proposed around the two dimensions of teaching concepts and music empowerment in teachers’ integration teaching. Then, taking the teaching of art courses in a university as an example, we collect relevant data through questionnaires and analyze the development status of music integration into art teaching in teachers’ teaching in terms of two types of value tendencies: teacher-centered and learner-centered, to get the group characteristics of teachers’ integration literacy. The group characteristics of integration literacy. Then, the influence dimensions of music integration in art teaching were selected, and correlation analysis and multiple regression analysis were carried out to explore the influence of music integration in art teaching on the effect of art teaching. Finally, effective ways of integrating music into art education teaching are proposed from the perspectives of music integration into art education.
2 Research model for the pedagogical study of the integration of music into art education

Cluster analysis is a data mining method, and this paper will use a K-means clustering algorithm to evaluate the comprehensive quality of teachers who integrate music into the teaching of art education and analyze the correlation between the integration of music into the teaching of art and the effectiveness of art teaching through multiple regression methods.

2.1 K-means-based model of comprehensive teacher literacy

Cluster analysis, referred to as clustering, is based on a clustering algorithm that divides data objects into subsets, each of which is called a cluster, where objects in the clusters are similar to each other. Objects in different clusters are different from each other. It can work independently to mine the hidden value information in the data or as a preprocessing step for other algorithms, such as personalized recommendations. The classification of group characteristics of art teachers’ comprehensive literacy is the focus of this paper.

2.1.1 Feature vectorization

Eigenvectorization is the quantitative disassembly of a complex clustering object into a multidimensional vector consisting of a series of eigenvalues for computer clustering analysis. In order to solve the problems caused by the non-uniformity of the quantitative vector, it is necessary to implement the dimensionless operation (also known as data specification operation) on the evaluation data of the initial art teachers’ comprehensive literacy before clustering so that the values of each attribute are within a uniform range of values.

Suppose the dataset has \( n \) data object, \( X = \{x_1, x_2, \ldots, x_n\} \), and each object has \( m \) attribute features, i.e., \( X_i = \{x_{i1}, x_{i2}, \ldots, x_{in}\} (i = 1, 2, \ldots, n) \). The data matrix that corresponds to this dataset is as follows:

\[
X’ = \begin{pmatrix}
X’_{11} & \cdots & X’_{1m} \\
\vdots & \ddots & \vdots \\
X’_{n1} & \cdots & X’_{nm}
\end{pmatrix}
\]  

(1)

Commonly used data specification operations in general are standard deviation specifications:

\[
X_{ij} = \frac{X’_{ij} - \frac{1}{n} \sum_{i=1}^{n} X’_{ij}}{\sqrt{\frac{1}{n-1} \left( \sum_{i=1}^{n} X’_{ij} - \frac{1}{n} \sum_{i=1}^{n} X’_{ij} \right)^2}}
\]  

(2)

2.1.2 Distance measurement

When the clustering algorithm is applied, a variety of distance measures can be used flexibly, and different distance measures will have corresponding effects on the algorithm’s operation speed and clustering results. Therefore, in order to obtain efficient and accurate clustering, the appropriate distance measure should be selected according to actual needs. The following is an example of several commonly used distance definitions for vectors \( (a_1, a_2, \ldots, a_n) \) and \( (b_1, b_2, \ldots, b_n) \):
Euclidean distance is the most straightforward and most intuitive of all distance measures and is suitable for two- and three-dimensional distance measurements. It is known as:

\[
d = \sqrt{\sum_{i=1}^{n} (a_i - b_i)^2}
\]  

(3)

Minkowski distance: is an extension of the Euclidean distance, which can be understood as the Euclidean distance in \( N \)-dimensional space. Denoted as:

\[
d = \left( \sum_{i=1}^{n} |a_i - b_i|^p \right)^{1/p}
\]  

(4)

Manhattan Distance: Manhattan distance is also known as called neighborhood distance. The distance between two points is the sum of the absolute values of the differences in their coordinates. The expression is:

\[
d = |a_1 - b_1| + |a_2 - b_2| + \cdots + |a_n - b_n|
\]  

(5)

Cosine Distance: The cosine distance is used to represent the difference in the direction of two vectors. It is denoted as:

\[
d = 1 - \frac{a_1 b_1 + a_2 b_2 + \cdots + a_n b_n}{\sqrt{a_1^2 + a_2^2 + \cdots + a_n^2} \sqrt{b_1^2 + b_2^2 + \cdots + b_n^2}}
\]  

(6)

2.1.3 Clustering Quality Assessment

Feature vectorization, distance measures, and algorithm selection all affect the clustering results, so the quality of clustering needs to be assessed after clustering the art teacher population.

