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Construction and Evaluation Method of an Integrated Teaching Model Combining Music Art and Textile Intangible Cultural Heritage for Aesthetic Literacy Enhancement

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ABSTRACT

Aesthetic literacy is an important objective of interdisciplinary education; however, existing teaching approaches often lack systematic integration and quantitative evaluation. To address this issue, this study proposes an integrated teaching model that combines music art with textile-related intangible cultural heritage elements. The model integrates music analysis, textile cultural heritage elements, and interdisciplinary design activities to help students connect musical features with textile-related visual patterns and cultural meanings. A multi-criteria evaluation index system was established to assess aesthetic literacy outcomes, and a hybrid method combining the Analytic Hierarchy Process and fuzzy comprehensive evaluation was used for quantitative analysis. A four-week experiment involving 48 undergraduate students was conducted, including an experimental group and a control group. The results showed that the experimental group achieved a higher overall score than the control group, with scores of 3.97 and 3.41, respectively, representing an improvement of approximately 16.4%. Statistical analysis indicated a significant difference between the two groups. Sensitivity analysis suggested that the evaluation framework remained relatively stable under moderate weight variations. The findings provide preliminary evidence that the proposed model may improve aesthetic perception, cultural understanding, and creative practice ability in interdisciplinary aesthetic education.

KEYWORDS

aesthetic literacy, interdisciplinary education, music art, textile-related intangible cultural heritage, fuzzy comprehensive evaluation

INTRODUCTION

In recent years, aesthetic literacy has received increasing attention in modern education systems because of its important role in fostering perceptual sensitivity, emotional engagement, and creative capacity [1]. Aesthetic

literacy is generally regarded as a multidimensional competence involving perceptual, emotional, and cognitive abilities that contribute to meaningful aesthetic experience and learning processes [2]. In this context, the integration of diverse artistic domains has become an important approach to enriching aesthetic education and promoting interdisciplinary learning [3]. Among various art forms, music art and textile-related intangible cultural heritage provide complementary aesthetic experiences. Textile-related intangible cultural heritage, including embroidery craftsmanship, regional textile motifs, and traditional pattern design, contains rich aesthetic, cultural, and symbolic values that can serve as important educational resources for interdisciplinary aesthetic education [4]. Music, as an auditory art form, has been shown to influence cognitive development, emotional expression, and social interaction [5]. Meanwhile, textile-related visual elements, such as color, pattern, structure, and decorative composition, play an important role in aesthetic perception and evaluation [6]. The integration of auditory and visual modalities through multimodal learning environments has been shown to enhance learning effectiveness and engagement [7]. Therefore, combining music art with textile-related intangible cultural heritage may provide a feasible pathway for improving aesthetic literacy through cross-modal and interdisciplinary learning, while also increasing students' awareness of traditional cultural resources. In this study, the integration between music art and textile-related intangible cultural heritage is based on cross-modal aesthetic learning. Musical features such as rhythm, tempo, and emotional tone are used as perceptual cues to help students interpret textile-related visual characteristics, including pattern repetition, symmetry, decorative rhythm, and color composition. Therefore, the proposed teaching model does not treat music and textile heritage as isolated artistic forms, but emphasizes the construction of perceptual and cultural associations between auditory experience and visual–textile expression. Despite this potential, current aesthetic education practices still face several limitations. First, many teaching approaches remain confined to single disciplines and lack systematic integration across different artistic domains. Second, existing teaching models are often experience-oriented and lack structured frameworks that can be replicated and evaluated. Third, the evaluation of aesthetic literacy is still mainly qualitative and subjective, with insufficient quantitative methods for assessing teaching effectiveness. Although educational technologies and pedagogical models, such as technological pedagogical content knowledge (TPACK), have been proposed to support interdisciplinary teaching [8], there remains a lack of integrated models that combine artistic content with measurable evaluation mechanisms. Furthermore, studies focusing on the integration of music art and textile-related intangible cultural heritage in aesthetic education remain limited, especially in terms of quantitative

