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Artificial Intelligence and Multimedia Technology in the Construction of Performance Courses

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Abstract: As computers and information technology evolve, multimedia technology has been perfect as a carrier for transmitting teaching information, multimedia presentation and related application technology. The fusion of media and various digital information has become an irresistible trend to promote the application and development of multimedia teaching demonstration in skill learning. Due to the diverse forms of performance classes, the traditional teaching methods can no longer satisfy the current teaching methods of the new curriculum standards. In this paper, artificial intelligence and multimedia technology (AI&MT) are introduced into the construction of performance courses at the same time, and the classroom becomes lively and interesting by using multimedia technology to improve teaching methods. At the same time, based on artificial intelligence, SAIES system, naive leaf Bays algorithm, random forest and other algorithms are used to evaluate students' academic performance and interest in learning, aiming to construct a reasonable curriculum construction and change the problems existing in traditional teaching methods. Experiments showed that by applying AI&MT to performance courses, students' interest in learning has improved, the completion rate of learning progress has increased by 7.9%, and the work efficiency of teachers has increased by 6.03% compared with the previous ones.

1. Introduction

Diversified teaching methods are the basis for improving students' interest. For a long time, the traditional Chinese performance course teaching method has been widely criticized due to various problems and deficiencies. The monotonous teaching method can only convey basic theoretical knowledge to students. For various forms of performance courses, the single teaching method cannot keep up with the development of the times. With the continuous reform of education, the new curriculum standards also put forward new requirements for the reform of performance teaching. In this context, this paper improves the construction of performance courses based on AI&MT, so as to enrich students' classroom activities.

Based on the shortcomings of previous courses, many teams have conducted research on the construction of courses. There are many problems in the production of traditional health sports video courses, such as low storage capacity, large delay error, and low information processing speed. To this end, Yang S constructed a video course of college sports health education based on the Massive Open Online Course (MOOC) platform [1]. Aiming at the weak link of vocal music theory, it should improve the teaching mechanism of vocal music theory, pay attention to the structure of vocal music theory course, and standardize the teaching method of vocal music theory course. Starting from the importance of theoretical courses in vocal music teaching, Zhao X analyzed several effective strategies for the design of courses related to vocal music theory [2]. By examining the basis and guiding ideology of curriculum setting, it provided theoretical basis and useful reference for the cultivation of dance talents and dance education in colleges and universities. Jung, Ju-Eee, Byong-Ju analyzed the current situation of dance courses in colleges and universities, and drew on the experience and practices of professional colleges in the establishment of dance choreography, and put forward some reasonable suggestions [3]. Patricia, McDougall–Covin, Marian, combined with the requirements of innovation and entrepreneurship practice teaching in higher vocational colleges, introduced the innovation and entrepreneurship practice course construction plan from the aspects of teaching staff construction, training infrastructure construction, information resource construction, and curriculum system construction, in order to carry out the construction of innovation and entrepreneurship practice courses [4]. Kaleli YS put forward some constructive suggestions for the music education major, hoping to change the predicament of the development of the music major piano course and provide more professionals for the national music teaching field [5]. Sharma P S discussed the constructive plans and countermeasures to improve the English curriculum by analyzing the characteristics of the hidden curriculum in English teaching and the existing problems in the current English curriculum construction [6]. Obear G R, Pedersen M, Kreuser WC on the importance of golf course construction and infrastructure through teaching infrastructure. They analyzed the important guarantees for the construction of golf courses in colleges and universities from three aspects of training and development technology and network [7]. This paper introduces AI&MT into the construction of performance courses at the same time, aiming to provide a variety of classrooms for students majoring in performance, improve students' interest in learning, and change the previous monotonous teaching methods.

Artificial intelligence and multimedia technology are not only used in the construction of courses, but also widely appear in other fields, and many teams are studying them. Under the background that multimedia technology is widely used in teaching, Gweon G, Jun S, Finger S analyzed the feasibility of multimedia technology in art design courses on this basis, and discussed the strategy of implementing multimedia technology in art design courses [8]. In view of the necessity of multimedia technology application in construction engineering technical disclosure, Liu L proposed the main problems that need to be solved in the application process of multimedia technology in construction engineering technical disclosure [9]. Roberts W E. elaborated on how multimedia technology can improve students' interest in students, solve teaching problems, in-depth art appreciation, create art scenes, and integrate into other art disciplines [10]. Architectural drawing courses have certain teaching difficulties. In order to improve the effectiveness of teaching courses, multimedia technology should be applied in the teaching process to cultivate students' innovative skills. Yang H U, Nishina D, Tanaka T mainly explored the application of multimedia technology in the teaching of architectural drawing courses [11]. Through the application of artificial intelligence in teaching courses, R Williams, Park H W, O hL research the construction of "smart ocean" artificial intelligence intelligent learning system. From the aspects of curriculum setting, teaching content, teaching methods, teaching methods, evaluation, practical courses, etc., it provided suggestions for cultivating talents in artificial intelligence [12]. Tahan M. described the basic overview of artificial intelligence and intelligent library, analyzed artificial intelligence in the field of intelligent library application, and presented the value of library artificial intelligence [13]. In order to make artificial intelligence technology better serve online education, Park J H. mainly explored the curriculum construction content of maker education in the era of artificial intelligence [14]. Baldus O A improves teaching quality and talent training from the characteristics of artificial intelligence and the real needs of professional computer information courses, which is in line with the research curriculum method. Research courses have taught lessons in courses and achieved good results, with positive implications for research-based teaching practices in other courses [15]. It can be seen from the above research that AI&MT are not only used in the construction of courses, but also widely used in other industries and fields. This paper builds the performance course based on AI&MT, aiming to provide a reference for the subsequent course construction.

