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# Dimension construction, scale development, and assessment application of junior high school students' musical aesthetic perception ability

*Jingyuan Wang[1*], Lijun Cai[1]*

[1]School of Music, Soochow University, Suzhou, China

*Corresponding Author. Email: jywangjingyuan@stu.suda.edu.cn

**Abstract.** Against the background of the Chinese government's advocacy for deepening the reform of aesthetic education evaluation, this study focuses on musical aesthetic perception ability. It aims to enrich aesthetic education evaluation tools applicable to Chinese students and promote the diversification of evaluation methods. First, the study sorts out relevant definitions of aesthetic perception and existing assessment tools. Then, based on the perspective of cognitive neuroaesthetics, it constructs the dimensions of junior high school students' musical aesthetic perception ability, and accordingly develops the Scale for Assessing Junior High School Students' Musical Aesthetic Perception Ability. Through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), the scale shows good reliability and validity (23 items, Cronbach's $\alpha$= 0.916, RMSEA = 0.064), verifying the six-dimensional theoretical hypothesis of musical aesthetic perception ability. At the application level, a survey conducted on junior high school students in Suzhou reveals significant differences in musical aesthetic perception ability among groups with different genders, grades, and musical learning experiences. This provides a reference basis for the assessment and cultivation of musical aesthetic perception ability.

**Keywords:** musical aesthetic perception ability, scale development, junior high school students

## 1. Introduction

In recent years, the Chinese government has attached unprecedented importance to aesthetic education. In December 2023, the Notice on the Comprehensive Implementation of the School Aesthetic Education Immersion Action issued by the Ministry of Education of the People's Republic of China clearly proposed to "deepen the reform of aesthetic education evaluation, give play to the leading and guiding role of evaluation, and explore diversified educational evaluation methods". This policy orientation highlights the urgency of transforming aesthetic education evaluation from a single form to multi-dimensional coordination.

Currently, aesthetic education evaluation mainly adopts a combination of artistic quality assessment and performance assessment. Although it has formed a relatively mature system for examining the mastery of knowledge and skills, there are still deficiencies in the assessment of in-depth literacy and ability. "Aesthetic perception" is the fundamental literacy for art learning and ranks first in the 2022 Revised Compulsory Education Art Curriculum Standards. Unlike cognitive ability that focuses on logical reasoning, aesthetic perception and experience are fields where individual response differences are relatively large [1]. This raises the question: Can aesthetic perception ability be measured by a single paper-and-pencil test? Existing studies have not reached a consensus on the composition of musical aesthetic perception ability, and there is a lack of measurement tools for musical aesthetic perception ability targeting junior high school students. Among them, Chinese studies mostly focus on the theoretical construction of concepts and lack the support of empirical research; international studies have formed relatively rich measurement methods for aesthetic ability, but they mainly target the broad field of art, and the measurement of aesthetic ability specific to music is still insufficient. For example, Diessner et al. divided aesthetic experience into four dimensions: perception, physiological arousal, emotion, and transcendence [2], covering the fields of art, nature, and morality; Wanzer et al. developed the Aesthetic Experience Questionnaire for the field of art, which is divided into four dimensions: emotion, culture, perception, and understanding [3]. However, the measurement of musical ability mainly uses standardized tests, focusing on evaluating basic auditory perception abilities such as pitch and rhythm. For instance, the Seashore Measures of Musical Talents assesses basic musical perception ability from five dimensions: pitch, loudness, rhythm, duration, and timbre; the Gordon Musical Aptitude Profile expands the measurement scope to comprehensive abilities such as musical perception, memory, and sense of rhythm.

These standardized test tools provide an important basis for the prediction and selection of musical talent, but they are insufficient to examine individuals' subjective musical experience and emotional responses. In one study, CHIN et al. pointed out that tests are mainly used to evaluate individuals' auditory perception, discrimination, and processing abilities, while the ability to respond to and understand music goes beyond these scopes [4]. In short, tests are difficult to capture the advanced cognitive and emotional processes involved in music understanding and aesthetic experience. In contrast, scales adopt a self-report method, which is more conducive to collecting information on how people perceive and respond to various emotions in music, including emotional resonance, physiological reactions, and imagery association. Therefore, the evaluation of musical aesthetic perception ability should not be limited to the form of tests, but should highlight its "aesthetic" characteristics and be supplemented by more subjective scales.

## 2. Theoretical construction and initial scale development

### 2.1. Definition of junior high school students' musical aesthetic perception ability

The measurement of musical aesthetic perception ability is inseparable from an operational definition and a clear conceptual scope. Currently, definitions of musical aesthetic perception can be roughly divided into two categories. The first category of definitions tends to "beauty lies in the object", holding that there is a series of specific "beautiful" characteristics that can be perceived by people. For example, Haanstra proposed that aesthetic perception is the cognition of the aesthetic characteristics of artistic objects [5]; China's Art Curriculum Standards also point out that aesthetic perception is the ability to discover, feel, recognize, and respond to the characteristics of beauty as well as their significance and functions. The second category of definitions tends to "beauty lies in the subject", holding that "beauty" is a kind of feeling and response that people obtain when listening to music. For example, Leonhard pointed out that musical aesthetic perception refers to the ability to have a keen and strong response to the expressive connotation of music, which means being able to capture elements such as emotions and artistic conceptions contained in music [6]; Du believed that perception ability is the initial aesthetic ability, which focuses on the appearance of the object and achieves sensory pleasure [7]. To define a clear measurement scope for musical aesthetic perception ability, further questions need to be addressed: What are the differences between musical aesthetic perception ability, musical ability, and musical perception ability? How to highlight the "aesthetic" characteristics?

