

Recurrent neural network-based teaching effect evaluation and dynamic adjustment mechanism in digital technology-assisted collaborative education of traditional aesthetic education and civic and political education

Danyu Wu^{1,*} and Yu Wu²

¹ School of Mechanical and Electronic Engineering, Jingdezhen Ceramic University, Jingdezhen, Jiangxi, 333403, China

² School of International Culture and Communication, Jingdezhen Ceramic University, Jingdezhen, Jiangxi, 333403, China

Corresponding authors: (e-mail: 017487@jcu.edu.cn).

Abstract Under the background of digital technology, the integration of aesthetic education into the reform of curriculum Civic and political education can enrich the content of Civic and political education and create a more attractive Civic and political education and education system. This paper explores the relationship between aesthetic education and civic education through the exploration of educational objectives, educational content and educational methods, formulates civic objectives for the specific topics of aesthetic education, extracts the corresponding civic elements and aesthetic elements, and designs a school-based curriculum for aesthetic education. A synergistic LSTM-SVR model is established to predict the educational effect of synergizing aesthetic education and Civic and political education. In the TensorFlow learning scenario, the average values of model accuracy, recall, and F1 score are 81.9, 80.4, and 79.4, respectively, and the predictive performance of the model is gradually improving. Through the model to analyze the participation and activity of the aesthetic and civic education activities, the proportion of learning enhancement value more than 1.5 in the teaching practice class is 21.321%, which indicates that the digital technology-assisted traditional aesthetic and civic education collaborative education has a more stable and positive impact on the enhancement of the learning effect.

Index Terms collaborative LSTM-SVR model, TensorFlow learning scenario, F1 score, aesthetic and civic education, learning effect

I. Introduction

Aesthetic education, i.e., aesthetic education, is mainly the education of personality, emotion and art, aiming to continuously cultivate students' literacy and ability to discover, appreciate, feel and create beauty during their college career [1]-[3]. And Civic and political education is an important part of college education, aiming to cultivate students to become citizens of the new era who are both moral and talented and have a strong sense of social responsibility, which is of great significance in contemporary higher education. Aesthetic education and Civic and political education in the education system belong to different levels, but both bear the fundamental task of moral education, are the pursuit of truth, goodness and beauty of the nurturing process, the two interact with each other, complement each other, forming a synergistic aesthetic education and Civic and political education in the innovative development of the situation of parenting [4]-[7].

However, at present, most of the colleges and universities are divided into lines of aesthetic education and civic education, the understanding of the significance of the mutual promotion of aesthetic education and civic education is not enough, and the parallel research and practice has not yet been carried out comprehensively and deeply [8]-[10]. The integration of aesthetic education and ideological education is relatively superficial, the implementation of the form, especially on the degree of importance of aesthetic education is not enough, in the opening of the art education program, aesthetic education general education course is not perfect and the content of the form of a single, the students of the content of the aesthetic education and the form of education is usually a half-knowledge, did not play a good aesthetic education on the ideological education to promote the role of the [11]-[14]. With the development of digital technology, it is widely used in education, and also brings unprecedented opportunities for collaborative education between aesthetic education and ideological education [15], [16]. By providing massive teaching resources, multimedia teaching means, interactive teaching software, personalized teaching platform, etc., digital technology not only improves the teaching efficiency and quality of the collaborative

education between aesthetic education and civic and political education, but also provides students with a more flexible and independent way of learning [17]-[20].

In this paper, we excavate the consistency and commonality of both aesthetic education and Civic Education, extract the key elements of Civic Education and Aesthetic Education, and design a school-based curriculum for Civic Integration into Aesthetic Education. Using recurrent neural networks, the time series data of Civic and political education and aesthetic education are processed, based on which, it is proposed to use the long and short-term memory neural network model to make up for the long-term dependence problem of the traditional RNN. The collaborative filtering recommendation algorithm is applied to predict the user's interest degree in unknown items, and the collaborative LSTM-SVR model is constructed for the collaborative parenting teaching effect on traditional aesthetic education and Civic and political education. The synergistic nurturing teaching effect of aesthetic education and Civic and political education is evaluated sequentially from the perspectives of teaching situation, students' learning interest, and participation, etc. Based on the analysis results, a dynamic adjustment mechanism is proposed to further enhance the effect of integration of aesthetic education and Civic and political education.

II. Collaborative nurturing of traditional aesthetic education and civic education with the help of digital technology

II. A. Relationship between aesthetic education and civic education

II. A. 1) High degree of coherence in educational objectives

From the viewpoint of educational goals, aesthetic education is highly consistent with the goals of curriculum ideological education. The core goal of aesthetic education is to help students improve their artistic aesthetic ability, which can improve students' aesthetic quality, cultivate students' sentiment, stimulate students' innovation ability, make students feel the truth, goodness and beauty, so as to set up a positive mindset in learning and life. The essence of curriculum education is to establish morality and nurture people, cultivate students' correct values and outlook on life, and have firm political beliefs, so that they can become an outstanding talent in their future work and life. In terms of educational goals, both are based on the growth of the students themselves, to improve their ideological and moral level, and to perfect their personality. The integration of aesthetic education into the reform of curriculum ideology education helps to improve the students' ideology, make them understand what is true, good and beautiful, and pay more attention to the improvement of their own quality, so that the curriculum ideology education can be simply upgraded to the level of life and ideological growth, so that the students can realize the beauty of thought and the beauty of art.