Intrinsic assessment methods often use the contour coefficient as a metric. For a dataset \( D \) containing \( n \) object, assume that \( D \) is partitioned into \( k \) clusters \( C_1, \ldots, C_k \). For each data object \( o \in D \), compute the average distance \( a(o) \) between \( o \) and other objects within the cluster in which it is located, and the minimum average distance \( b(o) \) between \( o \) and objects that do not belong to the cluster in which \( o \) they are located:

\[
a(o) = \frac{\sum_{o' \in C_i, o \neq o'} \text{dist}(o, o')}{|C_i|-1}
\]  

(7)

And:

\[
b(o) = \min \left\{ \frac{\sum_{o'' \in C_j} \text{dist}(o, o'')}{|C_j|} \right\} \{C_j : 1 \leq j \leq k, j \neq i \}
\]  

(8)

Based on \( b(o) \) and \( a(o) \), the contour coefficients of object \( o \) can then be defined as:
The contour coefficient derived from the above equation has a value between -1 and 1. The value of \( a(o) \) reflects the closeness of \( o \) to the cluster to which it belongs, the smaller the value means the closer it is to the cluster to which it belongs. The value of \( b(o) \) reflects the degree of separation of \( o \) from the other clusters, the larger the value, the more separated \( o \) is from the other clusters. Therefore, the closer the contour coefficient value of \( o \) is to 1, the closer \( o \) is to the cluster it belongs to and the farther it is from the other clusters, which is a more desirable clustering result. On the contrary, a negative contour coefficient means that \( o \) is closer to the objects in other clusters than to the objects in its own cluster, which is obviously an unreasonable clustering result.

2.1.4 The k-means algorithm

The k-means algorithm is a clustering algorithm that aims to classify sample data from \( n \) samples into \( k \) classes in \( m \)-dimensional Euclidean space. When used, the K-means algorithm requires the user to predetermine the number of clusters and then randomly select \( k \) data objects as the initial cluster centers.

K-means algorithm flow:

1) Assuming that the set of data points for evaluating the comprehensive literacy of art teachers is \( X = \{x_1, x_2, \ldots, x_n\} \), set \( k \) as the number of clusters, and randomly select \( k \) data objects as the initial center of \( C = \{c_1, c_2, \ldots, c_k\} \) mass.

2) Based on a certain distance measure, calculate the distance \( d(x_i, c_j) \) of all data points from the \( k \) center of mass if a certain distance satisfies the following conditions:

\[
d(x_i, c_j) = \min \{d(x_i, c_j), i = 1, 2, 3 \ldots n; j = 1, 2, 3 \ldots k\}
\]

Then assign data point \( x_i \) to cluster \( C_j \) with \( c_j \) as the center of mass.

3) After assigning all data points, update the \( k \) center of mass:

\[
c_j^* = \frac{1}{n_j} \sum_{m \in c_j} x_m
\]

4) If the center of mass \( c_j \) does not change anymore or changes within the pre-set threshold, terminate the iteration, otherwise go back to step (2) to start a new round of computation.

2.1.5 Deficiencies and optimization of k-means

Here are the main drawbacks of the k-means algorithm:
The clustering center of the k-means algorithm will be affected by the number of clusters, and it is easy to fall into the local optimum rather than the global optimum and the data of the isolated points are more sensitive, which will directly affect the final results.