evaluation and systematic teaching-model construction. To address these challenges, quantitative decision-making and evaluation methods provide useful tools for modeling and assessment. The Analytic Hierarchy Process (AHP), proposed by Thomas L. Saaty, has been widely used to determine the relative importance of multiple criteria in complex decision-making problems [9]. Fuzzy set theory, introduced by Lotfi A. Zadeh, enables the handling of uncertainty and ambiguity in human judgments [10]. Based on these theories, fuzzy AHP and related methods have been extensively applied in multi-criteria evaluation scenarios [11–13]. In addition, extensions such as fuzzy TOPSIS further enhance evaluation under uncertain information [14], while fuzzy arithmetic approaches provide flexible tools for processing subjective assessments [15]. These methods offer a theoretical and methodological basis for constructing a measurable evaluation framework for aesthetic education. In this study, aesthetic literacy is regarded as a multidimensional learning outcome involving aesthetic perception, cultural understanding, artistic expression, and creative practice, rather than simple classroom satisfaction or learning preference. Therefore, this study proposes an integrated teaching model that combines music art with textile-related intangible cultural heritage elements for aesthetic literacy enhancement. A structured teaching framework is developed to integrate teaching content, instructional methods, and learning experiences. Representative textile-related intangible cultural heritage features, including traditional embroidery patterns and regional textile motifs, are incorporated into interdisciplinary teaching activities and design tasks. Furthermore, a multi-criteria evaluation index system is constructed, and a hybrid evaluation method based on AHP and fuzzy comprehensive evaluation is used to quantitatively assess aesthetic literacy outcomes. An empirical study is conducted to validate the proposed model through comparative analysis. The main contributions of this study are summarized as follows: (1) An integrated teaching model combining music art and textile-related intangible cultural heritage is proposed; (2) A multi-criteria evaluation framework for aesthetic literacy is constructed; (3) A quantitative evaluation method based on AHP and fuzzy comprehensive evaluation is developed; (4) The effectiveness and robustness of the proposed model are preliminarily verified through experimental analysis.

METHODOLOGY

Overall Framework

To systematically integrate music art and textile-related intangible cultural heritage elements into aesthetic education, this study proposes an integrated teaching and evaluation framework. The framework includes three main components: (i) construction of an integrated teaching model, (ii) establishment of a multi-

criteria evaluation index system, and (iii) implementation of a quantitative evaluation method based on the Analytic Hierarchy Process (AHP) and fuzzy comprehensive evaluation. The overall process begins with the design of the integrated teaching model, in which the two artistic domains are combined through structured instructional strategies. The teaching process emphasizes the coordination of auditory and visual modalities, enabling students to develop cross-modal perception, cultural understanding, and aesthetic interpretation. Based on the expected learning outcomes, a hierarchical evaluation index system is then constructed to represent different dimensions of aesthetic literacy. The relative importance of each evaluation indicator is determined using AHP, which is effective for handling complex multi-criteria decision-making problems [9]. To address the uncertainty and subjectivity of human judgment, fuzzy set theory is introduced to transform qualitative evaluations into quantitative results [10]. The integration of AHP and fuzzy evaluation methods has been widely applied in multi-criteria evaluation scenarios [11–13].

Furthermore, fuzzy multi-criteria decision-making approaches, such as fuzzy TOPSIS, have shown applicability in handling imprecise and uncertain information [14,15]. By combining these methods, the proposed framework establishes a closed-loop process linking teaching design, learning outcomes, and quantitative evaluation, thereby improving the objectivity, consistency, and interpretability of aesthetic literacy assessment. The overall integrated teaching and evaluation framework is illustrated in Figure 1.

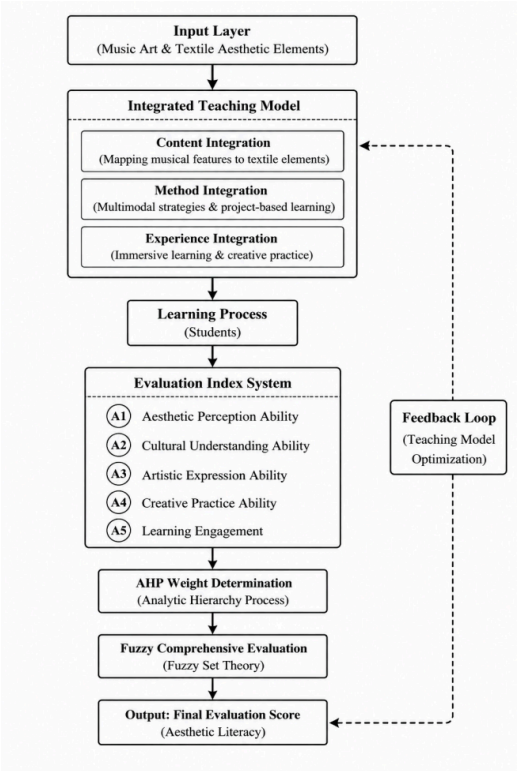

Figure 1. Integrated teaching and evaluation framework

Integrated Teaching Model Construction

To achieve effective integration between music art and textile-related intangible cultural heritage, a structured teaching model is developed with three interconnected layers: content integration, method integration, and experience integration.