II. A. 2) High commonality of educational content

Although on the surface, aesthetic education mainly involves four fields, namely, artistic beauty, natural beauty, social beauty and scientific beauty, and curriculum ideological education mainly involves world view education, political view education, life view education, rule of law education, moral view education, etc., both of them have their own focus on the content, but in terms of the substance of the education content has a high degree of commonality. Both aesthetic education and curriculum ideological education are centered on socialist core values, reflecting the requirements of contemporary Chinese education for talent cultivation. In the education process, it pays more attention to students' pursuit of beautiful emotions, focuses on shaping students' noble moral sentiments, and enables students to change the problems that exist in their ideology and morality. Compared with a single educational method, aesthetic education and curriculum ideology and politics are integrated and complementary in educational content, and both of them jointly promote the improvement of students' ideological and aesthetic ability, and show the spirit of China's high-quality talents in the new era.

II. A. 3) Complementarity of educational methods

The traditional curriculum civic education form is relatively single, due to the strong theoretical nature, so students in the learning process generally lack of interest in learning, lack of enthusiasm. Aesthetic education as a kind of art as the main content of the teaching curriculum, the teaching method pays more attention to the effect of art, infectious, artistic, can cause students' emotional resonance, from the artistic level of infection students, so that students feel the education brought by art. Aesthetic education and curriculum ideology and politics have their own characteristics in teaching methods, so the two education methods are highly complementary. In the course of Civic Education, with the help of the flexible power of aesthetic education to dissolve the rigidity of the traditional Civic Education, the two can be organically combined in the means of education and the art of teaching and learning from each other.

II. B. Development and design of the school-based curriculum for integrating Civics into aesthetic education

II. B. 1) Unit Civic and Aesthetic Education Elements Extracted

Curriculum Civics contains traditional culture and red culture Civics elements, and its aesthetic manifestations are rich and diverse, therefore, this paper needs to develop Civics objectives for specific topics, extract the corresponding Civics elements and aesthetic elements, to facilitate the conception of the design ideas of the theme unit, the preparation of the theme unit of aesthetic school-based teaching materials and the implementation of the implementation of the theme unit of the program.

II. B. 2) Thematic Unit Design Ideas

Figure 1 shows the unit course design process. In order to ensure the maximization of the educational value of the content of the school-based course on aesthetic education for students and the optimization of the practical effect, it is necessary to carry out an in-depth conceptualization of the thematic unit design of the school-based course on aesthetic education to ensure that it is operative and effective in the teaching practice. For this reason, the overall idea of the development of the Civics program is as follows: First, extract the elements of Civics and the expression of aesthetic education. Secondly, the school-based program of aesthetic education is prepared. Based on the extracted elements of Civics and Politics and expressions of aesthetic education, the school-based teaching materials of aesthetic education are prepared. Third, in the teaching design, teaching objectives, teaching methods, teaching contents and teaching evaluation are formulated. With the teaching objectives of aesthetic perception, artistic expression, creative practice and cultural understanding in the core qualities of art, the different qualities in the Core Qualities of Chinese Students' Development are cultivated in teaching practice through the teaching design of the four specific topics, so as to realize the goal of establishing morality and shaping people.