The clustering criterion is a criterion to classify the same kind of data into the same category when analyzing the data, and it is a kind of scale to confirm whether it is a similar pattern or not by the similarity metric. In this paper, the improvement of the traditional k-means algorithm uses the clustering criterion function as a measure:

1) Error Squared and Clustering Criterion Function \( J_c \)

The clustering criterion function is a function that expresses the similarity or dissimilarity between data sets. So, in simple terms, the clustering process can be understood as finding the optimal solution of the criterion function. Three types of criterion functions are commonly used:

The distance between any sample \( p \) within cluster \( C_i \) and the representative \( c_i \) of that cluster is computed using \( d(p, c_i) \), defining Eq. (12) as the sum-of-squares-of-errors criterion function:

\[
J_c = \sum_{i=1}^{k} \sum_{p \in c_i} d(p, c_i)^2
\]  

(12)

Where \( J_c \) represents the sum of error squares of all data samples in \( Z \), \( p \) is the data samples in cluster \( C_i \), and \( c_i \) is the mean of cluster \( C_i \), also the center of cluster \( C_i \), defined as shown in Equation (13):

\[
c_i = \frac{1}{n_i} \sum_{j=1}^{n_i} x_j
\]

(13)

Where \( n_i \) indicates the number of objects in cluster \( C_i \), \( x_j \in C_i, j = 1, 2, \ldots, n \). The statistic describing the completion of clustering with \( J_c \) indicates the sum of the cluster center being deviated by all the objects in the cluster, the larger the value, the more the objects are deviated from the center, and the smaller the value, the more compact the objects in the cluster are, and the better the clustering effect is.

2) Criterion function \( J_I \) and weighted mean square distance

The weighted mean squared distance and \( J_I \) are expressed as follows:

\[
J_I = \sum_{j=1}^{k} P_j S_j^*
\]

(14)

Where the mean squared distance between objects within a cluster is denoted by \( S_j^* \), i.e:

\[
S_j^* = \frac{2}{n_j(n_j-1)} \sum_{x \in C_j} \sum_{x' \in C_j} \|x - x'\|^2
\]

(15)

3) Criterion function \( J_b \) and interclass distance and
In the representation of the interclass distance of the clustering results, the weighted interclass distance and criterion $J_{b_1}$ and interclass distance and criterion $J_{b_2}$ are applied, respectively, as in Eqs. (16) and (17):

$$J_{b_1} = \sum_{j=1}^{k} \left( m_j - m \right)^T \left( m_j - m \right)$$  
(16)

$$J_{b_2} = \sum_{j=1}^{k} p_j \left( m_j - m \right)^T \left( m_j - m \right)$$  
(17)

From the above formula, it can be seen that the mean vector of cluster $C_j$ is denoted by $m_j$, the mean vector of all samples is denoted by $m$, and the prior probability is denoted by $P_j$. It can be clearly seen that the larger the value of $J_{b_1}$, the more significant the effect of clusterization in the clustering results, and the higher the quality of clustering.

2.2 Multiple linear regression models

Multiple linear regression analysis studies the effect of multiple factors on a problem, where $Y$ is the actual problem to be solved and $(x_1, x_2, \ldots, x_n)$ is a variety of factors, and by analyzing the relationship between the two, some regular changes can be derived, so as to create a multiple linear regression model. Due to its simplicity and practicality, this method is widely used in various fields, such as the financial industry, real estate industry, medical industry, etc. The aim of this paper is to teach art innovation. The model for multiple linear regression analysis is presented in the following way:

$$Y_i = \beta_1 + \beta_2 x_{i2} + \beta_3 x_{i3} + \ldots + \beta_k x_{ik} + \mu_i$$  
(18)

Parameter $\beta_j (j = 1, 2, \ldots, k)$ in the model is the partial regression coefficient, $n$ is the sample size, the role of the partial regression coefficient is to hold the other factors constant, and the unit change in the $j$th explanatory variable corresponds to the effect of the mean value of the variable.