Various forms of performance courses require reasonable curriculum construction and diverse teaching methods. In order to change the irrationality of the performance course arrangement and the monotony of the course teaching in the past, this paper introduces AI&MT into the construction of the performance course at the same time, so as to change the current situation of the construction of the performance course, so as to improve the teaching quality and students' interest in learning.

2. Construction Model of Performance Curriculum System Based on Artificial Intelligence and Multimedia Technology

(1) System Architecture of Multimedia Technology in Course Construction

The application of multimedia technology in course creation refers to the use of multimedia computers to process teaching information such as text, graphics, images, animation, video, and audio in the teaching process. The teaching content is organically integrated in the way of human-computer interaction and multimedia information extraction, so that students can obtain a variety of external stimuli. Figure 1 shows the use of multimedia technology in a performance curriculum.

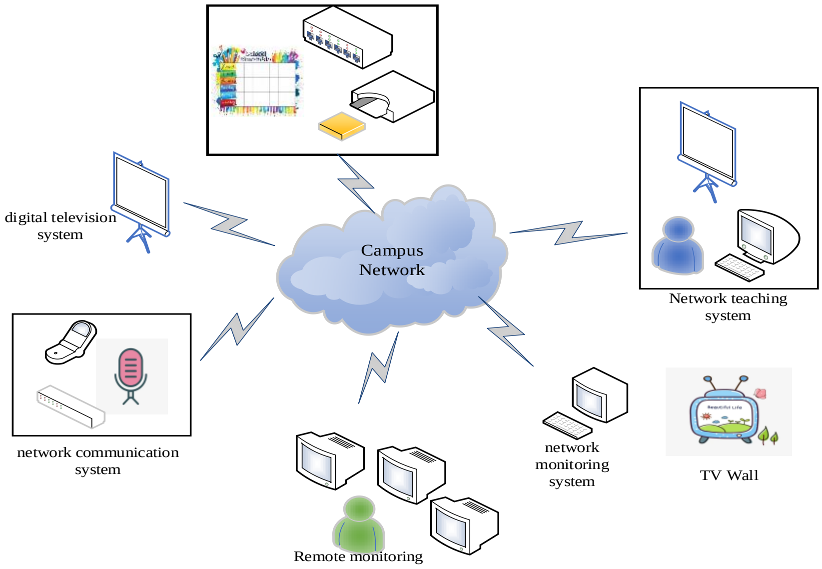

Figure 1. Flow chart of multimedia technology in curriculum construction

As shown in Figure 1, this part mainly involves the hardware operation of the system. The first is to obtain video and audio signals, and the microphone is used to collect audio signals; the download card completes the reception of computer screen signals, and the camera is responsible for obtaining video signals; cameras are installed in multimedia classrooms, not to capture the pictures of students listening to the class and the pictures of teachers in class. Remotely monitor the screen outside the multimedia classroom to keep abreast of teachers and students in the classroom.

(2) Recording and broadcasting system of multimedia technology

The composition of the multimedia recording and broadcasting system, the main materials of the system include ergonomic base, recording and transmission processing console, graphic image workstation, automatic recording and transmission processing machine, recording and transmission system camera, gooseneck microphone and software for automatic recording and transmission system. The most important hardware components of the system are graphics workstations and editing machines. The former is mainly used for face-to-face teaching and digital processing of courses using streaming media, while the latter is not only used to control external multimedia devices. The data flow diagram of the system is shown in Figure 2, because the integration of the system is relatively high. Therefore, the appearance of the whole system is simple and elegant, the occupied space is small, the maintenance is more convenient, the assembly lines are less, and the transmission distance is short, which reduces the loss of the signal during the transmission process.

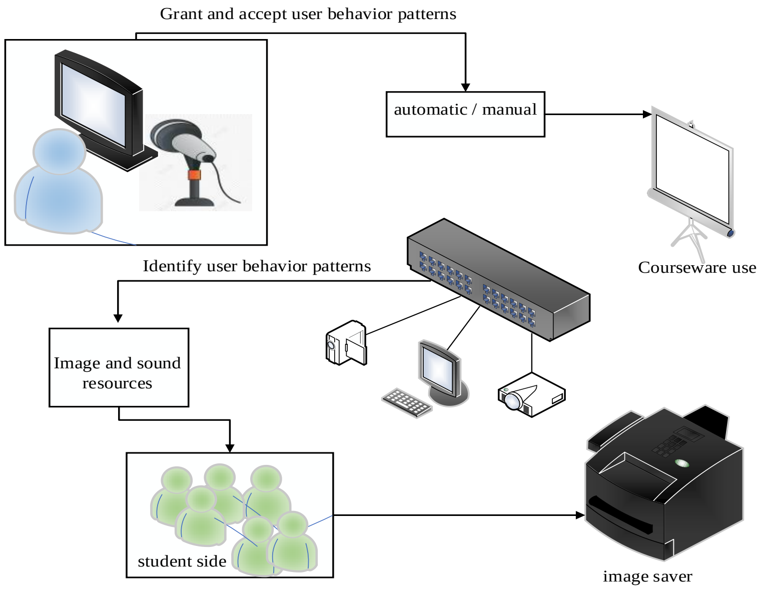

Figure 2. Structure diagram of multimedia recording and broadcasting system

(3) System modules of artificial intelligence in curriculum construction

From the perspective of students majoring in performance, this work is oriented towards the integration of information technology and curriculum, aiming to improve the quality and influence of teaching in colleges and universities. The research of the application of artificial intelligence in middle school performance classes focus on using artificial intelligence technologies such as natural language understanding, machine learning, and intelligent search, and try to design the modules of the performance class teaching system, as shown in Figure 3.