First, content integration focuses on establishing relationships between auditory and visual aesthetic elements. Musical characteristics, such as rhythm, tempo, and emotional expression, are mapped to textile-related intangible cultural heritage features, including traditional embroidery patterns, regional textile motifs, structural rhythm, and color composition. Representative cultural elements derived from traditional textile craftsmanship are incorporated into teaching activities to strengthen students' understanding of cultural symbolism and aesthetic meaning. This mapping process helps students connect musical rhythm and emotional expression with textile pattern structures, color composition, and decorative forms during interdisciplinary design tasks.

Second, method integration emphasizes multimodal teaching strategies, including auditory perception, visual analysis, and hands-on design activities. In this study, multimodal learning refers to the coordinated use of auditory materials, visual textile patterns, cultural interpretation, and hands-on design tasks in classroom

teaching, rather than a software-based interactive system. Multimedia learning environments have been shown to improve learning effectiveness by integrating multiple sensory channels [7]. In addition, instructional technologies, such as video-based learning and interactive tools, can further enhance student engagement and comprehension [16]. Project-based learning is adopted to promote active participation and interdisciplinary knowledge construction. Similar approaches have been widely discussed in arts-integrated learning research [17]. Students are encouraged to analyze the relationships between musical structures and textile-related intangible cultural heritage features and then apply these relationships in interdisciplinary design tasks.

Third, experience integration aims to enhance immersive learning and creative practice. Students are guided to generate integrated design outputs by transforming musical features into textile-related visual patterns inspired by traditional embroidery craftsmanship and regional textile culture, thereby improving their aesthetic expression and creative ability. This process may enhance creative thinking and artistic perception while increasing students' awareness of traditional cultural resources. The proposed approach aligns with interdisciplinary teaching frameworks such as technological pedagogical content knowledge (TPACK), which emphasizes the integration of content, pedagogy, and technology in effective teaching [8].

The overall teaching process can be formulated as:

$$D = f(C, M, E) \tag{1}$$

where D represents the teaching outcome, and C , M , and E denote content integration, method integration, and experience integration, respectively. This formulation reflects the dynamic coordination among different components of the teaching model.

Evaluation Index System

To quantitatively assess the effectiveness of the proposed teaching model, a hierarchical multi-criteria evaluation index system is established. The system consists of one target layer, namely overall aesthetic literacy, and five criterion layers representing key dimensions of learning outcomes.

In this study, aesthetic literacy is not defined as simple learning satisfaction or classroom preference. Instead, it is operationalized as a multidimensional learning outcome involving aesthetic perception, cultural understanding, artistic expression, and creative practice. Therefore, the evaluation index system was designed to measure students' observable aesthetic abilities and interdisciplinary creative performance. Learning engage-

ment was included only as a supplementary indicator to reflect participation in the learning process. The five primary evaluation criteria are defined as follows:

A1 Aesthetic perception ability: the ability to recognize and interpret musical rhythm, textile patterns, color relationships, and visual structures;

A2 Cultural understanding ability: the comprehension of cultural meanings embedded in textile-related intangible cultural heritage elements, musical expression, and traditional artistic forms;

A3 Artistic expression ability: the ability to convey aesthetic concepts through coordinated auditory and visual forms, including rhythm-inspired textile pattern expression;

A4 Creative practice ability: the level of innovation and effectiveness demonstrated in interdisciplinary design tasks involving the two artistic domains;

A5 Learning engagement and reflective participation: the degree of active participation, cultural reflection, discussion quality, and task involvement during interdisciplinary aesthetic learning.

Each primary criterion is further decomposed into sub-indicators based on literature review and expert consultation. The indicator system was developed with reference to previous interdisciplinary aesthetic education studies and was refined through expert discussion involving three specialists in art and design education. The final indicator system was determined through expert consensus to ensure both theoretical validity and practical applicability. This hierarchical structure enables a comprehensive and systematic evaluation of aesthetic literacy. The hierarchical evaluation index system is presented in Table 1.