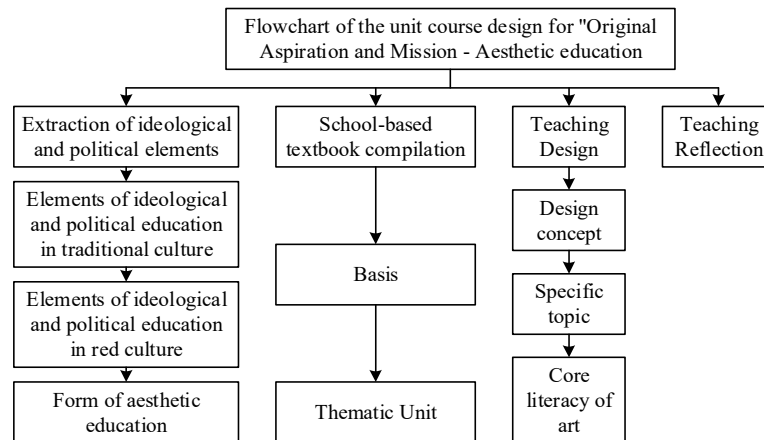


Figure 1: Unit course design process

Based on Figure 1, the specific teaching content and student learning tasks of each lesson are then refined and designed to develop the teaching content closely around the unit title of the course Civics and Aesthetic Education. Different teaching methods are used in each lesson to stimulate students to actively participate in the learning of the course and deeply understand the rich connotation of Dade culture. In the design of teaching content, the teaching content of each lesson has fusion of knowledge with other disciplines, so as to realize the integration of learning content and the migration of knowledge in teaching practice, thus realizing interdisciplinary integration. Thematic unit curriculum design ideas, through the thematic unit-based teaching, let students experience the process of perception, understanding, creativity, expression, communication and application of art practice. In teaching, task-driven inquiry-based learning is carried out to change "learning" knowledge into "using" knowledge. At the same time, it provides the specific operation of thematic unit teaching method. Therefore, this study is to be the leader and designer of the curriculum design, to carry out the theme as the leader, with the theme unit teaching method, guiding students to independent, cooperative inquiry learning, "learning" knowledge into students will "use" knowledge, so as to reflect the core literacy! This is the only way to reflect the core literacy and the original intention of the thematic unit teaching design.

II. B. 3) Development of school-based teaching materials for aesthetic education in thematic units

Textbook is the materialization of the curriculum standards, is the basis for curriculum teaching, a suitable for students to use aesthetic school-based curriculum materials and excellent teaching design can promote classroom teacher-student interaction, enhance the sense of classroom atmosphere, the teaching design must be fully interpreted and guided by the textbook, the content of the thematic unit materials is particularly important.

The school-based curriculum for aesthetic education is written in a standardized and rigorous manner to achieve the effect of rigorous teaching content, logical sequence of teaching materials, and easy-to-difficult problem setting. It is expected that through the teaching of this school-based art education program, students will not only cultivate their core artistic qualities, but also gain a deeper understanding and appreciation of the essence of Dade's culture, which will stimulate their patriotic feelings and enhance their sense of national pride.

III. Assessment of teaching effectiveness based on recurrent neural network

III. A. Recurrent Neural Networks

In real life, a lot of data are sequence data that exist in timeline, such as text, audio, student learning records, etc. In traditional neural networks, the input layer to the hidden layer to the output layer are independent of each other, and they cannot deal with sequence data. Recurrent neural network (RNN) is a kind of artificial neural network (ANN), compared with the traditional neural network, all the recurrent units are linked in a chain, and the hidden layer has an additional neuron with information memory function, each moment of the hidden layer contains the input of the input layer in the next moment and the output of the hidden layer in the previous moment, so the RNN is able to realize "memory function", and has the function of "memory". Therefore, RNN can realize the "memory function" and possess the "human brain-like" mechanism, which can process the sequential nonlinear feature data and retain the previously processed information. Students' practice records belong to long nonlinear feature data, so RNN is widely used in educational data mining and other fields [21].

Recurrent neural network is mainly composed of input layer, hidden layer and output layer, and its structure schematic diagram is shown in Fig. 2. The neural network unit of RNN is not only interconnected with the input and output, but also exists a loop itself, which is shown in the right half of the figure with its time series unfolding diagram.

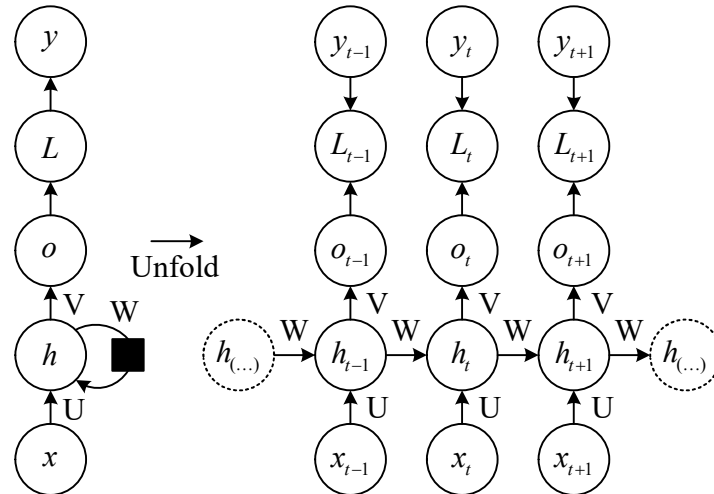


Figure 2: Schematic diagram of the recurrent neural network structure

In Fig. 2, the first layer x denotes the input layer, the second layer h denotes the hidden layer, the third layer o denotes the output layer, L denotes the loss function, and y denotes the label of the training set. At the moment t , the state of the hidden layer is related by the current input information of the input layer and the state of the hidden layer of the previous layer, which is computed in Equation (1):

$$h_t = \tanh(Ux_t + Wh_{t-1} + b) \quad (1)$$

The computational procedure corresponding to the output result at moment t is shown in equation (2):

$$o_t = Vh_t + c \quad (2)$$

The computational procedure corresponding to the prediction result output of the final model is shown in equation (3):

$$\hat{y}_t = \text{softmax}(o_t) \quad (3)$$

The computational procedure for defining the loss function is shown in equation (4):

$$L(y, \hat{y}) = -\sum_i y_i \log \hat{y}_i \quad (4)$$

where U, W, V represent the weights, b, c denote the bias, y denotes the prediction result, $\tanh(\cdot)$, and $\text{softmax}(\cdot)$ are the activation functions.