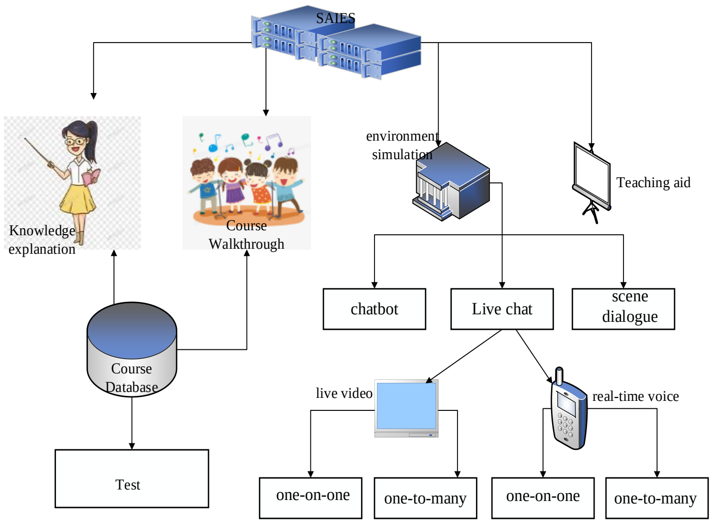

Figure 3. Diagram of the main modules of artificial intelligence

This paper selects the specific functions of the four modules of the SAIES system, namely the auxiliary teaching module, the knowledge explanation module, the practice module and the environment simulation module. First, the main users of auxiliary modules are teachers of university courses, and the main users of other modules are students. In this module, professional acting teachers can organize courses and upload teaching videos through the system interface, teachers can use data mining technology to evaluate the overall situation of the performance class exam, including analysis and assessment of student achievement, student knowledge system and inclusive language use ability, and providing teaching reference, etc. Secondly, through the system knowledge explanation section, students can preview and review knowledge points in the form of video or text, and apply the knowledge they have learned. Third, students can learn about their own performance knowledge system through the video practice part of the learning system, and can test themselves. The videos include types of videos covering all aspects of performance teaching such as music, dance, dialogue, and body, aiming to comprehensively examine students' performance abilities. Finally, after the system test is completed, the module automatically generates a score scale and study recommendations. In addition, with the help of this module, teachers can also conduct paperless examinations, based on the huge and scientific examination question database given after the examination, to evaluate the students' actual knowledge level and analysis of examination questions and examination results. Therefore, they can not only prompt acting teachers to teach according to their abilities, but also help learners to personalize the learning environment of the simulation module. The user of the simulation module is also the student system environment simulation unit.(4) Recommendation algorithm

1) Decision tree algorithm

Decision tree algorithms use a top-down retrospective approach. In the decision-making process, each internal attribute is compared, the branches under the node are judged by different attribute values, and the classification result after the decision is judged on the node leaves. There are two basic steps in classification using decision trees, the most important of which is the creation of a decision tree [16].

ID3 algorithm is a legacy algorithm in decision tree algorithm. Determine the nodes in the tree by calculating the information gain in the attribute, calculate the information gain in each attribute, the information gain percentage is the largest than the current node. By analogy, a decision tree is finally constructed [17]. Information entropy: In the algorithm ID3, for the sample data set B, the positive and negative examples of the sample data set are W and M respectively, and the information entropy type obtained from B is shown in formula (1).

$$I(B)=\frac{W}{W+M}\log_2\frac{W}{W+M}-\log_2\frac{M}{W+M} \quad (1)$$

In the example, the set A has an attribute S, the attribute has the value C{S(C1,...Cc)}, and the C subsets A1,...Ac correspond to A. For each subset in Ai, the information entropy of Wi positive Mi examples and negative examples Ai is determined as shown in Formula (2).

$$F(A_i)=-\frac{W_i}{W_i+M_i}\log_2\frac{W_i}{W_i+M_i}\log_2\frac{M_i}{W_i+M_i} \quad (2)$$

Then the information entropy formula for classification with S as the attribute is shown in (3).

$$F(S)=\Sigma_{i=1}^{c}\frac{W_i+M_i}{W+M}F(A_i) \quad (3)$$

Information gain: The information gain of attribute S is:

$$Gain(S)=I(B)-E(S) \quad (4)$$

C5.0 is a decision tree algorithm that can generate multi-branch decision trees whose target variables are categorical variables. Let B be the sample set, and the target variable M has s categories. Q(Wi,A) represents the number of samples belonging to the Wi class in A, and if A is the number of samples in the sample set A, the information definition of the entropy of A is:

$$I(B)=-\sum_{i=1}^{S}(Q(M_i,A)*\log_2(Q(M_i,A/|A|) \quad (5)$$

If the parameter W has c categories, the conditional entropy of the parameter W is defined as:

$$I(W)=-\sum_{i=1}^{c}((|W_i|/|W|)*I(W_i)) \quad (6)$$

The information gain of the attribute variable W is:

$$Gain(W)=I(B)-I(W) \quad (7)$$

When building a decision tree, the most important thing is to determine the separation principle of each node, that is, to choose the "optimal" attribute. The ID3 algorithm selects attributes based on information gain. Assuming that the sample set T β_n is a new feature in T, the information gain calculation formula is shown in Formula (8).

$$Gain(\beta_n)=Entropy(T)-\sum_{i=1}^{m}\frac{|T_i|}{|T|}\times Entropy(T_i)m \quad (8)$$

In formula (8), the number of samples of Ti is |Ti|, the number of samples of T is |T|, and the entropy calculation formula (T) is shown in formula (9).

$$Entropy(t) = -\sum_{i=1}^{s} frep(V_j, T) \times \log_2(frep(V_j, T) \tag{9}$$

The feature selection metric of the C4.5 algorithm mainly uses the information gain ratio. Its definition is shown in formula (10).

$$\begin{cases} GainRatio(\beta_n) = \dfrac{Gain(\beta_n)}{Split(\beta_n)} \\ Split(\beta_n) = \sum_{i=1}^{m} \dfrac{|T_i|}{|T|} \times \log_2(\dfrac{|T_i|}{|T|}) \end{cases} \tag{10}$$

The CART algorithm uses Gini coefficients to select feature separations. In Formula (10), $Split(\beta_n)$ represents the split information. The information produced when T is divided into m parts, each sample is considered equally likely, then $Gain(\beta_n)$ represents the information gain. In the separation option, the above two algorithms first calculate the entropy value of the candidate attribute. The attribute with the highest entropy value is selected as the separation attribute, and the above process is repeated to build the decision tree model.