Table 1. Evaluation index system for aesthetic literacy

Target Layer	Criterion Layer	Description
Aesthetic Literacy	A1	Aesthetic perception ability: recognition of musical rhythm, textile patterns, color relationships, and visual structures
	A2	Cultural understanding ability: comprehension of textile-related intangible cultural heritage features, musical expression, and traditional artistic meanings
	A3	Artistic expression ability: expression of aesthetic concepts through coordinated auditory and visual forms
	A4	Creative practice ability: innovation and effectiveness in interdisciplinary design tasks involving music art and textile-related intangible cultural heritage
	A5	Learning engagement: participation, interaction, collaboration, and motivation during learning activities

AHP-Based Weight Determination

The Analytic Hierarchy Process (AHP) is used to determine the weights of the evaluation indicators. The procedure consists of three main steps.

First, a pairwise comparison matrix is constructed based on the judgments of three experts in art and design education using the standard 1–9 Saaty scale, where 1 represents equal importance and 9 represents extreme importance., where 1 represents equal importance and 9 represents extreme importance. To reduce individual bias, the judgments from different experts are aggregated using the geometric mean method.

Second, the weight vector is obtained by normalizing the eigenvector corresponding to the maximum eigenvalue of the comparison matrix. This process generates the relative importance of each evaluation criterion.

Third, a consistency test is conducted to examine the logical reliability of the judgment matrix. The consistency index (CI) and consistency ratio (CR) are calculated as follows:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \tag{2}$$

$$CR = \frac{CI}{RI} \tag{3}$$

where $\lambda_{\max}$ is the maximum eigenvalue, n is the number of indicators, and RI is the random consistency index. A judgment matrix is considered acceptable when $CR < 0.1$ This procedure ensures that the derived weights are not arbitrarily assigned and remain logically consistent and methodologically reliable.

Fuzzy Comprehensive Evaluation Method

Considering the inherent uncertainty and subjectivity in aesthetic evaluation, a fuzzy comprehensive evaluation method is adopted to obtain quantitative assessment results.

First, the evaluation set is defined as:

$$V = \{Verygood, Good, Medium, Poor, Verypoor\} \tag{4}$$

Second, a fuzzy relation matrix R is constructed:

$$R = [r_{ij}] \tag{5}$$

where r_{ij} represents the membership degree of the i -th indicator to the j -th evaluation grade.

Third, the overall evaluation vector is calculated as:

$$B = W \cdot R \tag{6}$$

where W is the weight vector obtained from AHP.

The evaluation vector B is obtained through standard matrix multiplication between W and R , ensuring computational consistency.

Finally, a scoring vector is defined as:

$$S = \{5, 4, 3, 2, 1\} \tag{7}$$

The final evaluation score is calculated as:

$$F = B \cdot S^T \tag{8}$$

This method transforms qualitative assessments into quantitative results, thereby improving the objectivity, comparability, and robustness of evaluation outcomes. The integration of AHP and fuzzy evaluation provides a systematic and effective approach for assessing aesthetic literacy under complex and uncertain conditions [10–13].

EXPERIMENTAL DESIGN AND RESULTS

Participants and Experimental Setup

To evaluate the effectiveness of the proposed integrated teaching model, a controlled comparative experiment was conducted with undergraduate students majoring in design-related disciplines. A total of 48 students participated in the study and were randomly assigned to an experimental group ($n = 24$) and a control group ($n = 24$). The experimental group received the integrated teaching approach combining music art with textile-related aesthetic elements, while the control group followed a conventional single-discipline teaching model. The experiment lasted four weeks, with two sessions per week and each session lasting approximately 90 minutes. Both groups were taught by instructors with comparable teaching experience to reduce potential teaching-related bias. Before the formal experiment, a preliminary assessment of aesthetic

literacy was conducted. The pre-test results showed no statistically significant difference between the experimental and control groups ($p > 0.05$), indicating that the two groups were comparable at baseline. Although the sample size was relatively limited, it was considered acceptable for preliminary validation and consistent with similar exploratory studies in interdisciplinary educational research. The present study should therefore be regarded as an exploratory and preliminary investigation rather than a large-scale educational generalization.

Teaching Implementation

The experimental group adopted the integrated teaching model proposed in Section 2. The teaching process consisted of three main components. First, students were guided to analyze musical features, including rhythm, tempo, melody, and emotional expression. Second, textile-related intangible cultural heritage elements, such as traditional embroidery patterns, regional textile motifs, pattern structure, repetition, and color composition, were introduced. Third, students were required to complete interdisciplinary design tasks by translating musical characteristics into textile-related visual patterns inspired by traditional textile craftsmanship. For example, students transformed musical rhythm patterns into repeated embroidery-inspired visual structures and adjusted color combinations according to the emotional tone of the music.