According to traditional musical aesthetics theory, when listening to music, the relationship between humans and music can be either aesthetic or cognitive [8]. For example, when listening to music during work analysis, we can distinguish the melody and musical form of the music, and at this time, we are in a cognitive relationship rather than an aesthetic one. If musical aesthetic perception is considered different from musical perception, then the measurement of aesthetic feeling should also be different from the measurement of musical element identification, thereby highlighting the "aesthetic" characteristics. From this perspective, we take cognitive neuroaesthetics as the logical starting point: beauty is a subjective experience generated by the human brain, and there is no objective entity of beauty independent of the subject [9]. The identification of musical elements and musical expressive characteristics is an indirect reflection of aesthetic ability, while the subjective responses such as emotions and imagery triggered by music are the core part of aesthetic experience. Based on this, this study defines musical aesthetic perception ability as the ability of individuals to obtain aesthetic pleasure when listening to music.

Junior high school students are in adolescence aged 13-15. Studies have shown that their physiological auditory perception level is not significantly different from that of adults [10]. The core of junior high school students' musical aesthetic perception ability is "aesthetic perception", with the subject being "junior high school students" and the interactive object being "music". "Aesthetic" indicates that this ability is directly related to the acquisition of aesthetic pleasure, thereby excluding abilities suitable for test evaluation such as musical element identification and musical form analysis. In addition, perception, experience, and response in daily psychological activities are often closely connected and interact with each other [11]. For example, when hearing cheerful music, we will have a pleasant experience and unconsciously want to dance or smile. Perception, experience, and response occur almost simultaneously and are difficult to separate. Aesthetic response is based on perception, but perception does not necessarily lead to aesthetic pleasure. Therefore, "perception" here is not equivalent to the psychological process of perception in psychology, but refers to listening and appreciation, thereby distinguishing it from the aesthetic ability in the process of performance and creation.

### 2.2. Dimensions of junior high school students' musical aesthetic perception ability

In terms of dimension construction, the brain regions activated by aesthetic responses provide a basis for the dimensions of musical aesthetic perception ability. Aesthetic experience involves the activation of multiple functional brain regions, including the external perception and motor system, emotional system, reward system, and advanced cognitive system [12]. These brain regions are related to emotion, understanding, imagination, and reflection, and their activation level is positively correlated with individuals' subjective evaluation of beauty. At the same time, when experiencing the beauty of music, individuals are often

accompanied by subjective feelings related to emotion, imagination, and meaning. Thus, the highly abstract concept of "aesthetic pleasure" can be embodied as a comprehensive experience composed of emotion, association, understanding, and other elements.

Current scales related to aesthetic ability and musical ability cover some common fields (see Table 1). According to the definition of this study, dimensions such as "listening accuracy" and "pattern and structure" related to musical expressive elements and characteristics are excluded, while other dimensions are corresponding to subjective experiences related to aesthetic pleasure, forming an initial five-dimensional structure of junior high school students' musical aesthetic perception ability, including musical aesthetic concept, musical aesthetic emotion, musical aesthetic association, musical aesthetic willingness, and musical aesthetic behavior. Among them, musical aesthetic concept refers to the cognition and attitude towards the "beauty" of music. Aesthetics is regulated by top-down cognitive factors, so aesthetic concepts will also affect the aesthetic experience during music listening [13]. Musical aesthetic emotion refers to the emotion experienced when listening to music. This dimension exists in almost all aesthetic-related scales, indicating that emotion is the core of aesthetic experience. Musical aesthetic association refers to the spontaneous association of other sensory experiences (such as vision, taste, and smell) when listening to music, which has particularity in terms of art categories. Musical aesthetic willingness refers to an individual's subjective desire to appreciate music, which appears in the APES scale. Musical aesthetic behavior refers to the behavior of individuals actually participating in music-related activities, which is regarded as one of the emotional responses to beauty [14] and appears in the subscales of AERA and MUSEBAQ. Among the five dimensions, aesthetic concept occurs before music listening, aesthetic emotion and aesthetic association occur during listening, and aesthetic willingness and aesthetic behavior occur after listening, covering the entire process of musical aesthetic perception.

**Table 1.** Scales related to aesthetic perception and musical ability

| Author/Year of Publication | Scale Name | Measurement Field | Measurement Dimensions | Number of Items |
|---|---|---|---|---|
| Dan et al., 2024 | Aesthetic Competence Scale (ACS) | Visual art, music, literature, and film | 1. Liking<br>2. Appreciation | 20 |
| Schlotz et al., 2021 | Aesthetic Response Assessment (AERA) | Art | 1. Aesthetic appreciation (cognitive emotion)<br>2. Intense aesthetic experience (participatory emotion)<br>3. Creative behavior | 14 |
| Diessner et al., 2008 | Engagement with Beauty Scale (EBS) | Nature, art, morality | 1. Perception or cognition<br>2. Physiological arousal<br>3. Conscious emotion<br>4. Transcendence or spirituality | 14 |
| Bostech et al., 2021 | Aesthetic Perception and Experience Scale (APES) | Literature, music, film, art | 1. Wholeness and perfection<br>2. Pattern and structure<br>3. Simplicity and coherence<br>4. Complexity and entropy<br>5. Reactivity and sensitivity<br>6. Motivation and will | 140 |
| CHIN et al., 2018 | Musical Ability Subscale of MUSEBAQ | Music | 1. Emotional sensitivity to music<br>2. Listening accuracy<br>3. Musical memory and imagery<br>4. Personal engagement with music | 28 |

## 2.3. Development and revision of the preliminary test questionnaire

Based on the above theoretical construction and combined with the operational definition of each factor, 5-7 initial items were developed for each dimension according to their typical psychological characteristics, forming the preliminary version of the Scale for Assessing Junior High School Students' Musical Aesthetic Perception Ability with 32 items. According to the comments and suggestions of three music education scholars, items with similar or repeated meanings were merged, and ambiguous expressions were deleted or revised. Finally, an initial scale with 26 items was determined. Each item was scored using a 5-point Likert scale: for the aesthetic concept dimension, the options ranged from "Strongly Disagree" to "Strongly Agree"; for other dimensions, the options ranged from "Never" to "Always". The total score range of the entire scale is 25-125 points. The average score of each dimension is the sub-score, and a higher score indicates a higher level of musical aesthetic

perception ability. In addition to the scale, the overall questionnaire also includes four background information questions to collect demographic data.