Assuming that there is a set of samples T at node m, including category h, the definition of Gini coefficient is shown in formula (11).

$$G_i n_i(m) = 1 - \sum_{i=1}^{h} p_i^2 \tag{11}$$

If this property divides the sample T into l classes, the resulting average Gini is shown in Formula (12).

$$G_i n_i(\beta) = \sum_{i=1}^{l} \frac{|T_i|}{|T|} \times G_i n_i(i) \tag{12}$$

In formula (12), |Ti| represents the number of samples in child node i, l represents the number of child nodes d, and |T| represents the total number of samples before classification.

2) Random Forest Algorithm

The key building blocks of random forests are decision trees. Each random forest decision tree judges the imported new samples separately, and determines the prediction results of the new samples through a simple majority decision-making mechanism [18],which is shown in Figure 4.

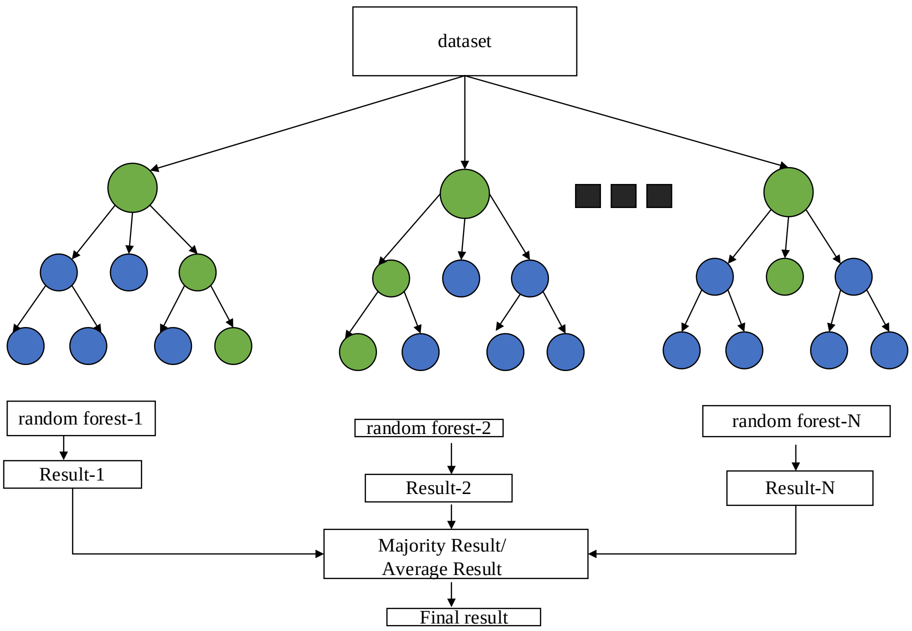

Figure 4. Random forest algorithm diagram

There are two standards for measuring the significance of variables in random forest, one is the Gini significance value, and the other is the permutation value. Assuming that there are M variables X1, X2, X3, H, XM, the significance evaluation statistic of variable M needs to be calculated. The evaluation statistic for the variable Xi is expressed as $VIM_i^{(GiMi)}$ according to the Gini index. This statistic $VIM_i^{(GiMi)}$ represents the average change in node separation contamination for the ith variable in a random forest tree. The formula for calculating the Gini index is formula (13).

$$GI_m = \Sigma_{h=1}^{H} \hat{p}(1 - \hat{p}_{mh}) \tag{13}$$

H is the number of classes in the set of self-service samples and the probability that node m belongs to class h. If the sample belongs to binary category data (ie, H=2), the Gini index of node m is shown in formula (14).

$$GI_m = 2\hat{p}_m(+\hat{p}_m) \tag{14}$$

$\hat{p}_{mh}$ is an estimate of the probability that a sample belongs to any class at node m. The value of the variable Xi at node m, that is, the change of the index Gini before and after the branch of node m is:

$$VIM_{im}^{(G_i n_i)} = GI_m - GI_i - GI_R \tag{15}$$

In Formula (16), GI_i and GI_R represent the Gini indices of two new nodes separated by node m. If the variable Xi occurs M times in the jth tree, the value of the variable Xi in the jth tree is defined as [19]:

$$VIM_{im}^{(G_i n_i)} = \Sigma_{m=1}^{M} VIM_{im}^{(G_i n_i)} \tag{16}$$

$$VIM_{i}^{(G_i n_i)} = \frac{1}{p} \Sigma_{j=1}^{n} VIM_{ji}^{(G_i n_i)} \tag{17}$$

In formula (17), p is the number of decision trees in the random forest.