To further clarify the teaching process, Figure 2 presents representative examples of music-to-textile visual mapping. Musical features, such as rhythm, melody, emotional tone, and dynamics, were transformed into corresponding visual elements, including line rhythm, color composition, pattern density, and decorative form. These mappings provided students with concrete references for completing interdisciplinary design tasks.

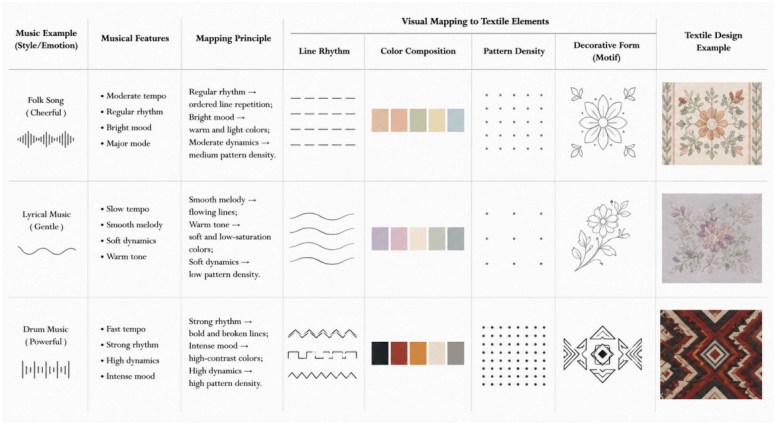

Figure 2. Representative examples of music-to-textile visual mapping

In contrast, the control group followed a traditional teaching approach. Music appreciation and textile design were taught separately without structured integration. Students mainly engaged in music appreciation and basic textile design exercises, with limited emphasis on cross-modal learning, cultural interpretation, or creative transformation.

The detailed teaching implementation process is summarized in Table 2.

Table 2. Teaching implementation process

Week	Experimental Group	Control Group
Week 1	Music rhythm analysis and textile pattern perception	Conventional music appreciation
Week 2	Analysis of embroidery motifs, color composition, and cultural symbolism	Basic textile design exercises
Week 3	Cross-modal mapping between musical emotion and textile visual elements	Independent music and textile activities
Week 4	Interdisciplinary creative design practice and presentation	Conventional assignment and discussion

Data Collection and Evaluation Procedure

At the end of the teaching period, student performance was evaluated using the multi-criteria evaluation index system established in Section 2.3. The evaluation focused on five dimensions: aesthetic perception, cultural understanding, artistic expression, creative practice, and learning engagement. In particular, cultural understanding and creative practice were assessed with attention to students' interpretation and application of textile-related intangible cultural heritage elements. Evaluation data were collected from three sources: expert assessment (three experts in art and design education), instructor evaluation, and student self-assessment. To reduce the influence of subjective preference and the possible novelty effect of the experimental teaching method, the evaluation was not based solely on student self-assessment. Expert and instructor assessments mainly focused on students' design task performance, cultural interpretation, aesthetic analysis, and creative application, rather than simple learning satisfaction. A five-level Likert scale was used, corresponding to the evaluation set:

$$V = \{Verygood, Good, Medium, Poor, Verypoor\} \tag{9}$$

The final evaluation data were obtained by integrating the three sources. Specifically, the scores from experts, instructors, and students were first normalized and then aggregated using arithmetic averaging to construct

the fuzzy relation matrices. This approach reduces individual bias and improves the reliability and objectivity of the evaluation results.

To further verify the internal consistency of the evaluation indicators, Cronbach's alpha coefficient was calculated. The overall Cronbach's alpha value reached 0.872, indicating good reliability and acceptable internal consistency of the evaluation system.

AHP Weight Determination

Based on expert judgments, the weights of the five evaluation criteria were calculated using AHP. The resulting weight vector is as follows:

$$W = (0.24, 0.21, 0.19, 0.18, 0.18) \tag{10}$$

where each element corresponds to aesthetic perception, cultural understanding, artistic expression, creative practice, and learning engagement, respectively.

The pairwise comparison matrix was constructed based on the geometric mean of judgments from three experts in art and design education. The consistency ratio of the judgment matrix was calculated as:

$$CR = 0.064 \tag{11}$$

which satisfies the acceptable consistency requirement of CR < 0.1, indicating that the expert judgments showed acceptable logical consistency and that the resulting weights were considered reliable for subsequent fuzzy evaluation.

$$CR < 0.1 \tag{12}$$

indicating acceptable consistency and logical reliability of the expert judgments.

