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MA of Aesthetic Literacy in Music Education from the Perspective of Psychology

Mingyao Zhou

College of Education, Changchun Normal University, Changchun, Jilin, 130000, China

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Abstract: With the development of quality education, the aesthetic quality of students has gradually been paid attention to. Music education is one of the important sources of students' aesthetic literacy, which requires teachers to strengthen the research on music teaching, so as to achieve the purpose of improving students' aesthetic level. In order to analyze the aesthetic literacy in music education, this paper conducts a multimodal analysis (MA) of the aesthetic literacy in music education based on the perspective of psychology. The experimental results showed that the more students pay attention to music education, the higher the students' aesthetic literacy. Based on multimodal analysis, the Encoder-Decoder structural model achieved the best results in the analysis of aesthetic literacy. In the survey of the current situation of college students' aesthetic ability, the students' aesthetic perception and aesthetic expression have both increased by about 6.58%. In the survey of different perceptions of the role of music among college students, most students believed that music can bring positive meanings to people's lives. In the survey on students' aesthetic orientation in life, most of the students judged beauty and ugliness according to the social mainstream value orientation and current fashion trends.

1. Introduction

In the past, people did not pay attention to music education, and music was an unreachable and untouchable existence for students. Even if some schools offer music classes, due to the neglect of teachers, music classes are often occupied by other courses, and students cannot receive a good music education, let alone cultivate a good aesthetic quality. This largely stifles students' interest and enthusiasm for music learning. As a result, the students' interest in music learning is weakened, and it is impossible to cultivate students with good moral, intellectual, physical, and artistic skills, so that the career of music education will not develop. Based on this, from the perspective of psychology, it is particularly important to analyze the aesthetic quality of students' music education.

The word aesthetic literacy is already familiar in life, and scholars have also done a lot of research on aesthetic literacy. Bowden H M explored the situational practice of game design critique in a Swedish fourth grade classroom. The findings showed that children and their teachers oriented themselves to different themes that address the aesthetic, functional, and moral aspects of the play and design process, and at the same time, completed the moral order of critical behavior in the interaction [1]. Araujo G investigated how aesthetic literacy develops from visual symbols and

writing in order to understand the realities of rural education for youth and adults in Brazil and using a pedagogical-formative experiment as a method [2]. Multimodal analysis is a method that has become popular in recent years and has been studied in many ways. Chen Y H proposed a multimodal multi-layer topic classification model for social event analysis. The model is able to reveal both visual and non-visual topics by jointly modeling textual and visual information while simultaneously learning and predicting multiple layers of class labels [3]. Farooq S S used neural networks for multimodal data analysis based game player experience modeling [4]. From this point of view, multimodal analysis has been applied in many aspects and achieved good results, but its application in aesthetic literacy has not been heard.In order to improve students' aesthetic literacy, improve the problems existing in the current music education environment, and improve students' music perception ability, this paper has explored the relationship between music education and aesthetic literacy, and proposed a multimodal analysis method. Three different structural models were compared. The best model was selected, and the current situation of students' aesthetic ability, cognition of music function and aesthetic orientation in life were analyzed, so as to provide reference for promoting the development of music education.

2. Aesthetic Literacy in Music Education from the Perspective of Psychology

With the development of the times, psychology is no longer a difficult topic to talk about, and people begin to use psychology as a tool to solve problems encountered in life. Shukla P surveyed consumers' consumption problems by focusing on three antecedents: social psychology, brand and situation. Findings found that psychosocial, brand, and contextual preconditions strongly influence identity consumption [5]. Music education can improve students' aesthetic literacy, allowing students to accept beauty, appreciate beauty, and create beauty. Music education is also a kind of quality education. Through the washing of music, students will get a good aesthetic quality. In recent years, due to the popularity of quality education, music education has received widespread attention, and people have paid more and more attention to students' music education. At the same time, people can not ignore the cultivation of aesthetic literacy. It is of great significance for students to improve students' aesthetic quality in music teaching.