(2) Course Classification Method Based on Naive Bass Algorithm

The Naive Bayes classification algorithm is based on Bayes' theorem and uses probability to classify courses [20]. The frequency of occurrence of the i-th lesson in the entire sample set is calculated as shown in Formula 18.

$$P(B_i) = \frac{Count(B_i)}{n} \tag{18}$$

$p = (A_j = a_j \mid C_i)$ represents the conditional probability of each value of the student feature in the category, which is calculated based on Formula (18). As can be seen from the example dataset, each course can only belong to one course category, and the differences between courses are characterized by 20 feature values, each of which has a different value. In this case, use Formula (19) to calculate the probability of different values of the same attribute in a category. As shown in Formula (19).

$$P = (A_j = a_j \mid C_i) = \frac{Count_{C_i}(A_j = a)}{Count(C_i)} \tag{19}$$

Hypothesis $P(X_k \mid C_i)$ represents the conditional probability of placing the student in the course category and computes the conditional probability of the feature instruction classified using Formula (19). During the calculation, it only needs to be displayed from the data, as shown in Formula (20).

$$P\ (X_k \mid C_i) = \underset{j=1}{\overset{m}{\Omega}} p(A_j = a_j \mid C_i) \tag{20}$$

Let $P(A_j = a_j)$ denote the probability that student attribute A_j has a value of a_j. Its value is the ratio of the number of course sections whose j-th attribute describing the difference of courses takes a value of a_j among all the sample numbers in all sample sets as the type. The calculation is shown in Formula (21):

$$P(A_j = a_j) = \frac{Count(A_j = a_j)}{n} \tag{21}$$

Let $P(X_k)$ denote the probability of course X_k to be classified in the training sample set. Since the attributes are independent, their values are the product of the frequency of each attribute value displayed in the sample set, and the calculation is shown in Formula (22).

$$P(X_k)=\underset{j=1}{\overset{m}{\Omega}}\, p(A_j=a_j) \tag{22}$$

3. Experiments of Artificial Intelligence and Multimedia Technology in the Construction of Performance Courses

(1) Experiment subjects: 3,000 teachers and students of performance majors in 5 universities of the same level in a city, including 2,800 students and 200 teachers, selected the types of courses required for performance majors for research. The basic information of the research subjects is shown in Table 1 and Table 2.

Table 1. Basic information for performance students

School name	Number of people	Number of boys	Number of girls	Type of study course
A university	600	200	400	Music
B university	500	150	350	Lines
C university	500	200	300	Drama1
D university	700	450	250	Drama2
E university	500	100	400	Dance

Table 2. Basic information of teachers of performing arts

School name	Number of people	Teacher's level	Length of service
A university	50	Lecturer and above	Over3years
B university	45	Associate professor and above	8+years
C university	35	Lecturer or above	5+years
D university	40	Professor and above	10+years
E university	30	Professor	10+years

(2) Experimental process

The experiment of this paper selects 2800 students majoring in performance and 200 teachers majoring in performance to conduct group experiments. Artificial intelligence and multimedia technology are used to compare students' interest in learning, academic performance, learning efficiency, teachers' work efficiency, and teaching quality before and after performing the course. A one-semester survey was conducted. After the experiment, questionnaires were distributed to teachers and students who participated in the experiment to analyze the role of AI&MT in the construction of the performance curriculum. The basic conditions of the experiment are shown in Table 3 and Table 4.

Table 3. Basic information of experimental students

School name	Number of people	Test group	Control group	Type of study course
A university	600	400	200	Music
B university	500	350	150	Lines
C university	500	400	100	Drama1
D university	700	500	200	Drama2
E university	500	280	220	Dance

Table 4. Basic information of experimental teachers

School name	Number of people	Test group	Control group	Teacher's level	Length of service
A university	50	35	15	Lecturer and above	Over3years
B university	45	25	20	Associate professor and above	8+years
C university	35	20	15	Lecturer or above	5+years
D university	40	32	18	Professor and above	10+years
E university	30	15	15	Professor and above	10+years

(3) Experiment method

The experimental methods used in this paper are mainly the control method and the questionnaire survey method, to compare a series of changes of teachers and students before and after the introduction of AI&MT into the construction of the performance curriculum. And it uses a questionnaire to evaluate the effectiveness of introducing AI&MT into the teaching of performance classes.

(4) The purpose of the experiment

Introducing AI&MT into the construction of performance courses, it enriches the teaching methods of performance courses, changes the traditional monotonous teaching mode and the irrationality of curriculum arrangements, so as to improve students' interest in learning.

4. Based on the Results of Artificial Intelligence and Multimedia Technology Applied to Curriculum Construction

(1) Students' interest in learning

Introduce artificial intelligence and multimedia technology to the performance curriculum, in order to test the effectiveness of AI&MT in the performance curriculum. Figure 5 shows the students' interest in the course before introducing AI&MT to the performance course, and Figure 6 shows the students' interest in the course after the introduction.