The calculated weights of the evaluation criteria are presented in Table 3.

Table 3. Weights of evaluation criteria based on AHP

Criterion	Description	Weight
A1	Aesthetic perception	0.24
A2	Cultural understanding	0.21
A3	Artistic expression	0.19

Criterion	Description	Weight
A4	Creative practice	0.18
A5	Learning engagement	0.18

Note: Consistency Ratio (CR) = 0.064 < 0.1.

Fuzzy Comprehensive Evaluation Results

(1) Experimental Group The fuzzy relation matrix for the experimental group is given as follows, where each row corresponds to A1–A5 and each column corresponds to the five evaluation grades:

$$R_1 = \begin{bmatrix} 0.36 & 0.38 & 0.17 & 0.06 & 0.03 \\ 0.28 & 0.46 & 0.15 & 0.08 & 0.03 \\ 0.31 & 0.41 & 0.19 & 0.06 & 0.03 \\ 0.33 & 0.37 & 0.21 & 0.06 & 0.03 \\ 0.35 & 0.36 & 0.18 & 0.08 & 0.03 \end{bmatrix} \tag{13}$$

The comprehensive evaluation vector is calculated as:

$$B_1 = W \cdot R_1 = (0.33, 0.40, 0.18, 0.07, 0.02) \tag{14}$$

The result was obtained through matrix multiplication between the weight vector W and the fuzzy relation matrix R_1 . Using the scoring vector $S = \{5, 4, 3, 2, 1\}$, the final score of the experimental group is:

$$F_1 = 0.33 \times 5 + 0.40 \times 4 + 0.18 \times 3 + 0.07 \times 2 + 0.02 \times 1 = 3.97 \tag{15}$$

(2) Control Group

The fuzzy relation matrix for the control group is:

$$R_2 = \begin{bmatrix} 0.22 & 0.33 & 0.26 & 0.13 & 0.06 \\ 0.18 & 0.31 & 0.30 & 0.16 & 0.05 \\ 0.17 & 0.29 & 0.34 & 0.15 & 0.05 \\ 0.19 & 0.27 & 0.33 & 0.16 & 0.05 \\ 0.24 & 0.29 & 0.28 & 0.14 & 0.05 \end{bmatrix} \tag{16}$$

The comprehensive evaluation vector is calculated as:

$$B_2 = W \cdot R_2 = (0.20, 0.30, 0.31, 0.15, 0.04) \tag{17}$$

Using the same scoring vector $S = \{5, 4, 3, 2, 1\}$, the final score of the control group is:

$$F_2 = 0.20 \times 5 + 0.30 \times 4 + 0.31 \times 3 + 0.15 \times 2 + 0.04 \times 1 = 3.41 \quad (18)$$

Comparative Analysis

The comparative evaluation results of the experimental group and the control group are summarized in Table 4.

Table 4. Comparison of evaluation results between the experimental group and the control group

Group	A1	A2	A3	A4	A5	Final Score
Experimental Group	4.12 ± 0.32	4.05 ± 0.35	3.88 ± 0.31	3.91 ± 0.34	3.96 ± 0.29	3.97 ± 0.34
Control Group	3.52 ± 0.36	3.44 ± 0.38	3.36 ± 0.35	3.40 ± 0.33	3.33 ± 0.37	3.41 ± 0.37

The results show that the experimental group achieved a higher overall score (3.97) compared to the control group (3.41), representing an improvement of approximately 16.4%. These findings suggest that the proposed integrated teaching model has a positive effect on improving students' aesthetic literacy in the short-term teaching experiment.

In terms of specific evaluation dimensions, the experimental group demonstrates notable improvements in aesthetic perception and cultural understanding, which may be associated with the cross-modal integration of auditory and visual elements. Creative practice ability is also improved, as students in the experimental group participated in interdisciplinary design tasks involving music art and textile-related intangible cultural heritage elements. Furthermore, learning engagement appears to increase due to the interactive and project-based characteristics of the teaching model.

To further examine the statistical significance of the observed differences, an independent-samples t-test was conducted. The results indicate that the difference between the experimental group and the control group was statistically significant ($t = 5.47$, $p < 0.001$). In addition, the calculated effect size (Cohen's $d = 1.58$) suggests a relatively strong intervention effect.

These findings provide preliminary evidence supporting the effectiveness of the proposed interdisciplinary teaching model.