1) Improving the quality of life

Learning to appreciate beautiful music will bring great benefits to a person's life. Having the ability to appreciate music can make people grow flowers in the tedious life, and make people distinguish the quality of music from bad [6]. Learning to appreciate good music will keep away from bad music, so that good music can be passed on and bad music will be abandoned. In the stressful real life, people occasionally listen to music to relax their mood, and having a good aesthetic quality can make people really quiet and give their hearts a vacation. In the current chaotic and complex society, all kinds of music works are mixed and emerging one after another. Only good aesthetic literacy can make people wise, know good music, and improve personal life quality.

2) Enhancing perception ability

Excellent musical works not only bring auditory enjoyment to people, but also give people profoundness and significance. In the process of teaching music education, the teacher not only teaches the music itself, but also guides the receiver to feel the charm of music based on his own experience and experience, so that the receiver can perceive and experience it himself. In the process of explaining the background of music, the instructor will invisibly bring inspiration to the recipient, so that the recipient can feel full of admiration for the music creator and spontaneously understands the hardships and difficulties of his creation, which also strengthens the will of the recipient to a certain extent.

3. MA

The multimodal analysis method used in this paper is a multimodal analysis method based on user psychology, which is inseparable from human language. What people think in their hearts may not be known, but people can classify their emotions through their language to judge the degree and tendency of emotions. Aesthetic literacy is an ability that integrates various factors such as aesthetic taste, aesthetic experience, aesthetic ideal, and aesthetic ability. Therefore, it is impossible to intuitively see whether a person's aesthetic literacy has improved with the naked eye. Therefore, it is necessary to analyze it with the help of psychological knowledge.

Multimodal analysis is multi-level and multi-angle, and people's psychology is constantly changing, so it is not possible to build a multi-modal analysis framework from only one aspect, and it is necessary to analyze students' aesthetic literacy from multiple perspectives. Based on the emotional experience and psychological state of students, this paper designs a comprehensive theoretical framework for multimodal analysis, as shown in Figure 1:

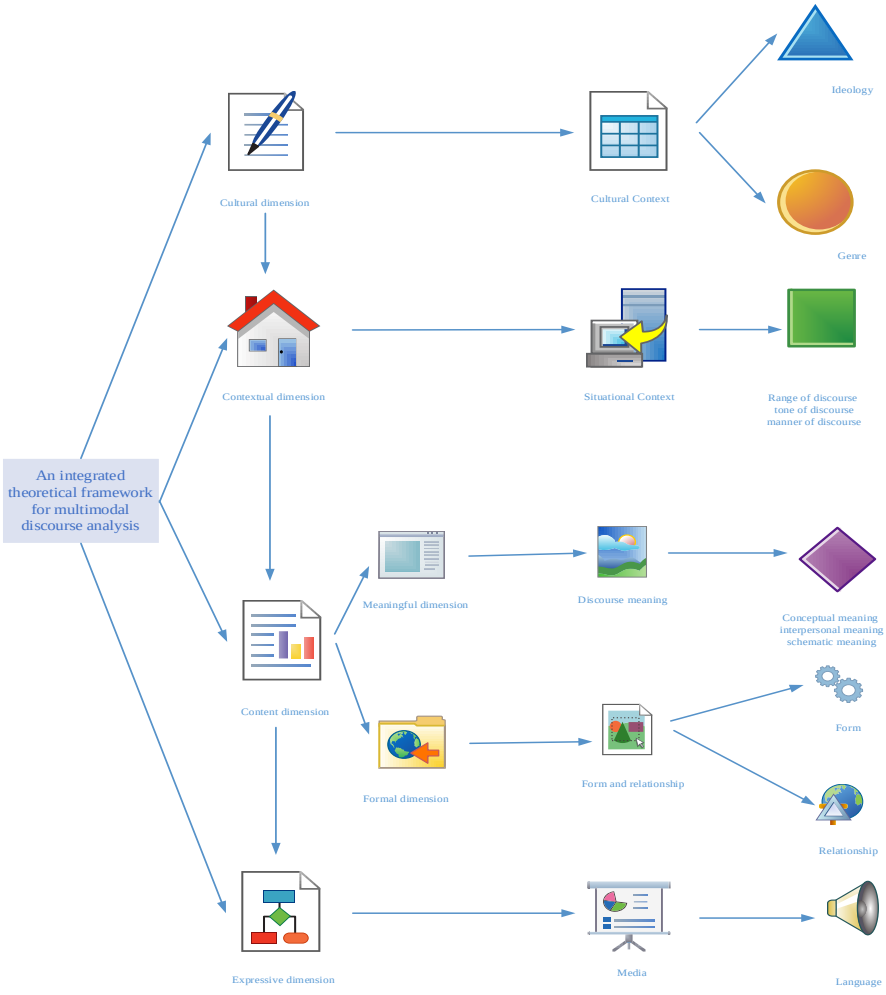

Figure 1: Integrated theoretical framework for multimodal analysis

As can be seen from Figure 1, multimodal analysis includes four levels: culture, context, content, and expression. The cultural level mainly includes cultural context, which can be refined into ideology and genre. The context level mainly includes the situational context, which can be refined into discourse scope, discourse tone, and discourse mode. The content level includes the meaning level and the formal level. The meaning level is mainly discourse meaning, which can be refined

into conceptual meaning, interpersonal meaning, and textual meaning. The formal level includes form and relationship, and form involves language, image perception, sound perception, and feeling. The expression level mainly refers to the media, and the medium of the media is the language. This multimodal analysis can analyze students' aesthetic literacy in music education.

4. Methods of MA

(1) The characteristics of the multimodal analysis method include four steps:

Step 1: The feature vector of the multimodal image is input;

Step 2: According to different aesthetic literacy features, the category labels and aesthetic literacy features are fused to obtain a feature set with category label information;

Step 3: The different aesthetic literacy features obtained in step 2 are respectively fused in parallel, and the maximum correlation between the two is used to establish a criterion function to obtain the projection vector, thus obtaining the fused feature set;

Step 4: The feature set obtained in step 3 is classified and identified by the method of parallel fusion and serial fusion respectively.

The following steps are used for category labeling and aesthetic literacy in step 2:

Step 2.1: A set of sample feature sets X and Y are selected for centralized processing, and the centralized features are $X \epsilon R^{p \times 1}$ and $Y \epsilon R^{q \times 1}$;

Step 2.2: For the biometric X, the maximum correlation between the feature set and the c category labels $L(N_1, N_2, \cdots, N_c)$ is established by Formula 1:

$$J_{CCA} = \frac{w_X^T C_{XL} w_L}{\sqrt{w_X^T C_{XX} w_X} \sqrt{w_L^T C_L w_L}} \tag{1}$$

In Formula 1, N represents the number of training samples, and w_X and w_Y are the projection directions. C_{XX} and C_L are the covariance matrices of feature set X and class labels L respectively, and C_{XL} is the cross-covariance matrix between feature set X and class labels, as shown in Formula 2:

$$C_{XX} = X^T X, C_L = L^T L, C_{XL} = X^T L \tag{2}$$

For the criterion function J, using the constraints of Formula 3 and Formula 4, w_X and w_Y are respectively derived to obtain w_X and w_Y:

$$w_X^T C_{XX} w_X = 1, \quad w_L^T C_L w_L = 1 \tag{3}$$

$$L(w_X, w_1) = w_L^T C_L w_L - \lambda_1 \left(w_X^T C_{XL} w_L \right) - \lambda_2 \left(w_L^T C_L w_L - 1 \right) \tag{4}$$

In Formulas 3 and 4, λ1 and λ2 are Lagrange multipliers.

Step 2.3: The method of step 2.2 is used to solve the biological feature Y to obtain the projection w_Y of the feature set Y on the category label;

Step 2.4: The feature set with label information is found according to Formula 5:

$$\left. \begin{aligned} X' &= w_X^T \times X \\ Y' &= w_X^T \times Y \end{aligned} \right\} \tag{5}$$

(2) The extraction of the projection vector in step 3 adopts the following steps:

Step 3.1: Formulas 6 to 8 are used to obtain the corresponding inter-class covariance matrix S_b,

the intra-class scatter matrix $S_{WX'}$ of X′, and the intra-class scatter matrix $S_{WX'}$ of Y′ from the feature set with label information obtained in step 2;

$$S_{wx} = \sum_{i=1, x \in X}^{c} \left(x - \overline{x_i}\right)\left(x - \overline{x_i}\right)^T \tag{6}$$

$$S_{wy} = \sum_{i=1}^{c} \sum_{y \in Y} \left(y - \overline{y_i}\right)\left(y - \overline{y_i}\right)^T \tag{7}$$

$$S_b = \frac{1}{n} \sum_{i=1}^{n} \left(x_i - \overline{x}\right)\left(y_i - \overline{y}\right)^T \tag{8}$$

In Formulas 6-8, $\overline{x_i}$ means the mean vector of the i-th class. $\overline{x}$ is the mean vector of all samples. S_{wx} and S_{wy} denote the within-class scatter matrix of X, Y respectively. S_b represents the inter-class covariance matrix of X and Y;

Step 3.2: In order to obtain the maximum correlation between the two feature sets, the criterion function model of Formula 9 is established, and the intra-class divergence matrix is constrained to ensure a unique solution. The constraint form is as shown in Formula 10:

$$J = \frac{u^T S_b v}{\sqrt{u^T S_{WX'} u}\sqrt{v^T S_{WY'} v}} \tag{9}$$

$$u^T S_{wx}\, u = 1, v^T S_{wx'} v = 1 \tag{10}$$

The Lagrangian function is used to solve the projection vectors u and v. Through Formulas 11-13:

$$H = S_{wx'}^{\frac{1}{2}} S_b S_{wy'}^{\frac{1}{2}} \tag{11}$$

$$U = S_{wx'}^{\frac{1}{2}} u \tag{12}$$

$$V = S_{wy'}^{\frac{1}{2}} v \tag{13}$$

Formula 14 can be proved:

$$\left.\begin{aligned} HH^T U &= \lambda^2 U \\ H^T H V &= \lambda^2 V \end{aligned}\right\} \tag{14}$$

Because U and V are the eigenvectors of HH^T and H^TH respectively, Formula 15 can be obtained:

$$\left.\begin{aligned} u &= S_{wx'}^{\frac{1}{2}} U \\ v &= S_{wy'}^{\frac{1}{2}} V \end{aligned}\right\} \tag{15}$$

At this time, u and v are the projection vectors that maximize Formula 9.

Step 3.3: According to u and v in step 3.2, the final feature sets X* and Y*, and the final projection matrices W_X and W_y can be obtained as Formula 16:

$$\left.\begin{aligned} X^* = uX' = u^T w_X^T X = W_X X \\ Y^* = vY' = v^T w_Y^T Y = W_Y Y \end{aligned}\right\} \tag{16}$$

Then Formula 17 can be obtained:

$$\left.\begin{aligned} W_X = u^T w_X^T \\ W_Y = v^T w_Y^T \end{aligned}\right\} \tag{17}$$

(3) In step 4, the following steps are used for the classification and identification of the feature set:

Step 4.1: According to the serial fusion strategy of Formula 18, the final fusion vector z_2 is obtained as the fused feature vector for classification and identification, as shown in Formula 18:

$$z_1 = \begin{pmatrix} W_x^T X \\ W_y^T Y \end{pmatrix} = \begin{pmatrix} W_x & 0 \\ 0 & W_y \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix} \tag{18}$$

Step 4.2: According to the parallel fusion strategy of Formula 19, the final fusion vector z_2 is obtained as the fused feature vector for classification and identification, as shown in Formula 19:

$$z_2 = W_x^T X + W_y^T Y = \begin{pmatrix} W_x \\ W_y \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix} \tag{19}$$

Step 4.3: The nearest neighbors are used to classify and identify the final fusion vectors z_1 and z_2, and the average classification accuracy MCA of Formula 16 is used to evaluate the performance of the fusion algorithm, as shown in Formula 20:

$$MCA = \frac{Ni}{N} \tag{20}$$

5. Experiments on Aesthetic Literacy Based on Multimodality

Music education is mostly in a person's childhood, but the perception of music and the true formation of a person's aesthetic literacy can only be revealed in the adult stage. Music education is inseparable from the cultivation of aesthetic quality. In order to explore the relationship between the two, based on the fact that current college students already have considerable aesthetic literacy and their recognition ability, Figure 2 is made according to the level of music education they have received and their aesthetic literacy:

According to Figure 2, it can be seen that the level of music education received by students is positively correlated with the development of aesthetic quality. The higher the level of students' music education, the higher the students' aesthetic literacy, the reason of which is that in the process of teaching music, teachers not only let students hear the sound of music, but also let students feel the expression of music and the beauty of music. The process of learning music is not only a process of simply learning music theory, but also a process of leading students to think about the spiritual connotation of music.