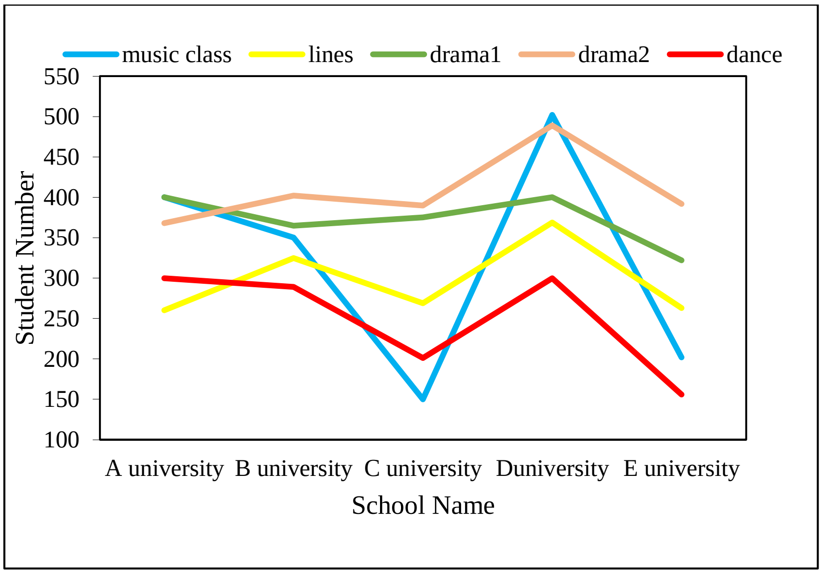

Figure 5. Students' interest in acting courses

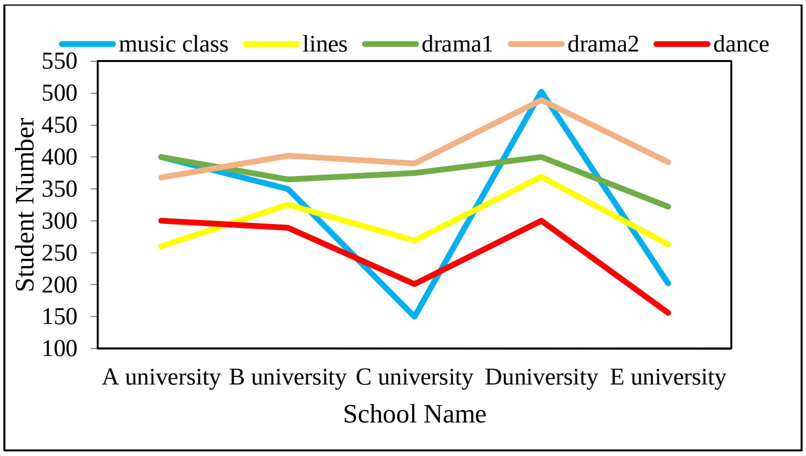

Figure 6. Students' interest in acting courses after the introduction of artificial intelligence and multimedia technology

According to Figure 5 and Figure 6, it can be seen that when AI&MT are introduced into the performance course, the students' interest in the course is generally low. After the adoption of AI&MT into the performance curriculum, it is evident from the graph that the number of students interested in dance has increased significantly across the 5 universities. The results show that the introduction of AI&MT into the construction of performance courses can not only enrich classroom teaching activities, but also stimulate students' interest in the course.

In order to clearly see the increase of students' interest in learning, Figure 7 shows the students' interest in music lessons before and after introducing AI&MT into the performance course on the basis of Figure 5 and Figure 6.

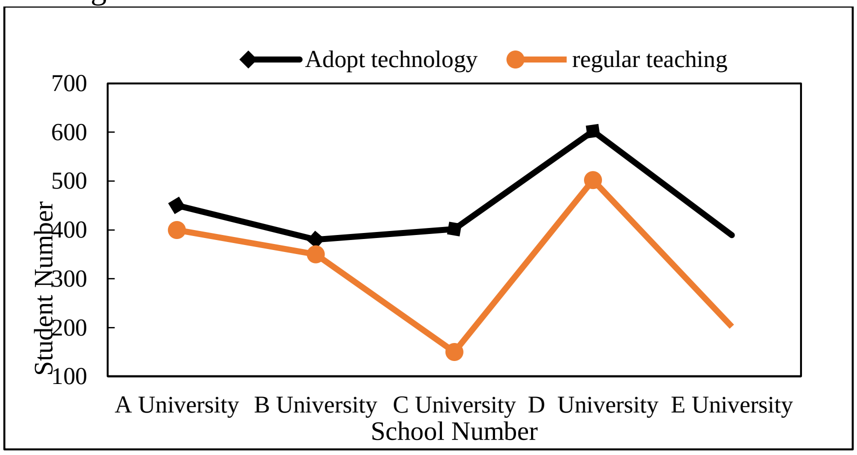

Figure 7. Student interest in music lessons before and after technology adoption

As can be seen from Figure 7, the application of AI&MT to classroom teaching has significantly increased students' interest in music lessons, especially in University C. Before the introduction of technology, only 150 of the 500 students in University C were interested in music courses. After the introduction of technology, 402 students were interested in music courses, accounting for 80.4% of the total number of students.

(2) Student's academic record

Figures 8 and 9 show the changes in student performance before and after the introduction of AI&MT to the performance course.

