Design of Teaching Mode and Evaluation Method of Effect of Art Design Course from the Perspective of Big Data

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***Abstract*—In modern educational curriculum teaching, we should fully leverage the advantages of modern technology, especially in teaching methods, and deeply understand and apply big data technology. This article explores the design and effectiveness evaluation methods of curriculum teaching models from the perspective of big data. We utilized big data thinking and conducted research and practical exploration to compare and evaluate teaching mode design methods. In the art and design course, we adopted a blended learning model, combining MOOC and SPOC, and innovated traditional teaching methods and plans. Meanwhile, we investigated the teaching effectiveness and feasibility of this blended learning model. By extensively evaluating teaching techniques, evaluation methods, and technologies that support the learning process, we reconstructed blended learning evaluation indicators and evaluated the effectiveness of learning outcomes and processes under different teaching modes. The research results show that the blended learning model based on big data perspective can significantly improve the effectiveness of classroom teaching. In contrast, learners' self-learning ability and practical innovation ability have also been further improved.**

***Keywords*—Big data perspective; teaching mode; evaluation system; art and design; hybrid teaching**

I. Introduction

This throughout the data explosion of the 21st century, data is no longer a static and obsolete number [1] but has become a business capital. This important economic input can create new economic benefits. From its beginnings in business and technology, it is gradually moving towards and having a huge impact on healthcare and education. From the perspective of big data, the teaching mode design of art and design courses needs to fully consider the learning needs and practical ability cultivation of students. By collecting learning data from students and analyzing their learning behaviors and habits, teachers can develop teaching plans and plans that are more in line with their actual needs. For example, teachers can use data mining techniques to analyze students' learning trajectories, stay times, and review times, understand their learning difficulties and needs, and thus develop more accurate teaching plans.

In addition, in the process of designing teaching modes, it is also necessary to fully consider the setting of course structure and content. Art and design courses usually include two parts: theoretical knowledge and practical operation, and the application of big data technology can better promote the integration of these two parts. Through big data analysis, teachers can have a clearer understanding of students' learning situations and needs; thereby better adjusting course structure and content, and improving teaching effectiveness.

In such an era, the practice and exploration of art design course teaching [2] mode design and assessment and evaluation methods are an important part of which has a guiding role, an important way to strengthen the construction of courses, professional construction and improve the quality of teaching, as well as a method to test the quality of talent training in colleges and universities. In the era of big data, it is a question worth practicing and exploring how to draw on the big data thinking that has triggered social changes and carry out scientific reform for the assessment and evaluation methods of art and design courses around teaching purposes, student characteristics and course objectives of art and design majors in colleges and universities [3].

In order to break the status quo of subjectivity, one-sidedness, and singularity of assessment and evaluation methods, the design assessment and evaluation methods of art design course teaching mode in universities need to be reformed. The two cores of big data thinking are important to draw on in this process. In the "small data era", because the amount of information collected is relatively small, subtle errors will be magnified in the limited information, and the error rate will increase, so much so that it may affect the accuracy of the whole result. In assessing and evaluating the design of the teaching mode of art and design courses in colleges and universities, a single, one-sided quantitative evaluation standard cannot guarantee that the evaluation results are free from bias. Therefore, quantitative evaluation criteria in assessing and evaluating art and design courses can only be one component of the information and data required. The depth and breadth of data and information should be increased, and the course assessment and evaluation should be conducted with more comprehensive and diversified data and information to promote a more comprehensive assessment and evaluation [4].

Professional competencies such as method, thought, creativity, and expression in creating art and design works are diverse, as are the professional competencies involved, such as teamwork, re-learning, and resistance to frustration. These competencies should be emphasized and focused on in university art and design courses, and they can all be learned, exercised, and presented in the design process. Focusing on the learning and design process and conducting real-time assessment and evaluation in stages for the corresponding competency points can prompt students to enrich their training in more professional and vocational competencies, clarify their learning and practice goals, and improve their initiative. In the meantime, the teacher is deeply involved in the whole process of students' learning and design. Based on what the students observed in the learning and creation process and the actual situation of learning competency points, the teacher can promptly adjust the teaching progress, supplement or strengthen the relevant contents, and give students adequate guidance.

As a practical and innovative discipline, art and design courses require the support of big data technology in order to better cultivate students' innovative thinking and practical abilities. From the perspective of big data, the teaching mode design of art and design courses needs to fully consider the learning needs and practical ability cultivation of students. By collecting learning data from students and analyzing their learning behaviors and habits, teachers can develop teaching plans and plans that are more in line with their actual needs. For example, teachers can use data mining techniques to analyze students' learning trajectories, stay times, and review times, understand their learning difficulties and needs, and thus develop more accurate teaching plans. Diversity of assessment and evaluation subjects to make assessment and evaluation more objective, the following points need to be achieved. Firstly, in course assessment and evaluation, it is usually necessary for the lecturer to take the lead and several non-lecturing professional teachers to participate. Secondly, there is a need to implement a three-in-one collaborative assessment in the assessment of courses. Thirdly, experts from academia and industry were invited to conduct immediate assessments of students to promote teaching and learning. Fourthly, elements of professional competitions in-course assessment and evaluation are introduced to get evaluated on more platforms. Teachers can guide students to choose professional competitions for university students with high gold content, wide audience, and indicative nature. They can also evaluate students and course works based on their performance and achievements in professional skills competitions.