III. B. Long and short-term memory networks

Some scholars proposed a special type of recurrent neural network - Long Short-Term Memory Neural Network (LSTM) in 1997, which solves the problem of long-term dependence existing in the traditional RNN by specially designing a special structure, and the LSTM demonstrates a unique advantage in dealing with longer sequence data. Student practice records contain longer sequential information, and the processing of student practice records using LSTM can preserve the student learning state for a longer period of time [22].

The structure of an LSTM unit is mainly composed of the cell state and three "gates" (forgetting gate, update gate and output gate), the cell can transmit information in the process of sequence chain processing, the main function of the gating mechanism is to add or delete the information of the cell state, control the flow of information in and out of the cell, enhance or forget the transmitted information, retain important information in the cell in time, and remove useless information in time, the structure diagram of the basic unit inside the LSTM is shown in Figure 3.

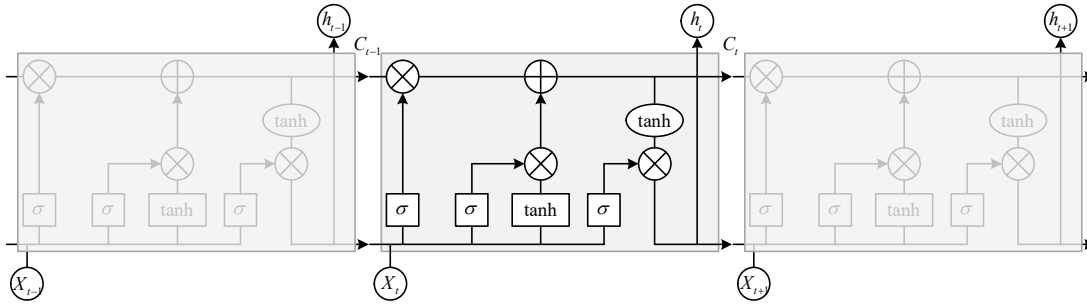


Figure 3: Schematic diagram of the LSTM structure

In Fig. 3, c_t denotes the cell state, h_t denotes the hidden layer state, x_t denotes the current input vector, and $\sigma(\cdot)$ and $\tanh(\cdot)$ are the activation functions, and the detailed structural information about the three gates of the LSTM is described as shown below [23]:

Forgetting gate: mainly decides whether to discard the information or save it, passes the current input information and the previous hidden state to the $\text{sigmoid}(\cdot)$ function, obtains the value closer to 0 means it needs to be discarded, and closer to 1 means it needs to be retained, and the calculation process is shown in Equation (5):

$$f_t = \sigma(W_f \cdot [h_{t-1}, x_t + b_f]) \quad (5)$$

Input gate: determines the input data that needs to be retained for the current cell state, and determines the information that needs to be stored in the cell state, which consists of two main parts: (1) the input layer decides the values that need to be updated, and (2) creates new candidate vectors $\tilde{C}_t$ to be added to the cell state, which is computed using the formulas shown below:

$$i_t = \sigma(W_i \cdot [h_{t-1}, x_t + b_i]) \quad (6)$$

$$\tilde{C}_t = \tanh(W_c \cdot [h_{t-1}, x_t + b_c]) \quad (7)$$

Output gate: determines the information contained in the hidden state, and the output determines the next hidden state, as shown in the following formula:

$$o_t = \sigma(W_o \cdot [h_{t-1}, x_t + b_o]) \quad (8)$$

$$h_t = o_t * \tanh(C_t) \quad (9)$$

$$C_t = f_t * C_{t-1} + i * \tilde{C}_t \quad (10)$$

where W_f, W_i, W_c, W_o represent the weights and b_f, b_i, b_c, b_o represent the bias.

III. C. Prediction Model of Teaching Effectiveness Based on Collaborative LSTM-SVR Modeling

Collaborative filtering is a common recommendation algorithm that originally predicts the user's interest level in unknown items based on user behavioral data [24]. Collaborative filtering is divided into two types: user-based and item-based. User-based collaborative filtering finds a group of users similar to the target user by analyzing the user's historical behavioral data, and then recommends the items preferred by this group of users to the target user. Item-based collaborative filtering, on the other hand, finds a group of items similar to this group by finding a group of items that the target user has historically liked, and then recommends this group of items to the target user. Zhong ingenious uses collaborative filtering algorithm to calculate the similarity between students (Eq. 11) and selects the K students that are most similar to the target student as the collaborative filtering subset, here K=5 is chosen. Then, the historical performance data of these similar students and the historical performance data of the target student are used as the training dataset:

$$sim(u_i, u_j) = \frac{\sum_{p \in P_{i,j}} (r_{i,p} - \bar{r}_i)(r_{j,p} - \bar{r}_j)}{\sqrt{\sum_{p \in P_{i,j}} (r_{i,p} - \bar{r}_i)^2} \sqrt{\sum_{p \in P_{i,j}} (r_{j,p} - \bar{r}_j)^2}} \quad (11)$$

where $sim(u_i, u_j)$ denotes the similarity between any two student samples i and student samples j , $P_{i,j}$ denotes the set of indicators in which student i and student j participate in the evaluation together, $r_{i,p}$ denotes student i 's rating on indicator p , $r_{j,p}$ denotes student j 's rating on indicator p , and $\bar{r}_i$ denotes the student's average rating on all evaluation indicator items.

The LSTM-SVR model is a combination of Long Short-Term Memory (LSTM) and Support Vector Regression (SVR). LSTM is a recurrent neural network that models sequential data and controls the flow of information through forgetting gates, input gates, and output gates, which allows it to deal well with long-term dependency problems and is well suited to be used for predicting students' grades. SVR, on the other hand, is a regression model, which achieves regression by mapping the input data to a high dimensional space using kernel functions and maximally spaced hyperplanes. Therefore, the LSTM used here to learn students' historical performance and behavioral patterns, and the SVR is used to predict the effect of aesthetic and civic education together, the LSTM model can be expressed as follows:

$$\begin{cases} i_t = \sigma(W_i x_t + U_i h_{t-1} + b_i) \\ f_t = \sigma(W_f x_t + U_f h_{t-1} + b_f) \\ o_t = \sigma(W_o x_t + U_o h_{t-1} + b_o) \\ c_t = f_t \square c_{t-1} + i_t \square \tanh(W_c x_t + U_c h_{t-1} + b_c) \\ h_t = o_t \square \tanh(c_t) \end{cases} \quad (12)$$

where i_t, f_t, o_t are the input, oblivion and output gates, respectively, σ denotes the sigmoid function, W_i, W_f, W_o, W_c are the weight matrices of the inputs, and U_i, U_f, U_o, U_c are the weight matrices of the outputs of the previous moment.

The inference process of LSTM is tedious, and the key inference nodes are given below.

First, the LSTM network can model the student's historical performance to obtain a hidden state h_t with the following specific formula:

$$h_t = f(W_{xh} x_t + W_{hh} h_{t-1} + b_h) \quad (13)$$

where x_t denotes the performance vector of the student and the similar 5 other students at moment t , W_{xh} and W_{hh} denote the weight matrices of the input layer and the hidden layer, respectively, b_h denotes the bias vector, and f denotes the activation function, which is chosen here as relu.

Then, by inputting the hidden state h_i into the SVR model, the predicted teaching effect y_i can be obtained as follows:

$$y_i = \sum_{i=1}^n \alpha_i K(x_i, h_i) + b \quad (14)$$

where x_i denotes the historical achievement vector, K denotes the kernel function, α_i denotes the coefficients of the support vector, and b denotes the bias term. With the above steps, the LSTM-SVR model can predict the teaching effectiveness based on the student's historical learning process data and assist the teacher in personalized teaching interventions.

IV. Assessment of teaching effectiveness

IV. A. Model Accuracy Analysis

In this study, the model will be validated on the learning dataset of traditional aesthetic and civic education. The experimental settings are as follows.

Experimental process and configuration: the experimental process begins with the collection and preprocessing of the dataset. Diversified traditional aesthetic and civic education learning data were collected, including various aspects such as information categories, learners' individuality and specific situations. In the preprocessing stage, staking was performed according to the AUC-ROC criteria for model training. The dataset was divided into training set, validation set and test set. In the training phase, the model is subjected to parameter learning on the training set, followed by tuning on the validation set and finally the final performance evaluation on the test set. The hardware configuration contains a GPU server while the LSTM-SVR model training and testing is implemented in TensorFlow.

Figure 4 shows the prediction accuracy of the training model, and in the TensorFlow learning scenario, the accuracy, recall and F1 score of the model increase with the increase of the training period, with the scores of 81.9, 80.4, and 79.4, respectively, and the mean values of the scores are above 79, indicating that the prediction performance of the model is gradually improving.