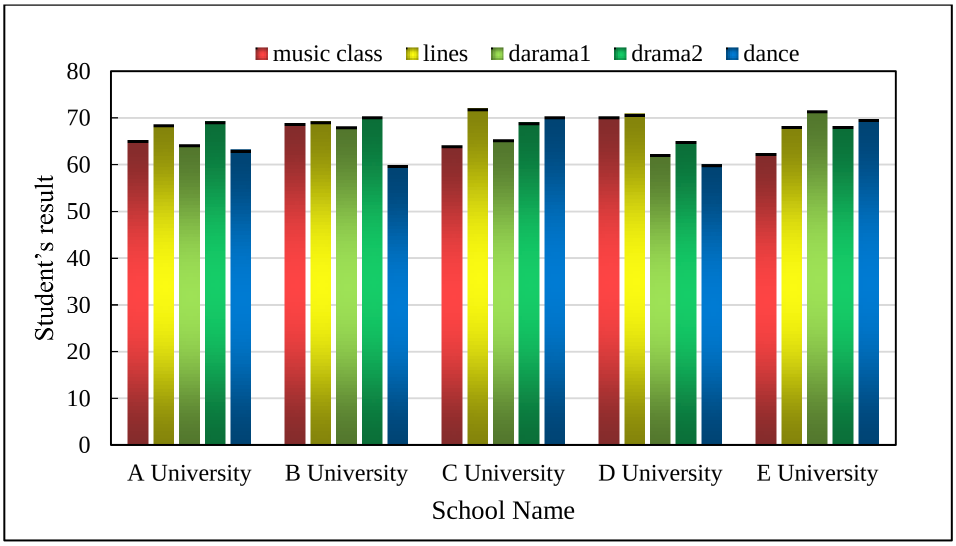

Figure 8. Final grades of students in regular teaching

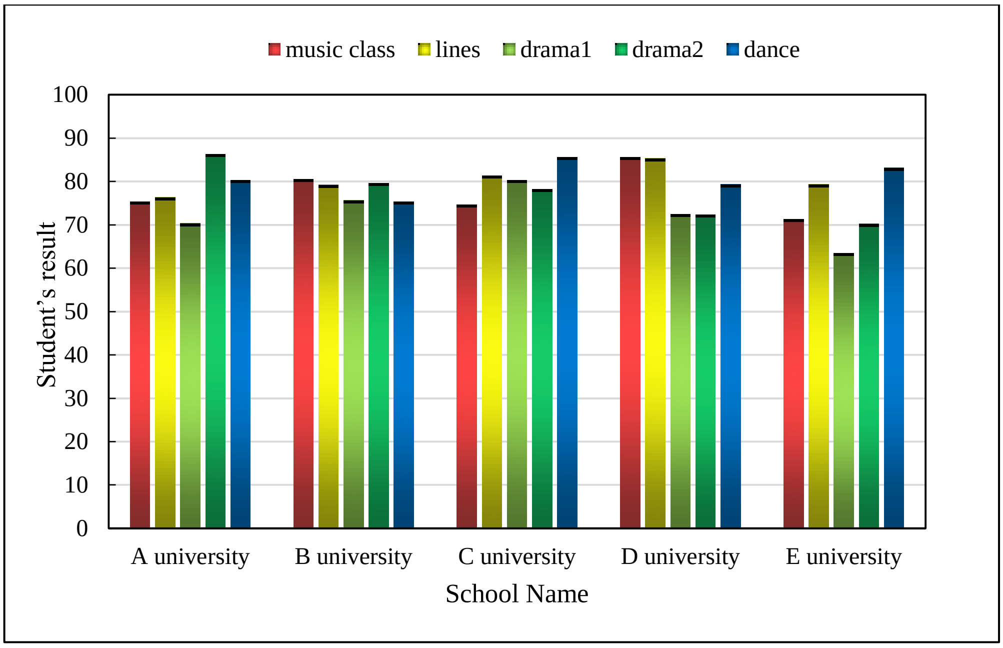

Figure 9. Student achievement after applying multimedia and AI teaching

As can be seen from Figure 8 and Figure 9, before the introduction of AI&MT into the construction of performance courses, the average grade of students in 5 universities' performance courses was 63.22. After the introduction of AI&MT into the teaching of performance courses, the average grades of these courses have improved by 75.46 respectively. Among them, the average grade of dance courses improved the fastest. The results showed that the introduction of AI&MT into performance courses can help students improve their grades.

(3) Students' learning efficiency

In order to test the effectiveness of AI&MT in performance courses, Figure 10 selects the comparison of students' learning progress before and after technology introduction in music courses and dance courses, and obtains students' learning efficiency.

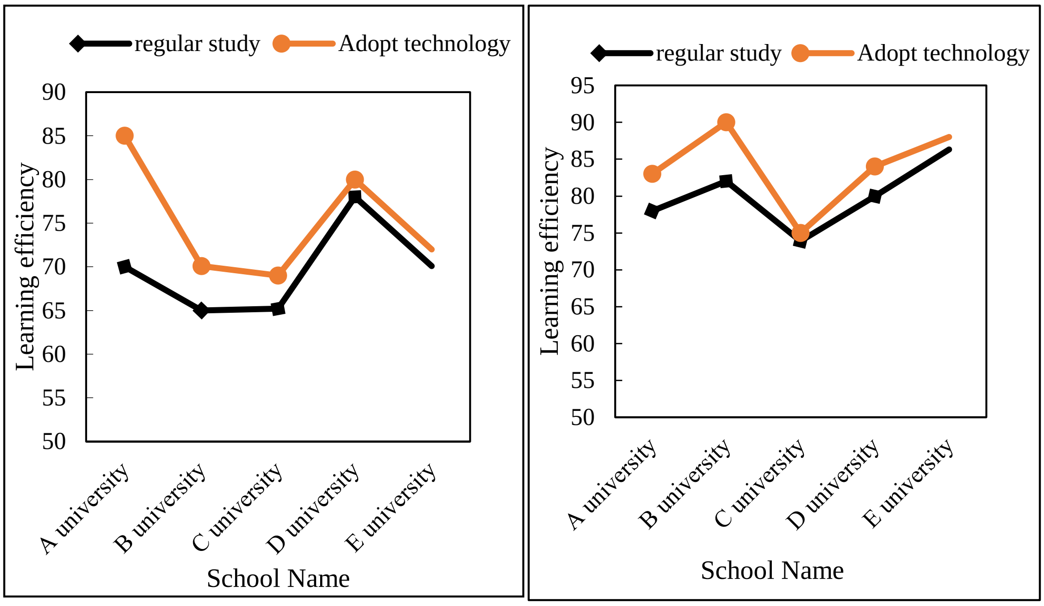

Figure 10. Comparison of student learning efficiency

As can be seen from Figure 10, after AI&MT are introduced into the performance course, the learning efficiency of students has been significantly improved. Students' learning progress can basically be completed within the stipulated time. The results show that the application of AI&MT to the construction of the performance curriculum improves the students' learning efficiency by 7.9%.

(4) Teachers' work efficiency

Figure 11 and Figure 12 show the comparison of changes in teachers' work efficiency before and after introducing AI&MT into performance courses.