The multivariate linear regression model with $K$ explanatory variables with $n$ observation samples can be expressed as:

$$\begin{align*}
Y_1 &= \beta_1 + \beta_2 x_{12} + \beta_2 x_{13} + \ldots + \beta_k x_{1k} + \mu_1 \\
Y_2 &= \beta_1 + \beta_2 x_{22} + \beta_2 x_{23} + \ldots + \beta_k x_{2k} + \mu_2 \\
&\vdots \\
Y_n &= \beta_1 + \beta_2 x_{n2} + \beta_2 x_{n3} + \ldots + \beta_k x_{nk} + \mu_n
\end{align*}$$  
(19)

It is written in matrix form as:

$$Y = X \beta + \mu$$  
(20)

Among them:
3 Analysis of teachers’ integration literacy for music in art teaching and learning

Teachers’ curricular integration competence is a skill with apparent professional inclination, which is particularly important in the construction of a school-based curriculum. The integration of art and music into the curriculum is a claim of professional art teachers’ curriculum competence. Teachers are not only curriculum implementers but also direct constructors and participants in the curriculum. Therefore, this study first assessed the integration literacy of teachers who integrate music into art instruction.

3.1 Evaluation content of comprehensive quality of art teachers

Based on relevant historical research, this paper will select the evaluation contents of teachers’ integration literacy from two dimensions: teaching concepts and musical empowerment.

Teaching concepts are divided into two value orientations: “teacher-centered” and “learner-centered.” The “teacher-centered” conception of teaching includes the teacher’s teaching, the emphasis on examinations, and the emphasis on the form of content delivery. The “learner-centered” conception of teaching consists of the guidance and support of the teacher in encouraging students to express themselves, learn independently, and work cooperatively, as well as the goal of developing students’ comprehensive abilities such as disciplinary thinking and problem-solving skills.

The aspect of music empowerment includes the technical support for the optimization of music empowerment teaching to support teachers’ education, content presentation, and teaching feedback, and the technical support for the transformation of music empowerment teaching to support students’ motivation, learning activities, and internalization of learning knowledge.

Based on the content of the teacher integration literacy evaluation, a questionnaire was designed and formulated to be distributed and collected from art teachers and students in a university. A total of 389 feedback scales were recovered from the survey, and after data cleaning, 320 complete and valid feedbacks were finally obtained, with a validity rate of 82.26% for the questionnaire.

3.2 Portrait of Art Teachers’ Comprehensive Literacy Groups

Sample features can be identified and characterized using cluster analysis. The clustering variables for technology-enabled instructional transformation, technology-enabled instructional optimization, learner-centered perception, and teacher-centered perception were chosen in this study. At the operational level, this study used the Kmeans clustering method in SPSS to cluster the samples and chose the number of iterations as 100. Four feature groups can be used to categorize the eigenvalues of the final clustering results.

The results of the cluster analysis of teachers’ integration literacy are shown in Table 1. In order to better analyze the group characteristics of the four types of teachers, this study converted the mean values of the four dimensions into a radar chart, and Figure 1 shows the radar of the cluster analysis of teachers’ integration literacy. In the teaching conception dimension, all four categories of teachers
scored higher overall on the learner-centered view of teaching than on the teacher-centered view of teaching. Music integration resulted in a higher score for music-enabled instructional optimization than for music-enabled instructional transformation. That is, although teachers were relatively more inclined to use learner-centered instructional methods in their general art instruction, the application of music was more supportive of teachers’ instructional activities than of students’ learning activities.

The first group of teachers is more numerous, accounting for 27.19%. Conservatory teachers have a lower mean value of integration literacy, 1.84, and lower scores on music empowerment teaching, with a less prominent tendency towards teaching concepts. Conservative teachers showed a higher level of maturity in the “teacher-centered” view of teaching and learning than the other two types of teachers, indicating that their strengths are in didactic teaching but less in music-integrated art teaching.

The second group of teachers tended to be learner-centered in their conception of teaching (4.20) but clearly tended to be teacher-centered in music-integrated art teaching (4.25). They were described as ambivalent teachers. Music integration art is taught by this type of teacher, who has the highest percentage of 47.50% and represents the school.

The third category of teachers referred to as the balanced type, had the smallest number of teachers at 10.31%, and the development of music applications and the development of teaching concepts were relatively equal for this type of teacher.