Sensitivity Analysis

To examine the robustness of the evaluation model, a sensitivity analysis was conducted by adjusting the weights of the main criteria by $\pm 10\%$, while maintaining normalization of the total weight. Since A1 and A2 had relatively higher weights and showed greater influence on the final evaluation results, they were selected as representative criteria for sensitivity testing. The sensitivity analysis results under different weight adjustment scenarios are presented in Table 5.

Table 5. Sensitivity analysis results under $\pm 10\%$ weight variation

Scenario	Experimental Group Score	Control Group Score
Original weights	3.97	3.41
A1 $+10\%$	4.02	3.45
A1 -10%	3.92	3.37
A2 $+10\%$	4.01	3.44
A2 -10%	3.93	3.38

The results indicate that the ranking between the experimental and control groups remained unchanged under all tested scenarios. For example, when the weight of A1 increased by 10% , the final score of the experimental group changed from 3.97 to 4.02, while decreasing the weight of A1 by 10% resulted in a score of 3.92. Similar limited variations were observed when the weight of A2 was adjusted.

The variation in final scores was limited to within ± 0.08 , indicating that the evaluation results were relatively stable and not overly sensitive to moderate changes in key criterion weights. These findings provide preliminary evidence for the robustness of the proposed evaluation framework, suggesting that the comparative advantage of the integrated teaching model did not depend on a single fixed weight setting.

DISCUSSION

The experimental results indicate that the proposed integrated teaching model had a positive effect on students' aesthetic literacy under the current experimental conditions. Compared with the traditional teaching approach, the experimental group achieved a higher overall evaluation score, and the difference was statistically significant ($p < 0.05$). These findings suggest that integrating music art with textile-related intangible cultural heritage elements may provide an effective pathway for interdisciplinary aesthetic education. In the present study, aesthetic literacy was not evaluated merely through students' learning satisfaction or classroom preference, but mainly through observable abilities related to aesthetic perception, cultural understanding,

artistic expression, and interdisciplinary creative practice. The observed improvement may be attributed to the structured design of the teaching model, which integrates teaching content, instructional methods, and learning experiences to support cross-modal aesthetic learning and cultural understanding.

From the perspective of specific evaluation dimensions, relatively greater improvements were observed in aesthetic perception and cultural understanding. The cross-modal association between musical features, such as rhythm and emotional expression, and textile-related intangible cultural heritage elements, including traditional embroidery patterns, regional textile motifs, pattern repetition, and color composition, may help students establish perceptual connections across different sensory domains. This process appears to improve their understanding of aesthetic relationships and cultural meanings. These findings are generally consistent with previous studies suggesting that music contributes to cognitive and emotional development [5], while visual elements such as color and pattern influence aesthetic perception and evaluation [6]. The integration of auditory and visual modalities also aligns with multimodal learning theory, which emphasizes the role of multiple sensory channels in improving learning effectiveness and engagement [7].

The improvement in creative practice ability further reflects the potential value of the proposed model. In the experimental group, students completed interdisciplinary design tasks by transforming musical characteristics into textile-related visual forms inspired by traditional textile craftsmanship and cultural motifs. Compared with the control group, in which learning tasks were relatively independent, the integrated approach provided a more interactive and interdisciplinary learning environment. This process may encourage students to combine artistic perception, cultural interpretation, and creative thinking in practical design activities. The findings are also consistent with interdisciplinary educational frameworks such as technological pedagogical content knowledge (TPACK), which emphasizes the integration of content, pedagogy, and technology in teaching practice [8].

In addition, active and reflective learning engagement appeared to be higher in the experimental group. The use of multimedia tools, project-based learning strategies, and interactive activities may have contributed to increased participation and collaborative learning. By introducing textile-related intangible cultural heritage elements into classroom tasks, students were exposed to both artistic and cultural materials and were encouraged to explore the relationship between traditional craftsmanship and contemporary design practice. Previous studies have shown that multimedia and interactive learning environments can positively influence learner motivation and engagement [16]. The findings of this study provide preliminary evidence that inte-

grating multiple artistic forms and cultural resources may contribute to a more engaging learning environment, which is generally consistent with arts-based interdisciplinary education research [3].

From a methodological perspective, the combination of AHP and fuzzy comprehensive evaluation provides a relatively systematic framework for assessing aesthetic literacy. AHP determines indicator weights based on structured expert judgment, while fuzzy evaluation helps address uncertainty and subjectivity in human assessments [9-13]. Compared with purely qualitative evaluation approaches, the proposed method transforms subjective judgments into quantitative results, thereby improving the comparability and interpretability of evaluation outcomes. In addition, the sensitivity analysis results indicate that the evaluation framework remained relatively stable under moderate weight variations, providing preliminary support for the robustness of the evaluation model.