## 3. Exploration and verification of the structure of junior high school students' musical aesthetic perception ability

### 3.1. Research subjects and procedures

#### 3.1.1. Research subjects

For the preliminary test questionnaire, cluster sampling was adopted. A total of 230 students from 4 classes were randomly selected from a junior high school in Suzhou, China, as the preliminary test sample. After collection, 3 invalid questionnaires were excluded, and 227 valid questionnaires were retained for exploratory factor analysis. Among them, there were 103 males and 124 females. For the formal questionnaire, convenience sampling was adopted. A total of 498 junior high school students in Suzhou were surveyed. After collection, invalid questionnaires were excluded, and 458 valid questionnaires were retained. Among them, there were 222 males and 236 females; 133 were in the first grade of junior high school, 182 in the second grade, and 143 in the third grade. The data were used for confirmatory factor analysis and reliability-validity analysis.

#### 3.1.2. Research procedures

The questionnaire filling was presided over by the researchers, or conducted by school teachers under the guidance of the researchers in accordance with unified instructions. Participants were informed that the questionnaire would be filled out anonymously and that they needed to provide true answers. They were also asked to complete all questions within the specified time as much as possible. SPSS 26.0 was used for data analysis.

### 3.2. Item analysis

Item analysis was conducted using the 227 valid data obtained from the preliminary test questionnaire. According to the critical ratio method and item-total correlation analysis method, the top 27% and bottom 27% of the scores on the junior high school students' musical aesthetic perception ability assessment questionnaire were taken as the high-score group and low-score group, respectively. An independent-samples t-test was conducted on the scores of the two groups on each item. The results showed that there were significant differences between the high-score group and the low-score group in all items ($p < 0.05$), indicating that all items had good discriminability. The item-total correlation analysis found that the correlation between the item "Music makes me feel sad" and the total score was 0.236, which was lower than the minimum standard of 0.3. After deleting this item, the correlation coefficients between each item and the total score ranged from 0.324 to 0.745.

### 3.3. Exploratory factor analysis

Exploratory factor analysis was conducted on the preliminary test questionnaire. First, the reliability analysis results showed that the Kaiser-Meyer-Olkin (KMO) value was 0.885, and the approximate chi-square value of Bartlett's test of sphericity was 3889.270 ($df = 276$, $p < 0.001$), reaching an extremely significant level. This indicates that there are common factors in the correlation matrix of the data group, which is suitable for factor analysis.

Subsequently, Principal Component Analysis (PCA) was used to extract common factors, and the initial factor loading matrix was obtained. Then, Varimax with Kaiser normalization was used to obtain the rotated factor loading matrix. The questionnaire items were screened according to the criteria of item loading > 0.40, communality > 0.40, and factor loadings being similar across two or more factors. Finally, two items—"Music makes me associate with some words" and "Music makes me associate with some scenes"—were excluded, and 22 items were retained. Factor analysis was conducted again on the remaining items. Based on the criterion of eigenvalue greater than 1 and combined with the scree plot, 6 factors were determined. The cumulative variance explained after rotation was 75.876%. Among them, the factor originally hypothesized as "musical aesthetic emotion" was split into two factors. The specific item loadings and communalities are shown in Table 2.

**Table 2.** Factor loadings of the scale for assessing junior high school students' musical aesthetic perception ability (rotated factor loading coefficient table)

| Item Name | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Communality |
|---|---|---|---|---|---|---|---|
| Appreciating music is an aesthetic way | 0.814 | | | | | | 0.752 |
| Appreciating music requires concentration | 0.742 | | | | | | 0.639 |
| Appreciating music can enrich life | 0.850 | | | | | | 0.814 |
| Appreciating music can improve one's aesthetic level | 0.836 | | | | | | 0.815 |
| When appreciating music, I notice the beauty in it | 0.800 | | | | | | 0.791 |
| Music makes me feel happy | | 0.831 | | | | | 0.848 |
| Music cheers me up | | 0.764 | | | | | 0.790 |
| When appreciating a musical work, I feel positive emotions such as happiness and tranquility | | 0.795 | | | | | 0.793 |
| Music makes me feel chills | | | 0.881 | | | | 0.803 |
| When appreciating a musical work, I feel feelings such as awe, fear, or shock | | | 0.781 | | | | 0.687 |
| Music makes me associate with some paintings | | | | 0.760 | | | 0.742 |
| Music makes me associate with some smells | | | | 0.862 | | | 0.908 |
| Music makes me associate with the taste of some foods | | | | 0.893 | | | 0.894 |
| I want to understand the creative background of musical works | | | | | 0.814 | | 0.802 |
| I want to understand the life story of the composer | | | | | 0.811 | | 0.774 |
| I want to understand the style type of musical works | | | | | 0.848 | | 0.813 |
| I want to understand other musical works of the same style | | | | | 0.765 | | 0.692 |
| I want to understand aesthetic knowledge related to music | | | | | 0.712 | | 0.733 |
| Attend concerts in concert halls | | | | | | 0.688 | 0.590 |
| Perform or sing musical works | | | | | | 0.616 | 0.582 |
| Join music-related clubs | | | | | | 0.848 | 0.754 |
| Attend music-related lectures | | | | | | 0.848 | 0.789 |
| Create or adapt musical works | | | | | | 0.786 | 0.664 |
| Rotation Method: Varimax with Kaiser normalization | | | | | | | |