Teachers in the fourth group, whose conceptual tendencies were significantly more learner-centered, scored higher on the learner-centered view of teaching and learning (4.67), as well as scoring higher overall on music empowerment than any of the other three groups, were called transformational. Teachers in this group were the strongest in the pedagogical application of music-integrated art, with the highest integration literacy score (3.32).

<table>
<thead>
<tr>
<th>Categories</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusion literacy</td>
<td>1.84</td>
<td>2.39</td>
<td>2.76</td>
<td>3.32</td>
</tr>
<tr>
<td>Teacher-centered teaching</td>
<td>3.58</td>
<td>3.31</td>
<td>4.58</td>
<td>2.93</td>
</tr>
<tr>
<td>Student-centered teaching</td>
<td>3.93</td>
<td>4.20</td>
<td>4.81</td>
<td>4.67</td>
</tr>
<tr>
<td>Music empowers teaching optimization</td>
<td>3.07</td>
<td>4.25</td>
<td>3.84</td>
<td>4.75</td>
</tr>
<tr>
<td>Music empowers teaching transformation</td>
<td>2.54</td>
<td>3.13</td>
<td>3.52</td>
<td>3.86</td>
</tr>
<tr>
<td>Number</td>
<td>87</td>
<td>152</td>
<td>33</td>
<td>48</td>
</tr>
<tr>
<td>Proportion</td>
<td>27.19%</td>
<td>47.50%</td>
<td>10.31%</td>
<td>15.00%</td>
</tr>
</tbody>
</table>
Figure 1. Teacher fusion literacy cluster analysis radar

3.3 Analysis of group background information

In order to further investigate the differences in the background information of the four teacher groups, the study examined the ANOVA of the background information of the four types of teachers. The background information of the four types of teacher groups was analyzed, as shown in Table 2. Different types of teachers will not show significance ($p > 0.05$) for a total of six items: gender, age group, teaching age, title, education, and the number of times they participated in information technology open classes or took part in related competitions, and different types of teachers show significance ($p < 0.05$) for the frequency of music application for teaching, and the first type of conservative teachers compared to the other types of teachers have a significant frequency of music application for teaching art less than the different types of teachers with a mean value of 2.64. The fourth type of transformational teachers had the highest frequency of music application with a mean value of 3.02.

<table>
<thead>
<tr>
<th>Clustering result (Mean±Standard Deviation)</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(n=87)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>1.69±0.42</td>
<td>1.72±0.45</td>
</tr>
<tr>
<td>Age group</td>
<td>2.83±0.92</td>
<td>2.81±0.93</td>
</tr>
<tr>
<td>Teaching age</td>
<td>2.62±1.12</td>
<td>2.53±1.10</td>
</tr>
<tr>
<td>Job title</td>
<td>2.24±0.75</td>
<td>2.22±0.73</td>
</tr>
<tr>
<td>Educational background</td>
<td>1.97±0.47</td>
<td>1.99±0.43</td>
</tr>
<tr>
<td>Participate in the information disclosure class or participate in the competition</td>
<td>1.95±0.71</td>
<td>1.93±0.68</td>
</tr>
<tr>
<td>The frequency of the music application teaching</td>
<td>2.64±0.83</td>
<td>2.72±0.79</td>
</tr>
</tbody>
</table>

4 Relevance of music integration to the effectiveness of art teaching and learning

The analysis of art teachers’ comprehensive quality and group portrait in the previous chapter can provide a direction for exploring and developing music integration into art education teaching. This chapter will study the relationship between music integration into art teaching and art teaching.
effectiveness, analyze the factors of music integration into art teaching that affect art teaching effectiveness, and provide some references for the next chapter on the improvement path of music integration into art education teaching.

4.1 Impact Factors and Data Collection

In terms of the influence of music integration on the effectiveness of art teaching, the following five influencing factors were selected: guiding the learning of art knowledge X1, creating a teaching context X2, exercising appreciation X3, enhancing imagination X4, and helping to experience a sense of picture X5. A questionnaire was designed according to the influencing factors, divided into the music integration into the art teaching section and the teaching effectiveness section, and distributed together with the questionnaire on teachers’ integration literacy above, collecting data from the A, B, and C art courses.