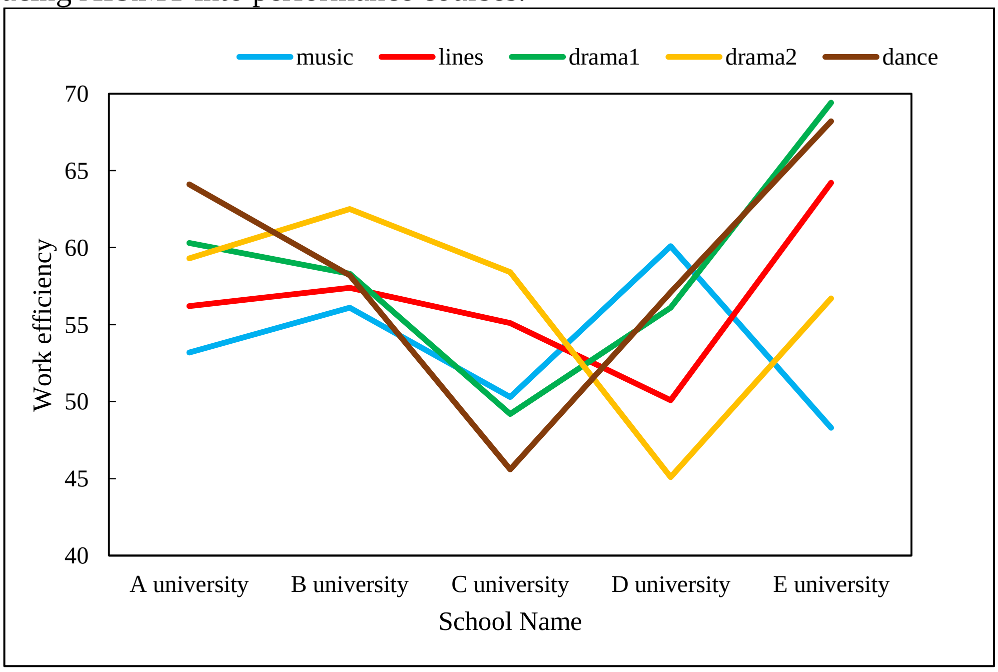

Figure 11. Teacher productivity in regular teaching

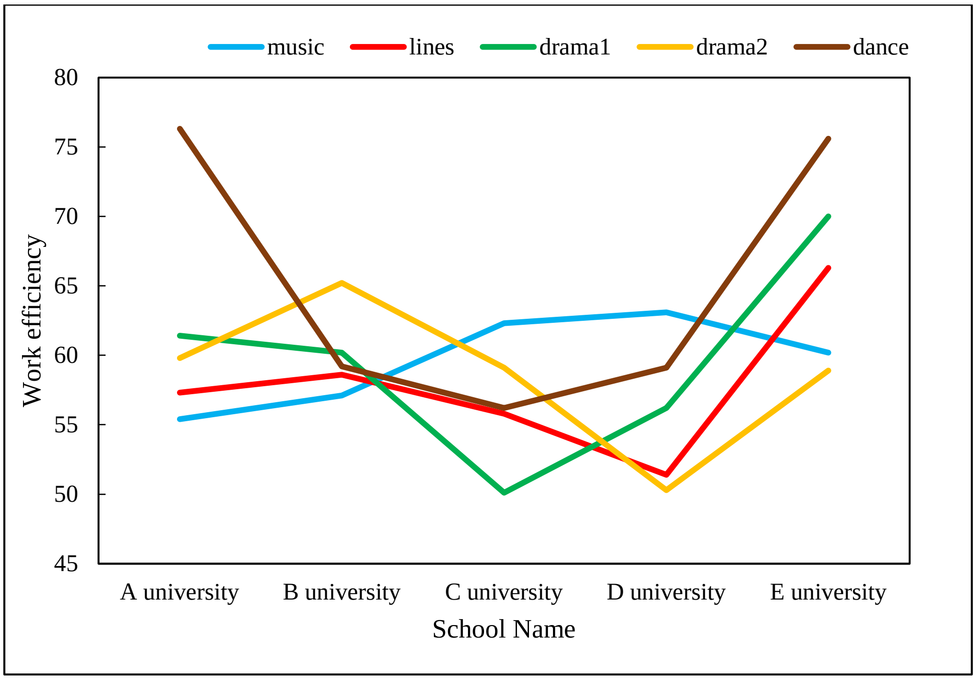

Figure 12. Teacher productivity after technology adoption

From the comparison between Figure 11 and Figure 12, it can be seen that after the introduction of AI&MT to the performance course, the completion of the teacher's teaching progress has been significantly improved. The results showed that after introducing AI&MT into the performance curriculum, teachers' work efficiency increased by 6.03%.

5. Conclusion

With the rapid development of artificial intelligence and multimedia technology and its wide application in learning and life. The application of artificial intelligence and multimedia technology in the construction of performance courses not only directly affects the completion of school tasks by students and teachers, but also affects the development of artificial intelligence and multimedia technology in information education. This paper introduces artificial intelligence and multimedia technology into the construction of performance courses, showing the practicability of artificial intelligence and multimedia technology in the teaching of performance courses. Through the specific functions of the four modules of the SAEIS system: the auxiliary teaching module, the knowledge explanation module, the exercise practice module and the environment simulation module, the efficiency of students' learning has been greatly improved, and the work efficiency of teachers has also been continuously improved. The application of artificial intelligence and multimedia technology in performance teaching has brought infinite vitality and vitality to the teaching of performance class. It is presented to students in the form of images, words and sounds, which greatly stimulates students' interest and enthusiasm for learning. Students' subjective initiative cultivates students' "objective awareness" and improves their academic performance.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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