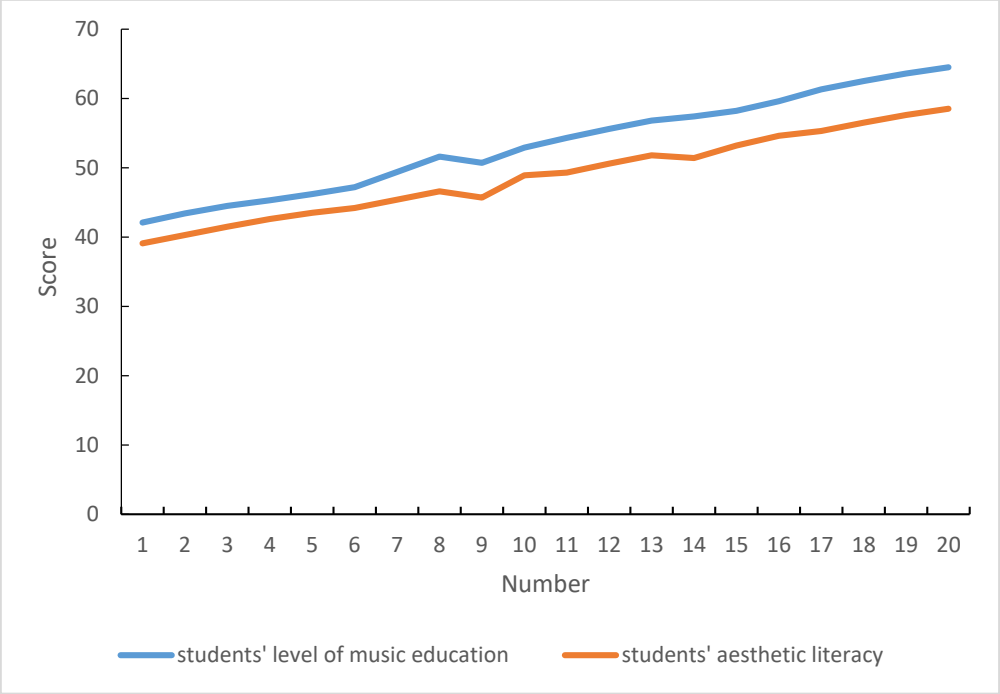

Figure 2: Relationship between students' level of music education and aesthetic literacy

Through the previous research on aesthetic literacy and multimodal data, an aesthetic literacy model based on multimodal data is constructed. This chapter uses the Encoder-Decoder model for aesthetic literacy assessment, and the multimodal analysis has good classification and prediction functions. In order to verify the accuracy of the prediction, the Encoder-Decoder structural model is used to compare with the Encoder-AE structural model and the Decoder-AR structural model. The survey results are shown in Figure 3:

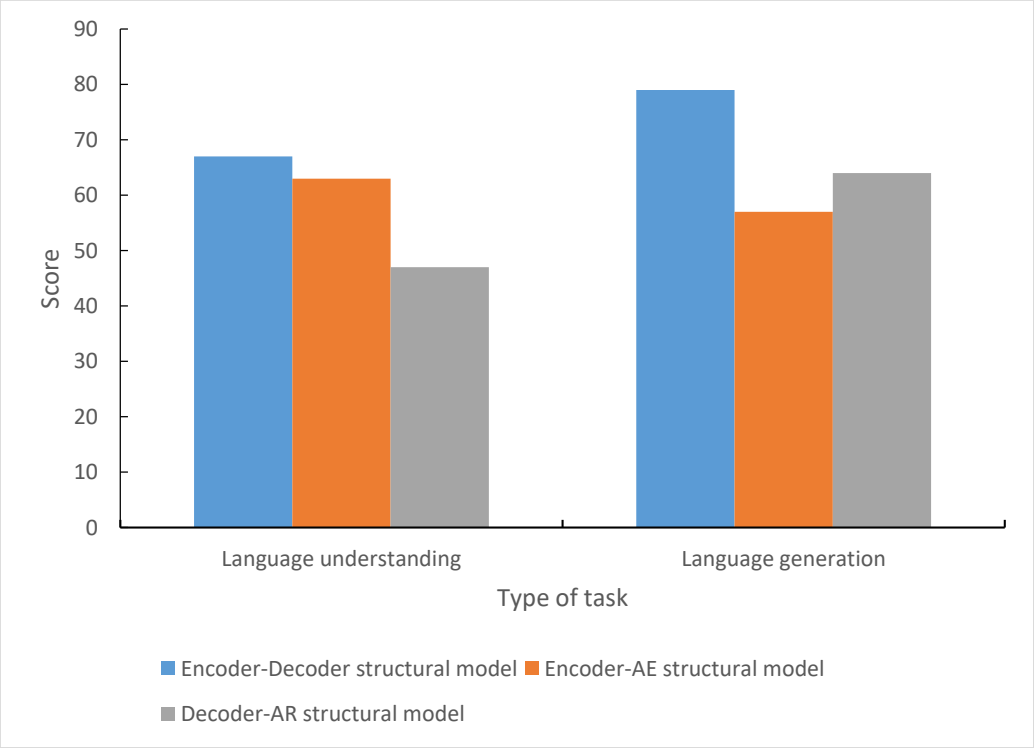

Figure 3: Effect of different model structures when performing different tasks

It can be seen from Figure 3 that when dealing with language understanding tasks, the Encoder-Decoder structure model has the best processing effect, followed by the Encoder-AE structure model, and finally the Decoder-AR structure model. When dealing with language generation tasks, the Encoder-Decoder structural model has the best processing effect, followed by the Decoder-AR structural model, and finally the Encoder-AE structural model. The experimental results showed that the Encoder-Decoder structure model not only has a good ability to handle language understanding tasks, but also has a good ability to handle language generation tasks. To sum up, in the process of analyzing the aesthetic literacy of students in music teaching, the Encoder-Decoder structure model has strong advantages.

The fundamental of understanding students' aesthetic ability is to understand the current situation of college students' aesthetic ability, and to find and solve problems according to the current situation. The aesthetic ability of college students was divided into aesthetic perception ability, aesthetic appreciation ability, aesthetic expression ability and aesthetic creativity ability. The total score was 100 points. The theoretical value of aesthetic perception ability was 20. The theoretical value of aesthetic appreciation ability was 20. The theoretical value of aesthetic expression ability was 20, and the theoretical value of aesthetic creativity ability was 40. The survey results of the current situation of college students' aesthetic ability are shown in Figure 4:

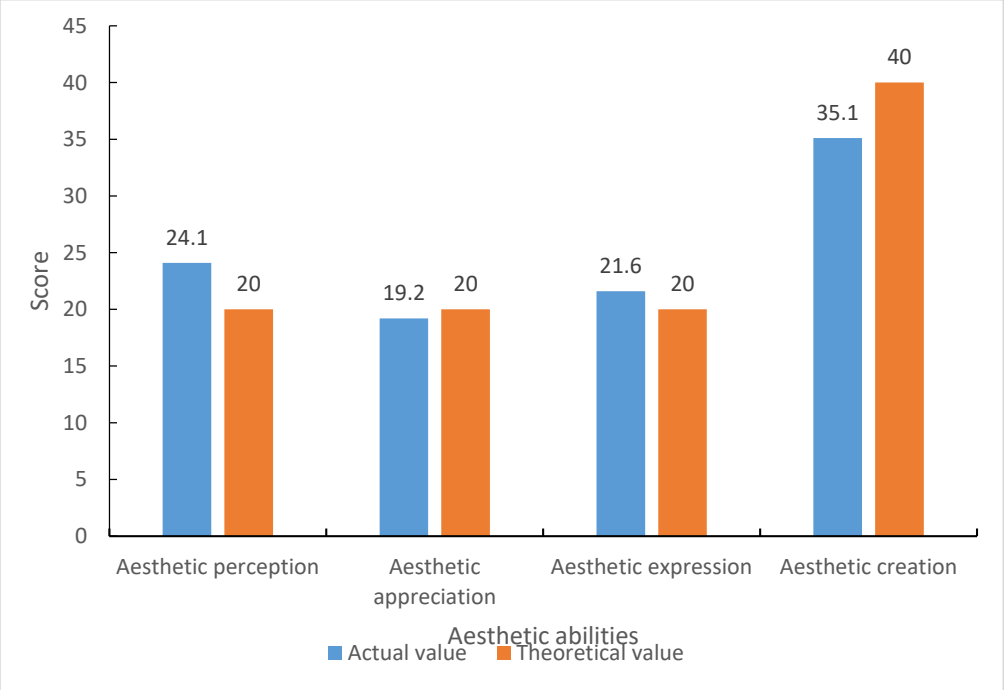

Figure 4: Current state of aesthetic ability of university students

As can be seen from Figure 4, based on the multimodal algorithm, the actual value of students' aesthetic perception was 4.1 higher than the theoretical value. The actual value of aesthetic appreciation was 0.8 lower than the theoretical value. The actual value of aesthetic expression was 1.6 higher than the theoretical value. The actual value of aesthetic creation was 4.9 lower than the theoretical value. To sum up, the aesthetic perception and aesthetic expression of students were higher than the theoretical value, so the aesthetic perception and aesthetic expression of students have been greatly improved.

Because of their different life experiences and musical experiences, college students also have huge differences in their cognition of the role of music. The different perceptions of college students on the role of music were set as different options, in which A represented that students believed that

music can cultivate sentiment and cultivate self-cultivation. B represented that students believed that music can develop intelligence and increase knowledge. C stood for students who believed that music can enrich the imagination and enhance creativity. D represented students believed that music can improve aesthetic ability and promote personality development. E stood for students who believed that music can kill time and pass time. F meant that students believed that music can promote the overall development of people. According to the different perceptions of college students on the role of music, the relevant content of the survey is shown in Figure 5:

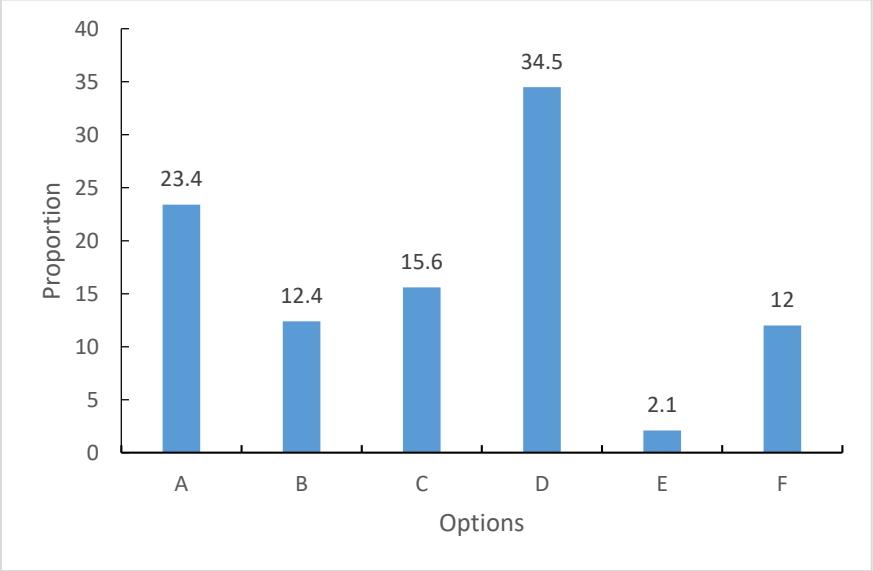

Figure 5: College students' perceptions of the role of music

As can be seen from Figure 5, most students believed that music can bring positive meaning to people's lives. Among them, 34.5% of the students believed that music can improve aesthetic ability and promote personality development. 23.4% of the students believed that music can cultivate sentiment and cultivate one's self-cultivation. 15.6% of students believed that music can enrich imagination and enhance creativity. 12.4% of students believed that music can develop intelligence and increase knowledge. 12% of students believed that music can promote the overall development of people. Only 2.1% of students thought that music can kill time and pass time. The survey results showed that students have fully realized the important role of music in their own development, and they can spontaneously feel the charm of music teaching.