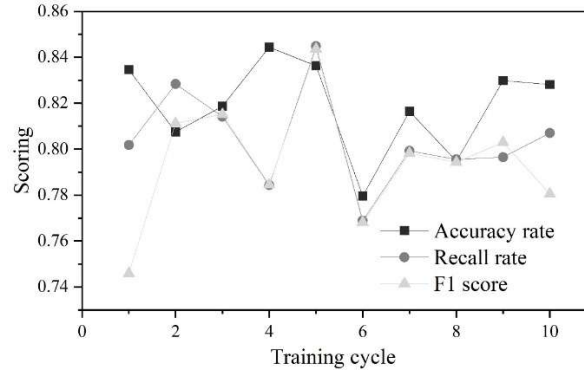


Figure 4: Training model prediction accuracy

Figure 5 shows the actual and predicted values of student evaluation results with 100 students as the test sample. The results show that the mean value of the error is 0.00114 below 1%, and the model performs excellently on the Aesthetic and Civic Synergy Learning dataset, which is a significant improvement over some of the previous methods. The graphical presentation section clearly indicates the evolutionary trend of the model in terms of classification accuracy, metrics, and proves the superiority of the model. The appearance of this result is not a coincidence. The superiority of the model mainly comes from its ability to effectively utilize the complex features of the Aesthetic and Civic Education data, such as the personalized needs of the learners and the complex attributes of the objects to be learned, in order to accurately predict the learning outcomes. All of this is inseparable from the meticulous data preprocessing work in the early stage and the appropriate model training strategy in the later stage. The importance of this result is also self-evident. Improving learning efficiency means that the learning pressure of learners can be reduced, the learning experience can be enhanced, and higher learning benefits can be obtained within the same learning time. This has a far-reaching impact on the popularization and deepening of aesthetic and ideological education.

Table 1: Teacher teaching analysis

Index	Content	Options	Frequency	Percentage	Average score
Teachers' teaching situation	In the teaching of beauty, the course of theory is quite the same as the course of practice	Very inconsistent	0	0.00%	0.835
		Discrepancy	10	14.29%	
		General	15	21.43%	
		Basic coincidence	20	28.57%	
		Very fit	25	35.71%	
	In the course of teaching, the education and virtue of the education are emphasized	Very inconsistent	3	4.29%	0.815
		Discrepancy	2	2.86%	
		General	20	28.57%	
		Basic coincidence	25	35.71%	
		Very fit	20	28.57%	
	Teach the basic qualities of traditional virtue	Very inconsistent	2	2.86%	1.048
		Discrepancy	6	8.57%	
		General	20	28.57%	
		Basic coincidence	50	71.43%	
		Very fit	20	28.57%	
	Through practical training virtues	Very inconsistent	5	7.14%	0.866
		Discrepancy	2	2.86%	
		General	20	28.57%	
		Basic coincidence	30	42.86%	
		Very fit	13	18.57%	
	Teaching is not limited to textbook knowledge	Very inconsistent	3	4.29%	0.575
		Discrepancy	10	14.29%	
		General	10	14.29%	
		Basic coincidence	25	35.71%	
		Very fit	22	31.43%	
	In the course of teaching, the teaching of social hot topics is taught	Very inconsistent	10	14.29%	0.125
		Discrepancy	5	7.14%	
		General	20	28.57%	
		Basic coincidence	25	35.71%	
		Very fit	10	14.29%	
	Correct errors in the course of teaching	Very inconsistent	2	2.86%	1
		Discrepancy	5	7.14%	
		General	18	25.71%	
		Basic coincidence	26	37.14%	
		Very fit	19	27.14%	

Through the experimental validation of the learning dataset of Aesthetic and Civic Education, the model has significant advantages in improving the educational efficiency of Aesthetic and Civic Education, enhancing the learning experience of learners, as well as promoting the popularization and deepening of Aesthetic and Civic Education. This fully demonstrates the great potential of using recurrent neural networks to improve the education method.

IV. B. Analysis of the Teaching Effect of Collaborative Education between Aesthetic Education and Civic and Political Education

IV. B. 1) Teaching and learning

In this survey, a total of 28 people in the 1st class of hotel management, 34 people in the 2nd class, and 8 people in the five-year college class of 2022 of a university were distributed, and 70 questionnaires were recovered, with an effective rate of 100%. This questionnaire is in the form of a scale, which is quantified when analyzing data. Table 1 is the analysis of teachers' teaching situation, using the LSTM-SVR model to predict the teaching situation, from the perspective of the average score of teachers' teaching situation, the average scores of "attaching importance to ideological and political education and virtue education in the teaching process", "correcting errors in the teaching process in a timely manner" and "teaching the basic literacy of traditional virtues" are higher, with 1.048 points, 1 point and 0.866 points, respectively. Among them, the scores of the first two have reached the score of the basic conformity. However, the average scores of "teaching knowledge around social hotspots", "training virtues through practical operations" and "teaching content is not limited to textbook knowledge" were low, with 0.125 points, 0.554 points and 0.575 points, respectively. This shows that in the teaching process, the depth of ideological and political elements is insufficient, and there is still room for improvement.