Nevertheless, several limitations should be acknowledged. First, the sample size was relatively small, which may limit the generalizability of the findings. Second, although multiple evaluation sources were integrated, the assessment process still relied partly on subjective judgments. In addition, the possible influence of the novelty effect or Hawthorne effect could not be completely excluded. Future studies should introduce more objective indicators, such as blind evaluation of students' design works, pre- and post-task performance scoring, classroom behavior observation, and delayed follow-up tests. Third, the current experiment mainly focused on short-term teaching outcomes and did not examine the long-term development of aesthetic literacy or cultural identity. Since aesthetic literacy and cultural appreciation are long-term developmental processes, longer intervention periods and follow-up assessments are needed to further verify the sustainability of the proposed teaching model. In addition, advanced digital technologies, such as virtual reality and intelligent interactive systems, were not incorporated into the present teaching model.

Future research can be extended in several directions. Larger-scale experiments involving more diverse participant groups should be conducted to improve the reliability and generalizability of the findings. More objective evaluation approaches, such as behavioral analysis or physiological measurement techniques, may also be introduced to complement subjective assessments. Furthermore, future studies may explore the integration of emerging digital technologies into interdisciplinary aesthetic education and textile intangible cultural heritage learning. Longitudinal studies are also needed to examine the long-term impact of integrated teaching models on aesthetic literacy development and cultural understanding [18].

CONCLUSION

This study proposed an integrated teaching model that combines music art with textile-related intangible cultural heritage elements for aesthetic literacy enhancement. By integrating music analysis, textile cultural heritage elements, and interdisciplinary design activities, a structured interdisciplinary teaching framework was established to support cross-modal learning, cultural understanding, and creative practice. In addition, a multi-criteria evaluation framework based on the Analytic Hierarchy Process (AHP) and fuzzy comprehensive evaluation was developed to quantitatively assess aesthetic literacy outcomes.

The experimental results indicate that the proposed teaching model showed preliminary positive effects on students' aesthetic literacy under the current experimental conditions. Compared with the traditional teaching approach, the experimental group achieved higher evaluation scores in several dimensions, including aesthetic perception, cultural understanding, artistic expression, creative practice ability, and learning engagement. These evaluation dimensions mainly reflected observable aesthetic and creative abilities rather than simple classroom preference or learning satisfaction. The overall evaluation score of the experimental group reached 3.97, which was higher than that of the control group (3.41). Statistical analysis further suggested that the observed difference was significant ($p < 0.05$). These findings provide preliminary evidence that integrating music art with textile-related intangible cultural heritage elements may contribute to interdisciplinary aesthetic education.

From the perspective of educational methodology, the proposed framework demonstrates several potential advantages. First, the integration of auditory and visual artistic forms may enhance students' cross-modal perception and interpretative ability. Second, the incorporation of textile-related intangible cultural heritage resources may strengthen students' awareness and understanding of traditional cultural elements. Third, the combination of AHP and fuzzy comprehensive evaluation transforms subjective judgments into quantitative and comparable results, thereby improving the interpretability of evaluation outcomes. The sensitivity analysis further indicates that the evaluation framework remained relatively stable under moderate weight variations.

Nevertheless, several limitations remain. The sample size of the current study was relatively limited, and the experimental period mainly reflected short-term teaching effects. In addition, part of the evaluation process still relied on subjective assessment from experts and participants. Future research should therefore involve larger and more diverse participant groups, introduce more objective evaluation indicators, and further

explore the integration of emerging digital technologies, such as virtual simulation and intelligent interaction systems, into interdisciplinary aesthetic education and textile intangible cultural heritage learning.

Overall, this study provides a relatively systematic and quantitative approach for integrating music art and textile-related intangible cultural heritage into aesthetic education. The proposed framework may offer reference value for interdisciplinary teaching research and the development of aesthetic literacy education involving cultural heritage resources.

Availability of Data and Materials

The datasets used and/or analysed during the current study were available from the corresponding author on reasonable request.

Author Contributions

Yizhi Bai designed, collected and analyzed the data, and drafted the manuscript. Yizhi Bai conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Yizhi Bai participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

The author declares no conflict of interest.

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Ethics Approval and Consent to Participate

This survey was conducted in compliance with Ethics Committee of Shangqiu Normal University. Participants were informed of the study's purpose and data usage prior to participation, and responses were collected anonymously. No personally identifiable information was stored.

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Not applicable.

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