Exploratory factor analysis showed that the 5 items of the first factor were all from the "musical aesthetic concept" factor in the theoretical model. The second and third factors were split from the same factor "musical aesthetic emotion" in the initial construct. Through literature review, it was found that there may be differences between the relatively positive daily aesthetic experience and another part of more intense aesthetic experience. For example, feelings such as "being moved", "awe", and "sublime" are considered peak aesthetic experiences, often accompanied by subjective feelings such as chills, touch, and awe, and usually occur in concert settings [15]. It can be seen that aesthetic emotion can be more specifically divided into two aspects: general aesthetic pleasure and peak aesthetic experience. Therefore, the second factor was named "musical aesthetic pleasure experience" according to the attributes of the descriptive words. The third factor, which includes words related to peak aesthetic experience such as chills and shock, was named "intense musical aesthetic experience". The fourth factor had 3 items, all from the "musical aesthetic association" factor in the initial questionnaire; the fifth factor had 5 items, all from the "musical aesthetic willingness" factor in the initial questionnaire; the sixth factor had 5 items, all from the "musical aesthetic behavior" factor in the initial questionnaire.

## 3.4. Reliability analysis

Internal consistency reliability (Cronbach's $\alpha$ coefficient) and split-half reliability (Spearman-Brown correction coefficient) were used for testing. The results showed that the internal consistency reliability coefficients of each dimension of the scale ranged from 0.79 to 0.907, and the α coefficient of the total scale reached 0.916 (see Table 3). The split-half reliability coefficients of each dimension ranged from 0.767 to 0.918, and the split-half reliability of the total scale was 0.765 (> 0.7). This indicates that the scale has ideal measurement stability and internal consistency, and is suitable for evaluating junior high school students' musical aesthetic perception ability.

**Table 3.** Analysis results of reliability coefficients of each dimension of the scale

| Factor | Cronbach's $\alpha$ Coefficient | Split-Half Coefficient (Spearman-Brown Coefficient) |
|---|---|---|
| Musical Aesthetic Concept | 0.895 | 0.904 |
| Musical Aesthetic Pleasure Experience | 0.852 | 0.842 |
| Intense Musical Aesthetic Experience | 0.79 | 0.767 |
| Musical Aesthetic Association | 0.907 | 0.918 |
| Musical Aesthetic Willingness | 0.907 | 0.861 |
| Musical Aesthetic Behavior | 0.832 | 0.855 |

## 3.5. Confirmatory factor analysis

The revised junior high school students' musical aesthetic perception ability included 6 dimensions with a total of 23 items. The test was distributed again, and the collected data were tested. After the first test, the item "Perform or sing musical works" with low convergent validity was deleted, and the remaining 22 items were retained. Among the fitting indexes of the final model, the chi-square to degrees of freedom ratio ($\chi^2/df$) was 2.870, CFI > 0.9, RMSEA < 0.10, and TLI > 0.9. Multiple indexes reached the level of a good-fitting model (see Table 4), indicating that the dimension construction of the model is reasonable.

**Table 4.** Fitting results of confirmatory factor analysis

| TLI | *p* | Chi-Square to Degrees of Freedom Ratio ($\chi^2/df$) | GFI | RMSEA | SRMR | CFI |
|---|---|---|---|---|---|---|
| 0.930 | 0.000 | 2.870 | 0.888 | 0.064 | 0.055 | 0.940 |

## 3.6. Convergent validity and discriminant validity analysis

The evaluation of the scale's validity mainly adopted content validity and construct validity. Content validity was established by logically analyzing propositions or judging the rationality of the test. During the research process, the refined components of junior high school students' musical aesthetic perception ability and their corresponding items (after revision) were recognized by three experts in the field of music education, indicating that the scale for junior high school students' musical aesthetic perception ability has high content validity.

Convergent validity was evaluated using Average Variance Extracted (AVE) and Composite Reliability (CR). The analysis results showed that the AVE values of the six factors all exceeded 0.5, and the CR values were all not less than 0.7, indicating that the scale has good convergent validity (see Table 5). Discriminant validity was analyzed using Pearson correlation and the square root of AVE. The results showed that the square root of AVE of all dimensions was greater than the maximum absolute value of the correlation coefficient between factors, indicating that the scale has good discriminant validity in each dimension (see Table 6).

**Table 5.** Convergent validity indicators

| Factor | Average Variance Extracted (AVE) | Composite Reliability (CR) |
|---|---|---|
| Musical Aesthetic Concept | 0.653 | 0.902 |
| Musical Aesthetic Pleasure Experience | 0.673 | 0.860 |
| Intense Musical Aesthetic Experience | 0.566 | 0.796 |
| Musical Aesthetic Association | 0.778 | 0.913 |
| Musical Aesthetic Willingness | 0.664 | 0.908 |
| Musical Aesthetic Behavior | 0.574 | 0.842 |

**Table 6.** Discriminant validity indicators

| Factor | Musical Aesthetic Concept | Musical Aesthetic Pleasure Experience | Intense Musical Aesthetic Experience | Musical Aesthetic Association | Musical Aesthetic Willingness | Musical Aesthetic Behavior |
|---|---|---|---|---|---|---|
| Musical Aesthetic Concept | 0.808 | | | | | |
| Musical Aesthetic Pleasure Experience | 0.549 | 0.820 | | | | |
| Intense Musical Aesthetic Experience | 0.155 | 0.238 | 0.753 | | | |
| Musical Aesthetic Association | 0.373 | 0.444 | 0.316 | 0.882 | | |
| Musical Aesthetic Willingness | 0.484 | 0.478 | 0.214 | 0.551 | 0.815 | |
| Musical Aesthetic Behavior | 0.272 | 0.292 | 0.184 | 0.439 | 0.489 | 0.758 |

Note: The blue numbers on the diagonal are the square roots of AVE

## 4. Assessment application of junior high school students' musical aesthetic perception ability

### 4.1. Overview of sample data

The samples in the assessment application stage were from Jiangsu Province, China. A total of 458 valid questionnaires were collected. The basic information of the samples is shown in Table 7.