4.2 Integration of music into art teaching in general

A one-way ANOVA was utilized to determine if there was a variation in the level of music integration into fine arts instruction among the three programs. Table 3 displays the overall state of music integration in fine arts instruction. The variability of the data samples of the three courses in these six items was statistically significant (p < 0.05). The integration of music into art teaching showed inconsistencies in the overall scores, guiding the learning of art knowledge X1, creating a teaching context X2, exercising appreciation X3, enhancing imagination X4, and helping to experience a sense of the picture X5. Courses A, B, and C had overall scores of 3.193, 3.329, and 3.216, respectively, for the integration of music into art teaching. The overall score for course B was higher than that of course A, with a score of 3.193, 3.329, and 3.216.

Table 3. The general situation of music integrated into art teaching

<table>
<thead>
<tr>
<th></th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Mean</td>
<td>3.614</td>
<td>3.502</td>
<td>2.906</td>
<td>2.932</td>
<td>3.009</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>0.596</td>
<td>0.638</td>
<td>0.425</td>
<td>0.437</td>
<td>0.641</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>0.614</td>
<td>0.653</td>
<td>0.497</td>
<td>0.515</td>
<td>0.673</td>
</tr>
<tr>
<td>C</td>
<td>Mean</td>
<td>3.344</td>
<td>3.128</td>
<td>3.591</td>
<td>3.053</td>
<td>2.962</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>0.624</td>
<td>0.684</td>
<td>0.587</td>
<td>0.453</td>
<td>0.614</td>
</tr>
<tr>
<td>F</td>
<td>4.578</td>
<td>7.338</td>
<td>6.723</td>
<td>5.688</td>
<td>3.835</td>
<td>8.014</td>
</tr>
<tr>
<td>P</td>
<td>0.001</td>
<td>0.003</td>
<td>0.014</td>
<td>0.002</td>
<td>0.005</td>
<td>0.000</td>
</tr>
</tbody>
</table>

4.3 Variable correlation analysis

To analyze the relationship between music integration in art teaching and art teaching effectiveness, correlation analysis was conducted across five dimensions of music integration in art teaching and art teaching effectiveness. Table 4 presents the correlation analysis of music integration into art teaching and its effectiveness. The correlations between the variables are roughly the same as the expected research direction of this study. There is a statistically significant positive correlation between the overall situation of the five dimensions of music integration into art teaching and the art teaching effect (p < 0.05), with correlation coefficients of 0.554, 0.469, 0.523, 0.353, and 0.482, respectively. Among them, the enhancement of imagination X4, as compared to the other ones, presents a low
positive correlation, and the different dimensions showed a moderate positive correlation with classroom performance.

Among the five dimensions of music integration into art teaching, the strongest correlation with teaching effect was found in guiding the learning of art knowledge X1 in the integration teaching, of course, A, with a correlation coefficient of 0.676 and P < 0.01. The strongest correlation with the teaching effect was found in helping to experience the sense of picture X5 in the integration teaching of course B, with a correlation coefficient of 0.646. Similarly, the strongest correlation with teaching effect was found in the creation of teaching situations X2 in course C with a correlation coefficient of 0.488.
Table 4. The correlation analysis of music integrated into the teaching and teaching effect of art

<table>
<thead>
<tr>
<th></th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>0.554**</td>
<td>0.469**</td>
<td>0.523**</td>
<td>0.353**</td>
<td>0.482**</td>
</tr>
<tr>
<td>A</td>
<td>0.676**</td>
<td>0.535**</td>
<td>0.583</td>
<td>0.336**</td>
<td>0.345**</td>
</tr>
<tr>
<td>B</td>
<td>0.514**</td>
<td>0.567**</td>
<td>0.609**</td>
<td>0.415**</td>
<td>0.646**</td>
</tr>
<tr>
<td>C</td>
<td>0.473**</td>
<td>0.488**</td>
<td>0.376**</td>
<td>0.307**</td>
<td>0.455**</td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01

To further investigate whether the level of music integration in art instruction was predictive of the effectiveness of art teaching, this study conducted multiple linear regression analyses. The linear regression analysis took the dimensions of curriculum and music integration into art teaching as independent variables and the overall art teaching effectiveness as the dependent variable, and the regression analysis of the level of music integration into art teaching and art teaching effectiveness is shown in Table 5. The R² value of the model is 0.624, indicating that guiding the learning of art knowledge X1, creating teaching situations X2, exercising appreciation X3, enhancing imagination X4, and helping to experience a sense of the picture X5 can explain the reason for 62.4% of the variation in the art teaching effect overall.