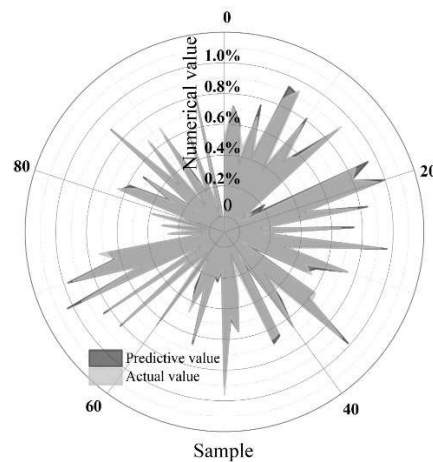


Figure 5: The student evaluates the actual value and the predicted value

IV. B. 2) Students' interest in learning

Table 2 shows the analysis of students' learning interests. The mean score of "preferring aesthetic and ideological education among the specialized courses" is 0.953, and the predicted choices of "general" and "basically conform" are 21.43% and 42.86% respectively. In the option of "the content of the course is very interesting", 35.71% and 35.71% of the students chose the options of general and general conformity, respectively. It can be seen that the teaching methods and modes of Civics and traditional aesthetic education have achieved better results.

Table 2: Student learning interest analysis

Index	Content	Options	Frequency	Percentage	Average score
Study interest	In the course of learning, we prefer the course of education and the collaborative education	Very inconsistent	3	0.00%	0.953
		Discrepancy	5	7.14%	
		General	15	21.43%	
		Basic coincidence	30	42.86%	
		Very fit	17	24.29%	
	The course teaching is very interesting	Very inconsistent	2	2.86%	0.943
		Discrepancy	5	7.14%	
		General	25	35.71%	
		Basic coincidence	25	35.71%	
		Very fit	13	18.57%	

IV. B. 3) Participation and Activity Statistics

Through the pre-processing and optimization operations, the effective information of the teaching data is effectively extracted, while the invalid and redundant data are filtered out. However, preprocessing and optimization operations cannot completely eliminate all invalid and redundant data, but can only reduce their influence to a certain extent. Therefore, combining other data processing methods, such as data cleaning and data integration, is a necessary means to improve the quality and application effect of teaching data. Data-driven, by comparing the actual application results with the expected results, the participation and activity statistics of various teaching activities are based on the actual data. Figure 6 shows the prediction of participation and activity of various teaching activities. The synergy of traditional aesthetic education and ideological education assisted by digital technology helps to improve the participation and activity of teaching. The statistics show that the engagement level increased by an average of 4.6% in the optimized teaching activities, with the interactive display project showing the highest increase, with a total increase of 7% in engagement and activity. This reflects the effectiveness of digital technology in promoting teaching interaction.

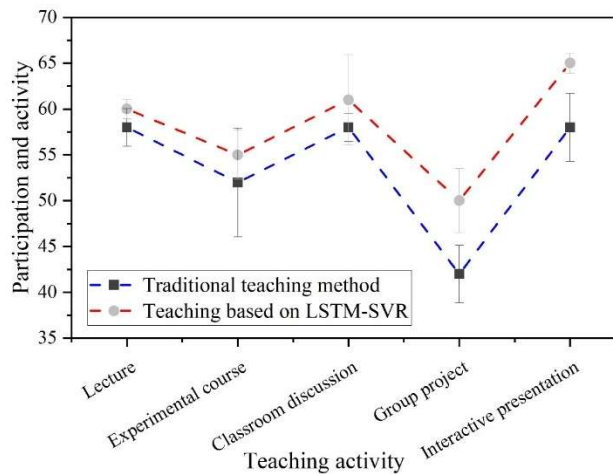


Figure 6: The participation and activity of various teaching activities are predicted

IV. B. 4) Identification of the effects of educational activities on aesthetic education and civic consultation

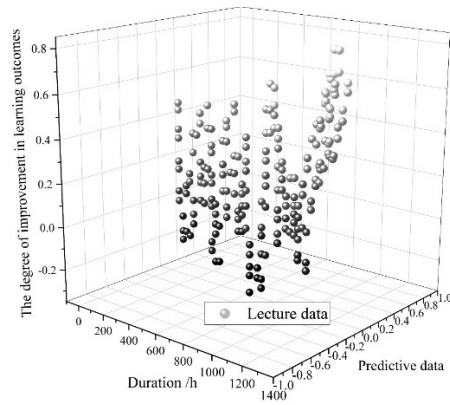
The statistical results of the participation and activity of different types of teaching activities show that the optimization of traditional aesthetic and ideological education based on the help of digital technology can effectively improve the teaching effect. The learning effects of different types of teaching activities are shown in Figure 7.

Figure (a) shows the learning effect of “lectures”, and Figure (b) shows the learning effect of “experimental class”. Statistical analysis reveals that different teaching activities significantly affect the learning effect, which is quantified by the absolute value method. The learning enhancement values of lecture activities are concentrated in the range of 0.2 to 1, showing the consistency of its positive effect. In contrast, the enhancement values of the experimental courses were distributed in the range of -0.4 to 0.4, reflecting their uneven contribution to the learning effect. Especially in the experimental courses, the percentage of learning enhancement value over 1.5 is 21.321%, while that of lectures is 40.065%, indicating that the digital technology-assisted collaborative cultivation of traditional aesthetic education and civic education has a more stable and positive effect on improving learning effects.