**Table 7.** Statistical table of basic sample information

| Category | Option | Frequency | Percentage (%) | Total |
|---|---|---|---|---|
| Gender | Male | 220 | 48.03 | 458 |
| | Female | 238 | 51.96 | |
| Grade | First grade of junior high school | 132 | 28.95 | 458 |
| | Second grade of junior high school | 183 | 39.69 | |
| | Third grade of junior high school | 143 | 31.36 | |
| Extracurricular musical instrument learning | Yes | 233 | 51.32 | 458 |
| | No | 225 | 48.68 | |
| Years of instrument learning ($n$ = 233) | 1-3 years | 81 | 34.76 | 233 |
| | 4-5 years | 56 | 24.03 | |
| | 6-7 years | 45 | 19.31 | |
| | More than 7 years | 51 | 21.89 | |

### 4.2. Results of descriptive statistical analysis

As shown in Table 8, the overall score of junior high school students' musical aesthetic perception ability was above the medium level, with an average score of 72.17 points (standard deviation 15.709). By converting the total score of each dimension into a 100-point scale, it was found that the score of the musical aesthetic concept dimension was the highest (84.14 points), followed by the musical aesthetic pleasure experience (82.46 points); the score of the musical aesthetic behavior dimension was the lowest (37.57 points), reflecting the relative weakness in the practical aspect of aesthetics.

**Table 8.** Descriptive statistics of each dimension of musical aesthetic perception ability

| Factor | Mean | Converted Mean (100-point scale) | Standard Deviation (SD) |
|---|---|---|---|
| Musical Aesthetic Concept | 21.035 | 84.14 | 3.838 |
| Musical Aesthetic Pleasure Experience | 12.368 | 82.46 | 2.471 |
| Intense Musical Aesthetic Experience | 8.007 | 53.38 | 3.137 |
| Musical Aesthetic Association | 8.149 | 54.33 | 3.841 |
| Musical Aesthetic Expectation | 15.094 | 60.38 | 5.493 |
| Musical Aesthetic Behavior | 7.513 | 37.57 | 3.778 |

## 4.3. Results of group difference statistical analysis

### 4.3.1. Gender difference analysis

The independent-samples t-test showed (see Table 9) that there was an extremely significant difference in musical aesthetic perception ability between males and females ($t$ = -3.216, $p$ < 0.01). The score of females (74.43 ± 15.51 points) was significantly higher than that of males (69.74 ± 15.60 points). From the perspective of dimensions, females were significantly better than males in the four dimensions of musical aesthetic concept, musical aesthetic association, musical aesthetic expectation, and musical aesthetic behavior, while there were no significant gender differences in musical aesthetic pleasure experience and intense musical aesthetic experience.

**Table 9.** Gender difference analysis of each dimension of musical aesthetic perception ability

| Factor | Male ($n$ = 220) (M ± SD) | Female ($n$ = 236) (M ± SD) | $t$ | $p$ |
|---|---|---|---|---|
| Musical Aesthetic Perception Ability | 69.74 ± 15.60 | 74.43 ± 15.51 | -3.216 | 0.001** |
| 1. Musical Aesthetic Concept | 20.52 ± 3.79 | 21.51 ± 3.83 | -2.772 | 0.006** |
| 2. Musical Aesthetic Pleasure Experience | 12.21 ± 2.61 | 12.51 ± 2.33 | -1.292 | 0.197 |
| 3. Intense Musical Aesthetic Experience | 7.84 ± 2.99 | 8.16 ± 3.27 | -1.089 | 0.277 |
| 4. Musical Aesthetic Association | 7.64 ± 3.95 | 8.63 ± 3.68 | -2.772 | 0.006** |
| 5. Musical Aesthetic Expectation | 14.41 ± 5.68 | 15.73 ± 5.24 | -2.588 | 0.010* |
| 6. Musical Aesthetic Behavior | 7.12 ± 3.93 | 7.88 ± 3.59 | -2.164 | 0.031* |
| | * $p$ < 0.05 ** $p$ < 0.01 | | | |

### 4.3.2. Grade difference analysis

One-way Analysis of Variance (ANOVA) showed (see Table 10) that there was an extremely significant difference in musical aesthetic perception ability among different grades ($F$ = 13.004, $p$ < 0.001). Among them, there were significant grade differences in the four dimensions of musical aesthetic pleasure experience, intense musical aesthetic experience, musical aesthetic association, and musical aesthetic behavior, while there were no significant differences in musical aesthetic concept and musical aesthetic expectation.

Post-hoc tests (see Table 11) showed that the score of musical aesthetic perception ability presented a significant increasing trend of "third grade of junior high school (77.13 ± 16.03 points) > second grade of junior high school (71.39 ± 14.70 points) > first grade of junior high school (67.85 ± 15.33 points)"; there were significant differences in musical aesthetic association and musical aesthetic behavior among the three grades, with the third grade scoring significantly higher than the first and second grades; the intense musical aesthetic experience showed "second grade > first grade" and "third grade > first grade", with no significant difference between the second and third grades; the musical aesthetic pleasure experience had significant differences only between the third grade and the first grade, and between the third grade and the second grade (the third grade scored higher).