Among the dimensions of music integration into art teaching, curriculum (0.278) has the most significant influence on art teaching effectiveness, followed by creating teaching context X2 (0.217), guiding the learning of art knowledge X1 (0.154), exercising appreciation X3 (0.136), and the lowest influence is enhancing imagination X4 (0.128), and helping to experience the sense of picture X5 (0.115). This indicates that not only do the dimensions of music integration into art teaching have a significant effect on the total teaching effectiveness score, but the curriculum also has a significant impact on classroom performance. The analysis resulted in a regression equation for the effectiveness of art teaching, i.e., the effectiveness of art teaching = 0.631 + 0.278*curriculum + 0.154*guiding the learning of art knowledge + 0.217*creating a teaching context + 0.136*exercising appreciation + 0.128*improving imagination + 0.115*helping to experience a sense of picture.

Table 5. The regression analysis of music integrated into the teaching and teaching effect of art

<table>
<thead>
<tr>
<th></th>
<th>Nonnormalized coefficient</th>
<th>Normalized coefficient</th>
<th>t</th>
<th>p</th>
<th>R²</th>
<th>Adjusted R²</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>0.631</td>
<td>0.261</td>
<td>-</td>
<td>1.578</td>
<td>0.028</td>
<td>0.624</td>
<td>0.563</td>
</tr>
<tr>
<td>Course</td>
<td>0.278</td>
<td>0.053</td>
<td>0.247</td>
<td>5.602</td>
<td>0.015</td>
<td>0.563</td>
<td>0.563</td>
</tr>
<tr>
<td>X1</td>
<td>0.154</td>
<td>0.064</td>
<td>0.174</td>
<td>2.014</td>
<td>0.015</td>
<td>0.563</td>
<td>0.563</td>
</tr>
<tr>
<td>X2</td>
<td>0.217</td>
<td>0.034</td>
<td>0.152</td>
<td>3.215</td>
<td>0.013</td>
<td>0.563</td>
<td>0.563</td>
</tr>
<tr>
<td>X3</td>
<td>0.136</td>
<td>0.055</td>
<td>0.165</td>
<td>1.786</td>
<td>0.022</td>
<td>0.563</td>
<td>0.563</td>
</tr>
<tr>
<td>X4</td>
<td>0.128</td>
<td>0.031</td>
<td>0.138</td>
<td>5.606</td>
<td>0.025</td>
<td>0.563</td>
<td>0.563</td>
</tr>
<tr>
<td>X5</td>
<td>0.115</td>
<td>0.053</td>
<td>0.181</td>
<td>3.084</td>
<td>0.028</td>
<td>0.563</td>
<td>0.563</td>
</tr>
</tbody>
</table>

Dependent variables: Art teaching effect
D-W value: 1.736

5 Effective ways of integrating music into the teaching of art education

Through the correlation analysis of music integration and the art teaching effect above, it has been verified that all the five influencing factors selected in this paper have a positive correlation with the art teaching effect. Therefore, the chapter will start from these five dimensions to propose practical
ways of integrating music into art education teaching. The effective ways of integrating music into art education teaching are shown in Figure 2. Incorporating music into art classroom teaching can improve the defects of art teaching by utilizing the beautiful melody of music so that students can better use their imagination and create artworks with a better sense of picture.

![Figure 2. The effective way of music integrated into teaching art](image)

1) Utilizing music to guide students in learning about art

Students may lack a comprehensive understanding of the material, making it difficult for them to appreciate the meaning and charm of the material. If the teacher still follows the traditional teaching method, students will be allowed to create paintings in a state of confusion, which will always limit their knowledge. To solve this problem, the teacher should play music related to the material through multimedia equipment so as to guide the students to learn the relevant knowledge in a more relaxed way.