After learning about the students' views on music, I learned that most students thought that music can improve aesthetics. Based on this, this paper further investigated students' aesthetic orientation in life. Among them, A stood for judging beauty and ugliness according to current fashion trends. B stood for judging beauty and ugliness according to their own interests and hobbies. C stood for judging beauty and ugliness according to the mainstream value orientation of society. The survey results are shown in Figure 6.According to Figure 6, most students judged beauty and ugliness according to the social mainstream value orientation and current fashion trends. It showed that college students have different cognitions on aesthetics and different aesthetic standards, and the aesthetics at this stage also tends to be diversified, but the mainstream trend is to judge beauty and ugliness according to the mainstream social value orientation and current fashion trends. A small number of students judge beauty and ugliness according to their own interests and hobbies. These people pay more attention to the development of their own personality and pursue individualized development more.

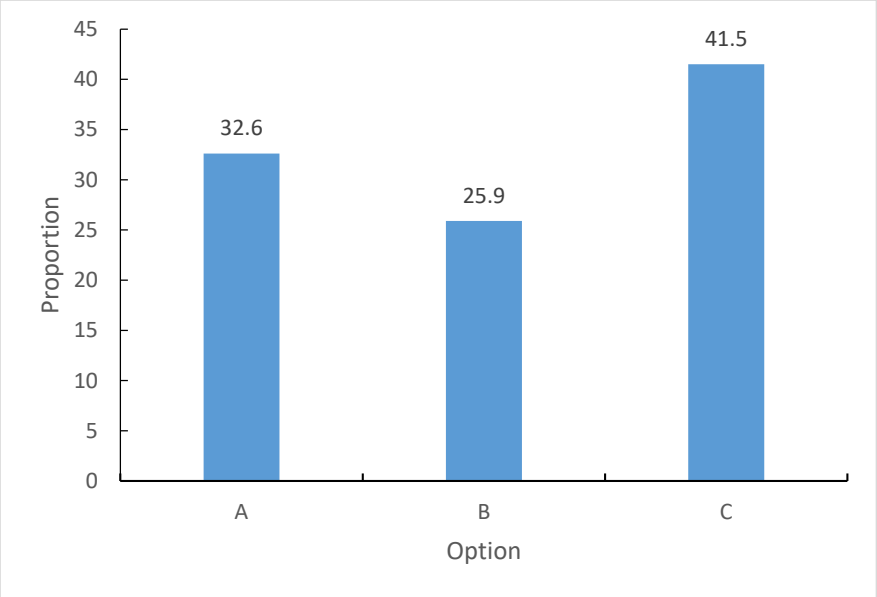

Figure 6: Students' orientation to aesthetics in their lives

6. Conclusions

This paper draws the following conclusions through a multimodal analysis of aesthetic literacy in music education. The more students pay attention to music education, the higher the students' aesthetic literacy. Based on multimodal analysis, the Encoder-Decoder structural model achieves the best results in the analysis of aesthetic literacy. In the survey of the current situation of college students' aesthetic ability, students' aesthetic perception and aesthetic expression have been greatly improved, but students' aesthetic appreciation ability and aesthetic creativity still need to be further improved. In the survey of different perceptions of the role of music among college students, most students believe that music can bring positive meanings to people's lives. In the survey on students' value orientation in life, most students judge beauty and ugliness according to the mainstream social value orientation and current fashion trends. Therefore, in music education, it is necessary to strengthen the cultivation of students' aesthetic appreciation ability and aesthetic creativity ability, and pay attention to the positive meaning that music brings to people, cultivating aesthetic quality with heart and strengthening the education of aesthetic quality.

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