**Table 10.** Grade difference analysis of each dimension of musical aesthetic perception ability

| Factor | First Grade ($n$ = 132) (M ± SD) | Second Grade ($n$ = 181) (M ± SD) | Third Grade ($n$ = 143) (M ± SD) | $F$ | $p$ |
|---|---|---|---|---|---|
| Musical Aesthetic Perception Ability | 67.85 ± 15.33 | 71.39 ± 14.70 | 77.13 ± 16.03 | 13.004 | 0.000** |
| Musical Aesthetic Concept | 20.79 ± 3.84 | 20.76 ± 3.93 | 21.62 ± 3.68 | 2.398 | 0.092 |
| Musical Aesthetic Pleasure Experience | 11.95 ± 2.42 | 12.28 ± 2.58 | 12.87 ± 2.30 | 5.132 | 0.006** |
| Intense Musical Aesthetic Experience | 7.03 ± 2.71 | 8.23 ± 3.14 | 8.63 ± 3.30 | 10.040 | 0.000** |
| Musical Aesthetic Association | 6.93 ± 3.71 | 7.74 ± 3.43 | 9.79 ± 3.92 | 22.675 | 0.000** |
| Musical Aesthetic Expectation | 14.43 ± 5.37 | 15.04 ± 5.10 | 15.78 ± 6.02 | 2.081 | 0.126 |
| Musical Aesthetic Behavior | 6.72 ± 3.45 | 7.35 ± 3.18 | 8.45 ± 4.52 | 7.665 | 0.001** |

* $p < 0.05$ ** $p < 0.01$

**Table 11.** Post-hoc test for gender differences in each dimension of musical aesthetic perception ability

| Factor | (I) Grade | (J) Grade | (I) Mean | (J) Mean | Difference (I-J) | $p$ | Cohen's $d$ Value |
|---|---|---|---|---|---|---|---|
| Musical Aesthetic Perception Ability | First | Second | 67.848 | 71.392 | -3.544 | 0.044* | -0.231 |
| | First | Third | 67.848 | 77.133 | -9.284 | 0.000** | -0.606 |
| | Second | Third | 71.392 | 77.133 | -5.741 | 0.001** | -0.375 |
| Musical Aesthetic Pleasure Experience | First | Second | 11.947 | 12.276 | -0.329 | 0.241 | -0.134 |
| | First | Third | 11.947 | 12.874 | -0.927 | 0.002** | -0.379 |
| | Second | Third | 12.276 | 12.874 | -0.598 | 0.030* | -0.244 |
| Intense Musical Aesthetic Experience | First | Second | 7.030 | 8.227 | -1.196 | 0.001** | -0.389 |
| | First | Third | 7.030 | 8.629 | -1.599 | 0.000** | -0.520 |
| | Second | Third | 8.227 | 8.629 | -0.403 | 0.242 | -0.131 |
| Musical Aesthetic Association | First | Second | 6.932 | 7.740 | -0.809 | 0.055 | -0.220 |
| | First | Third | 6.932 | 9.790 | -2.858 | 0.000** | -0.779 |
| | Second | Third | 7.740 | 9.790 | -2.050 | 0.000** | -0.558 |
| Musical Aesthetic Behavior | First | Second | 6.720 | 7.354 | -0.634 | 0.138 | -0.170 |
| | First | Third | 6.720 | 8.448 | -1.728 | 0.000** | -0.464 |
| | Second | Third | 7.354 | 8.448 | -1.094 | 0.009** | -0.294 |

* $p < 0.05$ ** $p < 0.01$

4.3.3. Musical experience difference analysis

The results of the independent-samples t-test showed (see Table 12) that the extracurricular musical instrument learning group ($n$ = 233) scored significantly higher than the non-musical instrument learning group ($n$ = 225) in the overall musical aesthetic perception ability (76.06 ± 15.72 vs 68.06 ± 14.65, $t$ = 5.612, $p < 0.001$) and all dimensions. This indicates that musical instrument learning plays a promoting role in the development of musical aesthetic perception ability.

**Table 12.** Musical experience difference analysis of each dimension of musical aesthetic perception ability

| Factor | Musical Instrument Learning Group ($n$ = 234) (M ± SD) | Non-Musical Instrument Learning Group ($n$ = 222) (M ± SD) | $t$ | $p$ |
|---|---|---|---|---|
| Musical Aesthetic Perception Ability | 76.06 ± 15.72 | 68.06 ± 14.65 | 5.612 | 0.000** |
| Musical Aesthetic Concept | 21.43 ± 3.73 | 20.62 ± 3.91 | 2.251 | 0.025* |
| Musical Aesthetic Pleasure Experience | 12.62 ± 2.38 | 12.10 ± 2.54 | 2.277 | 0.023* |
| Intense Musical Aesthetic Experience | 8.41 ± 3.21 | 7.59 ± 3.01 | 2.813 | 0.005** |
| Musical Aesthetic Association | 8.52 ± 3.83 | 7.76 ± 3.82 | 2.133 | 0.033* |
| Musical Aesthetic Expectation | 16.39 ± 5.41 | 13.73 ± 5.25 | 5.338 | 0.000** |
| Musical Aesthetic Behavior | 8.69 ± 3.85 | 6.27 ± 3.28 | 7.218 | 0.000** |

* $p < 0.05$ ** $p < 0.01$

Further ANOVA on the years of musical instrument learning showed (see Table 13) that there was no significant difference in the overall musical aesthetic perception ability among junior high school students with different learning years. A significant difference was only found in the musical aesthetic association dimension ($F = 3.599$, $p < 0.05$). Among them, the score of the group with more than 7 years of musical instrument learning (10.04 ± 4.05) was significantly higher than that of the group with 1-3 years (8.19 ± 3.46) and the group with 5-7 years (7.69 ± 3.79).