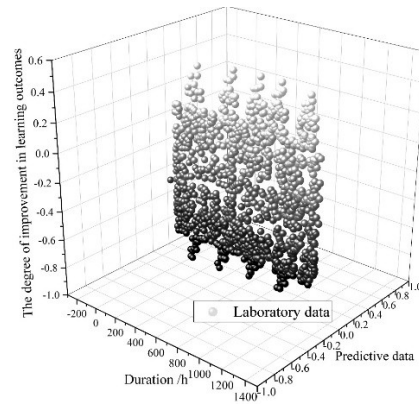
IV. C. Dynamic Adjustment Mechanism for Synergistic Education between Aesthetic Education and Civic and Political Education

IV. C. 1) Enhancing teachers' aesthetic literacy and awareness of inclusion

Education is a noble cause for the future of mankind, and teachers are a decisive factor in education. Teachers are an important factor in the teaching process, occupying a dominant position in the teaching process, teachers are responsible for linking all the teaching links in the teaching process, implementing a variety of teaching activities, and transforming the teaching objectives into actual teaching results, so the degree of teachers' aesthetic education directly determines the teaching effect of the aesthetic education integrated into the ideological and political class. With the concept of “curriculum ideology and politics”, aesthetic education gradually breaks the boundaries between different disciplines, and aesthetic education is no longer purely art education, nor is it a key competency that only teachers of art disciplines need to have. Aesthetic education should run through the whole process of individual training, and become the quality and ability that all teachers should have.



(a)"Lecture" learning effect



(b)"Experimental course" learning effect

Figure 7: The learning effect of different types of teaching activities is identified

IV. C. 2) Well-conceived teaching and learning sessions to improve the integration process

The integration of aesthetic education into the teaching of ideological and political courses not only requires teachers to strengthen their own level of construction, but also requires every teacher to seriously think about how to better integrate aesthetic education into every teaching link. One of the most important jobs of teachers is to prepare lessons, how to prepare a good lesson with aesthetic value, teachers can start from several parts of the teaching process.

IV. C. 3) Integrate teaching resources and optimize integration content

Ideological and political class is a key course for cultivating moral character, and aesthetic education is emotional education, aesthetic education, moral sentiment education and spiritual education, and aesthetic education affects students' vision and value orientation. Under the teaching concept of "curriculum politics", teachers of ideological and political class should get rid of the teaching concept of "talking about politics in politics", combine aesthetic resources with ideological and political education, and realize the virtue of aesthetic education. Political classroom teaching should not be limited to the classroom, should pay attention to the students' own life, pay attention to social life, and constantly explore the aesthetic resources in various fields, and incorporate aesthetic factors into the teaching of ideological and political classroom, so as to realize the promotion of knowledge and learning through beauty. Promote students' emotional sublimation with a wide range of natural, social, scientific and other resources.

IV. C. 4) Enhance students' aesthetic literacy and strengthen the effect of integration

The purpose of integrating aesthetic education in ideological and political courses is to better realize the disciplinary core qualities of ideological and political courses and to help students' aesthetic ability to evolve. Students' aesthetic ability is expressed through students' perception, appreciation and practice of beauty, that is, creation of beauty, therefore, teachers should pay attention to the development of students' aesthetic ability in teaching.

IV. C. 5) Improvement of the evaluation mechanism for aesthetic education and integration links

Teaching evaluation refers to the process of teachers in the teaching process according to certain teaching objectives, the process of value judgment on the process of students' learning and learning results, which includes the evaluation of teachers' teaching as well as the evaluation of students' learning. Generally speaking, teaching evaluation has the functions of orientation, diagnosis, motivation and regulation. Integrating aesthetic education into teaching, improving the evaluation mechanism of aesthetic education is an essential part.

V. Conclusion

This paper explores the relationship between aesthetic education and civic education, and develops and designs a school-based curriculum for the integration of civic education into virtue education. Based on the systematic filtering recommendation algorithm, combined with the long and short-term memory network and support vector regression model, it predicts the effect of aesthetic education and civic and political education together. Taking 100 students as test samples, the actual and predicted values of the students were evaluated, and the mean value of

the error was 0.00114 below 1%, and the model performed well on the learning dataset of aesthetic education and Civics and Politics Concerted Parenting, which is a significant improvement compared with some of the previous methods. Analyzing the students' learning interest, in the option of "the course teaching content is very interesting", the students who chose general and basically in line with the 35.71% and 35.71%, respectively, which can be seen that the teaching method and teaching model of the Civic Education course and the traditional aesthetic education have achieved better results. Based on the collaborative nurturing model of traditional virtue and civic education facilitated by digital technology, students' classroom activity and participation increased by a total of 7%, reflecting the effectiveness of digital technology in promoting teaching interaction.

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