Drawing on big data thinking, the method of diversifying assessment and evaluation subjects and assessment and evaluation content can effectively improve the problems of subjunctivization, one-sidedness, and singularity that arise in the assessment and evaluation of art and design courses in colleges and universities so that the assessment and evaluation of art and design courses is no longer a task at the end of the course, but a part of the course teaching in which students must participate. Using the method of diversifying assessment and evaluation subjects and assessment and evaluation contents not only makes the assessment and evaluation more comprehensive and objective, but more importantly, it makes the learning objectives clear to students while improving their learning initiative.

In recent years, MOOC has developed rapidly, with the construction of various MOOC platforms and a sudden surge in the number of online courses and users [5]–[7]. The huge growth in quantity has also caused certain quality problems, which are mainly manifested as follows: firstly, learners do not have a better grasp of their knowledge needs, leading to a large number of learners blindly registering and following the trend of learning, and MOOC platforms do not have effective means to restrain learners' learning discipline and learning progress. Secondly, teachers' lack of necessary guidance and communication during the learning process has reduced learners' interest in learning. Although most MOOC platforms have some interactive means, they cannot find learners' questions and answer them promptly. The one-way knowledge dissemination method based on video learning is unsuitable for cultivating and improving learners' learning capabilities. It is even more difficult to achieve in-depth learning. Thirdly, the MOOC platform only provides some theoretical materials and practice content without monitoring the learning process of learners. A new evaluation system should be developed by proposing a new teaching model for art and design courses from the perspective of big data.

The concept of SPOC [8]–[10] (Small Private Online Course) was first introduced and used by Professor Armand Fox of California State University, Berkeley. Massive and Open are in opposition to small and private. While Small helps to increase participation, interactivity, and completion rates, Private make the course somewhat restrictive and simple to keep up and manage. The hybrid teaching mode, which combines the ideas of MOOC and the flexibility of SPOC, is a further learner-centred approach that takes into account the leading role of the teacher, incorporates multiple teaching methods, mixes multiple teaching devices, combines multiple learning resources, and uses multiple evaluation indicators to build a hybrid learning mode that intersects synchronous and asynchronous learning [11], [12].

The construction of a teaching mode for art and design courses in higher education is upgraded through the borrowing and application of the big data thinking mode while forming a diversified assessment work system, both in terms of assessment content and subject matter respectively. The result is that while eliminating the problem of developmental limitations, the overall art course assessment can be better adapted to student growth needs and encourages and actively contributes to the advancement of art and design education. This paper aims to analyze the effectiveness of teaching methods and the feasibility of this mode by using a hybrid teaching mode that combines MOOC and SPOC. By conducting a comprehensive evaluation of teaching techniques, assessment methods and technologies that support the learning process, and a reconstructed hybrid teaching assessment index to assess learning outcomes in different teaching modes, the design of a teaching mode for art and design courses from a big data perspective act as a catalyst for traditional teaching methods.

In previous studies, scholars mainly focused on the potential applications and advantages of big data in art and design courses. For example, some studies suggest that big data can help teachers better understand students' learning needs and behavioral patterns, thereby developing more personalized teaching plans. In addition, research has shown that big data can be effectively used to evaluate the learning effectiveness of students and the effectiveness of course design.

In the current research, we will delve deeper into the design of teaching modes and evaluation methods for art and design courses from the perspective of big data. Firstly, we will further investigate and address the challenges of data processing and analysis, and propose more effective methods and techniques to handle large amounts of unstructured data. Secondly, we will delve deeper into privacy and security issues and propose more comprehensive data protection strategies and measures. In addition, we will also explore how to combine big data with other advanced technologies such as artificial intelligence; machine learning, etc. to provide a more personalized and efficient learning experience.

II. Main Framework for Blended Learning

The SPOC-based hybrid teaching combines traditional face-to-face and independent learning on the SPOC platform. Considering the actual teaching mode design of art design courses in colleges and universities, this paper divides the whole learning stage into task-based independent learning before class, guided learning through teacher-student interaction within the class, and enhanced learning through consolidation and evaluation after class. The teaching framework of the blended teaching mode is shown in Fig. 1.

The teacher sets the learning tasks before the class; learners learn through online videos, share their learning, and practice through online tests to consolidate and master the knowledge. Teachers led workshops in the classroom, practiced and analyzed the lessons, refined knowledge, and reviewed learning outcomes. At the end of the lesson, the teacher assigns practical tasks, and learners expand their knowledge, deepen their understanding and mastery, and submit their results to the teacher for comments [13], [14].