**Table 13.** Difference analysis of years of musical instrument learning in each dimension of musical aesthetic perception ability

| Factor | 1-3 Years ($n = 77$) (Mean ± SD) | 3-5 Years ($n = 56$) (Mean ± SD) | 5-7 Years ($n = 45$) (Mean ± SD) | More Than 7 Years (n = 49) (Mean ± SD) | $F$ | $p$ |
|---|---|---|---|---|---|---|
| Musical Aesthetic Perception Ability | 75.60 ± 14.78 | 74.61 ± 15.15 | 74.11 ± 16.48 | 80.47 ± 17.17 | 1.690 | 0.170 |
| Musical Aesthetic Concept | 21.62 ± 3.52 | 21.23 ± 3.14 | 20.78 ± 4.09 | 21.92 ± 4.48 | 0.837 | 0.475 |
| Musical Aesthetic Pleasure Experience | 12.81 ± 2.36 | 12.48 ± 2.30 | 12.29 ± 2.55 | 12.80 ± 2.48 | 0.583 | 0.627 |
| Intense Musical Aesthetic Experience | 8.32 ± 3.09 | 7.68 ± 3.08 | 9.11 ± 3.27 | 8.84 ± 3.37 | 2.019 | 0.112 |
| Musical Aesthetic Association | 8.19 ± 3.46 | 8.41 ± 3.89 | 7.69 ± 3.79 | 10.04 ± 4.05 | 3.599 | 0.014 * |
| Musical Aesthetic Expectation | 16.30 ± 5.18 | 16.11 ± 5.40 | 15.60 ± 5.57 | 17.37 ± 5.90 | 0.884 | 0.450 |
| Musical Aesthetic Behavior | 8.35 ± 3.57 | 8.70 ± 4.13 | 8.64 ± 3.53 | 9.51 ± 4.25 | 0.923 | 0.431 |

* $p < 0.05$ ** $p < 0.01$

## 5. Discussion

According to the 2022 Compulsory Education Art Curriculum Standards issued by China, aesthetic perception ability involves the discovery, feeling, recognition, and response to the characteristics of beauty in the natural world, social life, and works of art, as well as their significance and functions. Currently, the senior high school entrance examination for aesthetic education, which is mainly in the form of tests, mainly evaluates students' ability to discover and recognize the expressive characteristics and artistic language of music, but pays relatively insufficient attention to the examination of feeling and response abilities. This study holds that being able to identify musical elements and expressive characteristics is not equivalent to being able to obtain aesthetic pleasure. Although auditory sensitivity is the starting point of musical aesthetic experience, regardless of the characteristics of works of art and other objects with aesthetic value, they can all be perceived [16]. If aesthetic perception is equated with the identification of expressive characteristics, it actually presupposes a series of "beautiful" characteristics of music, and on this basis, explores people's ability to identify these characteristics. These "beautiful" characteristics may indeed exist and can be described as certain parameters [17], but musical aesthetics is a holistic feeling, rather than the isolated and separate perception of each characteristic. During music listening, listeners integrate elements such as melody, rhythm, and timbre to form an organic holistic perception, thereby obtaining a unique aesthetic experience. Therefore, the measurement of the identification of the characteristics of each part of music cannot replace the evaluation of feeling and response abilities. Combining theoretical analysis and empirical research methods, this study constructs the dimensions of junior high school students' musical aesthetic perception ability and develops the Scale for Assessing Junior High School Students' Musical Aesthetic Perception Ability with 23 items. The scale covers six dimensions: musical aesthetic concept, musical aesthetic pleasure experience, intense musical aesthetic experience, musical aesthetic association, musical aesthetic willingness, and musical aesthetic behavior. Compared with the division of dimensions of musical aesthetic perception ability based only on theoretical analysis, this scale is more methodologically reliable.

In terms of the scale's dimensions, previous aesthetic ability scales mostly target art, nature, or morality, making it difficult to refine and focus on the particularity of musical art aesthetics; the evaluation of musical ability mainly adopts the form of tests, and a few studies using scales focus on evaluating individuals' sensitivity to music structure and its elements. The Scale for Assessing Junior High School Students' Musical Aesthetic Perception Ability developed in this study integrates the characteristics of the above two types of scales, highlights the aesthetic experience and response related to music, and is more targeted in terms of measurement field and measurement object. The specific characteristics are as follows: First, aesthetic scales usually do not include the dimension of association, which may be because other art forms rarely evoke recall and imagination experiences. However, music art is universal in evoking association and imagination, so the dimension of "musical aesthetic association" should be included. Second, in the empirical research, the aesthetic emotion dimension was further split into two dimensions: aesthetic pleasure experience and intense aesthetic experience. This is not an isolated case. Similar dimension

division bases can also be found in the AERA scale and EBS scale: in the AERA scale, "aesthetic appreciation" and "intense aesthetic experience" form their own dimensions but both belong to the category of aesthetic emotion; in the EBS scale, "conscious emotion" and "transcendence or spirituality" are similar. Third, in addition to the emotion dimension, aesthetic scales also include dimensions related to cognition, will, and behavior. For example, "perception or cognition" in the EBS scale, "motivation and will" in the APES scale, and "personal engagement with music" in the MUSEBAQ scale. In this scale, the above dimensions correspond to "musical aesthetic concept", "musical aesthetic willingness", and "musical aesthetic behavior" respectively. Fourth, music scales usually include listening accuracy, that is, the measurement of the identification of musical expressive elements and characteristics. Since the existing artistic quality assessment already includes this part, this study also excludes identification ability when defining the concept of musical aesthetic perception ability, so it does not include dimensions related to the identification of musical elements.