2) Using music to create teaching situations and mobilize students’ enthusiasm

Teachers need to change their concepts by constantly adjusting the teaching program to develop the development of students’ space and the use of music to create a teaching situation so that students from the music harvest creative inspiration and stimulate the students’ associative ability. Music can be used to introduce the content of the teaching, which can not only revitalize the classroom atmosphere and attract the attention of students but also allow students to understand the specific content of the learning so that the teaching task can be completed efficiently.

3) Exercise students’ appreciation with the help of music

Art is an art discipline. Suppose students only have theoretical knowledge but do not have good aesthetic ability. In that case, they will not be able to find beauty in daily life, experience beauty, or create beauty, which will affect their art learning effect, unable to achieve the teaching goals of art
courses. For this reason, art teachers should incorporate music into their classroom teaching to enhance their students’ aesthetic abilities. For the art classroom, the exercise of students’ insight ability is the focus of teaching. Teachers can use music to help students explore the charm of related artworks so that students can be more detailed in the expression of emotions through painting and appreciate the beauty of the music situation when the emotion is more full and can be well integrated into the creation of this emotion into the painting.

4) Enhance students’ imagination with the help of music

The art classroom provides an opportunity for students to utilize their imagination, and they can portray the things they imagine in their minds through art creation. However, although many students like to imagine, but cannot abstract thought content in a symbolic way to present it, music can provide help for students.

The value of imagination in painting creation cannot be overstated. Teachers should use beautiful music to guide students to associate so that their thinking gets exercise and to create a good teaching atmosphere. For example, when teaching the second-grade art textbook of Zhejiang Art People’s Publishing House, “Standing Origami Animals,” the teacher can introduce the music of “Animals in Music” in the second-grade music textbook of the Humanistic Education Edition in the classroom so that the students can listen to the music while showing their images of the animals through the form of origami.

5) Use music to help students experience a sense of picture.

To create art, teachers must use music to help students experience a sense of image. While students may be curious about new things, they will unconsciously reject stuff they have never touched before based on instinct. Therefore, teachers should pay attention to ensure that the new materials students come into contact with have vitality so that students can create a sense of picture when making paintings, thus enhancing the interest of classroom teaching. In addition, when students develop paintings, teachers should also encourage students to use the material as the theme of association, write a complete story, and then play related music for students, guide students to associate the story in the form of visualization, encourage students to flexibly give play to their associative ability, to create paintings with their characteristics.

6 Conclusion

This paper takes music integration into the art teaching course of a university as an example. It uses the K-means clustering algorithm to explore the integration literacy of art teachers. Then, through multiple regression analysis, the relationship between music integration into art teaching and the effect of art teaching is analyzed, and effective ways of integrating music into art teaching are further proposed. The outcomes are as follows:

1) Teachers’ integrated literacy groups were divided into four categories: conservative, ambivalent, balanced, and transformational. Teachers are most represented by the ambivalent type, which accounts for 47.50%. On the whole, the score for learner-centeredness in teaching concepts was high, and the score for music integration in optimizing music-empowering teaching was high.

2) All five dimensions of music integration in art teaching had a significant positive correlation with art teaching effectiveness (P < 0.05). The art teaching effect is most influenced by the regression coefficients of 0.217 and 0.154 for creating a teaching situation and guiding the
learning of art knowledge. The impact of art teaching is most affected by helping people experience the sense of a picture.

3) This paper assesses the comprehensive quality of teachers and studies the effect of music integration on the effectiveness of art teaching and achieves specific results. However, the research questionnaire sample source is relatively single and did not explore in depth the particular impact of music integration on the effectiveness of art teaching. There are certain limitations and shortcomings in the subsequent investigation, and research needs to be improved and optimized.

Funding:

1. The research on the curriculum system construction of music education major in normal compulsory education under the background of the new curriculum standard of the art of music (no. K23ZG3040190).

2. Research results of the “Three Gorges folk culture and art research workstation” in Chongqing Preschool Education College (2023GZZ-008).

References