In terms of assessment application, the survey of some junior high school students in Jiangsu Province in this study shows significant differences in each dimension. For example, females scored significantly higher than males in the dimensions of musical aesthetic concept, association, expectation, and behavior. This may be related to the fact that females have a higher degree of participation in emotional experience activities during the process of adolescent gender role socialization. Grade differences show an increasing trend with the advancement of grades. Third-grade junior high school students are significantly better than first-grade and second-grade students in musical aesthetic perception ability, which is consistent with the difficulty progression of junior high school music courses and the laws of students' cognitive development. It is worth noting that the significant improvement of musical aesthetic association ability in the third grade may be related to the development of students' abstract thinking ability and the accumulation of musical knowledge. However, there are no significant differences in musical aesthetic concept and expectation among grades, indicating that junior high school students' musical aesthetic cognitive framework may have been initially formed in the first grade of junior high school. Subsequent teaching needs to focus more on expanding the depth of cognition rather than building the foundation. The analysis of musical experience differences shows that extracurricular musical instrument learning has an all-round promoting effect on the development of musical aesthetic ability. The score of the musical instrument learning group in the musical aesthetic behavior dimension is 2.42 points higher than that of the non-musical instrument learning group, indicating that instrumental training can effectively improve students' participation in musical practice. However, there is no significant correlation between the years of musical instrument learning and the overall aesthetic ability. Only the musical aesthetic association dimension shows an advantage in the group with more than 7 years of learning, which may imply that long-term instrumental training has a cumulative effect on the shaping of musical imagination, but has no obvious impact on the overall musical aesthetic perception ability.

## 6. Conclusion

Driven by the concept of "promoting learning through assessment", the aesthetic education evaluation system should attach equal importance to the evaluation of perception and response abilities, thereby guiding teachers and students to pay more attention to the aesthetic experience itself in classroom interaction. This study focuses on the dimension construction and scale development of junior high school students' musical aesthetic perception ability, providing theoretical support for music education oriented to core literacy goals and a feasible assessment tool for music education practice. This assessment scale is not only applicable to the field of aesthetic education evaluation to enhance the diversity of evaluation tools, but also can be applied in classroom teaching scenarios to facilitate teachers to grasp the current situation of students' musical aesthetic perception ability. The results of the assessment suggest that we need to design differentiated teaching according to the characteristics of gender and grade, and strengthen students' aesthetic behavior through forms such as campus music festivals and interdisciplinary music projects. Limited by research conditions, the sample representativeness of this study has certain limitations. In the future, we can further explore the application of this scale among junior high school students in different regions, and conduct cross-sample verification in rural schools and different regions to ensure the scientificity and fairness of aesthetic education evaluation tools.

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## References

[1] Schlotz, W., Wallot, S., Omigie, D., Masucci, M. D., Hoelzmann, S. C., & Vessel, E. A. (2021). The Aesthetic Responsiveness Assessment (AReA): A screening tool to assess individual differences in responsiveness to art in English and German. *Psychology of Aesthetics, Creativity, and the Arts*, *15*(4), 682.

[2] Diessner, R., Solom, R. D., Frost, N. K., Parsons, L., & Davidson, J. (2008). Engagement with beauty: Appreciating natural, artistic, and moral beauty. *The Journal of Psychology, 142*(3), 303–332.

[3] Wanzer, D. L., Finley, K. P., Zarian, S., & Cortez, N. (2020). Experiencing flow while viewing art: Development of the Aesthetic Experience Questionnaire. Psychology of Aesthetics, *Creativity, and the Arts, 14*(1), 113.
[4] Chin, T. C., Coutinho, E., Scherer, K. R., & Rickard, N. S. (2018). MUSEBAQ: A modular tool for music research to assess musicianship, musical capacity, music preferences, and motivations for music use. *Music Perception: An Interdisciplinary Journal, 35*(3), 376–399.
[5] Haanstra, F. (1996). Effects of art education on visual-spatial ability and aesthetic perception: A quantitative review. *Studies in Art Education, 37*(4), 197–209.
[6] Leonhard, C. (1991). Aesthetic literacy in music. *Design for Arts in Education, 93*(1), 27–33.
[7] Du, W. (2014). On aesthetic literacy and its cultivation. *Educational Research, 35*(11), 24–31.
[8] Song, J. (2008). *Fundamentals of music aesthetics* (p. 110). Shanghai Music Publishing House.
[9] Li, Z. H. (2008). *Cognitive neuroaesthetics* (p. 93). China Book Press.
[10] Trainor, L. J. (2005). Are there critical periods for musical development? *Developmental Psychobiology, 46*(3), 262–278.
[11] Varela, F. J., Thompson, E., & Rosch, E. (2017). *The embodied mind, revised edition: Cognitive science and human experience*. MIT Press.
[12] Hu, J. (2022). *Neural mechanisms of aesthetic experience* (p. 25). People's Publishing House.
[13] Güsewell, A., & Ruch, W. (2012). Are there multiple channels through which we connect with beauty and excellence? *Journal of Positive Psychology, 7*(6), 516–529.
[14] Brielmann, A. A., & Pelli, D. G. (2017). Beauty requires thought. *Current Biology, 27*(10), 1506–1513.
[15] Jiang, C. M. (2016). *Music psychology*. East China Normal University Press.
[16] Margolis, J. (1960). Aesthetic Perception. *The Journal of Aesthetics and Art Criticism, 19*(2), 209–213.
[17] Zhang, W. X. (2020). *Neural basis of musical aesthetic processing* [Master's thesis, Shanghai Normal University].