Learners can access theoretical and practical knowledge through various channels, depending on their preferences. They can use materials such as textbooks, online videos, electronic lesson plans, and supplementary materials provided in the online courses. In addition, learners can use the case library to practice their art and design expertise. Its components are shown in Fig. 2.

1) Includes 56 videos on course knowledge and 18 videos on extended knowledge for learners' independent study before class and extended practice after class.

2) 38 videos of experimental explanations and 42 experimental assignments, and learners can use the online assessment platform to program and receive real-time feedback.

3) Five unit-based theory tests, five unit-based arts, design tests and a final theory test and a practical test.

4) From the fifth week of the course, learners will work in groups to solve two complete cases. Rigorous tests and an assessment of the system's hand-in results are conducted as required.

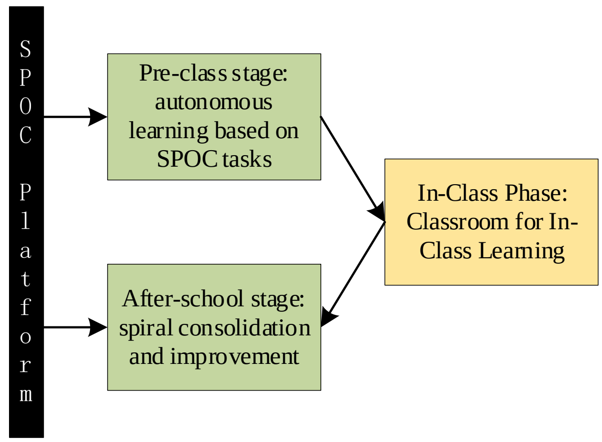


Fig. 1. MOOC + SPOC-based hybrid teaching mode with a modal teaching framework.

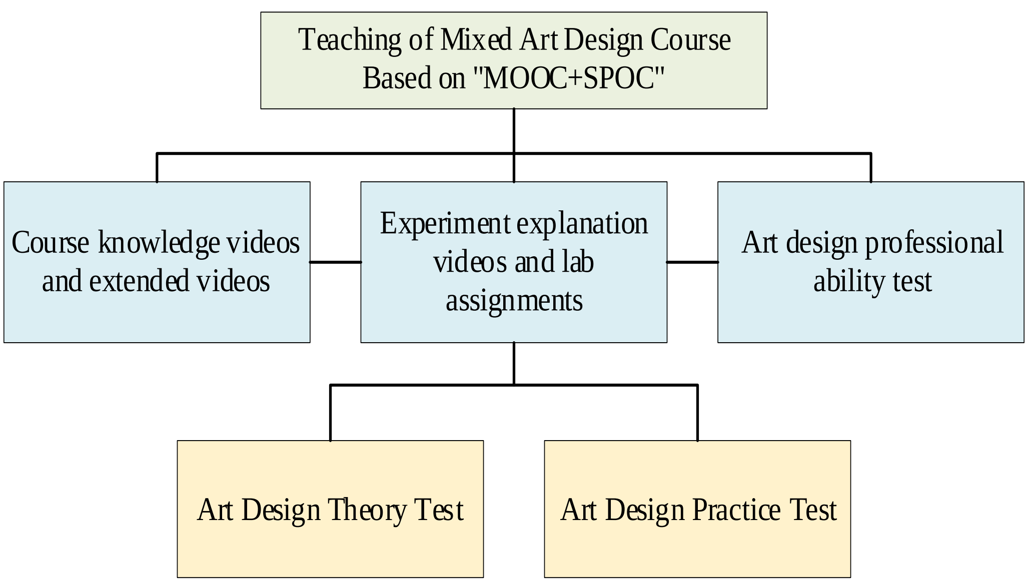


Fig. 2. Art and design course hybrid teaching plan.

III. Hybrid Teaching Evaluation Indicators

In the hybrid teaching approach, the assessment of learners focuses heavily on the entire learning process. It involves monitoring their pre-learning progress, assessing their mastery of knowledge during class, and measuring their ability improvement after class. This solves the problem of traditional teaching methods neglecting to assess learners' learning attitudes and learning processes. Through the evaluation system, teachers can identify the shortcomings of teaching strategies and content, understand learners' learning, improve teaching design in time, and make timely and targeted interventions on learners' learning to improve teaching quality.

In this study, the Delphi method [15], [16], the Experts Grading Method (EGM), and the Analytic Hierarchy Process (AHP) [17], [18] were combined to construct the index system, and 16 industry experts were sent a call for comments to establish a hierarchical mode of the evaluation system, as shown in Fig. 3. The weights for each indicator system were determined and presented in Table I.

Fig. 4 compares the total weights of the blended learning assessment indicators. As can be seen from Fig. 4, the indicator system no longer uses examination results as the only criterion for evaluating learners' abilities. Still, it gives more weight to problem-solving, active learning, participation in discussions, and design innovation, thus placing more emphasis on cultivating independent learning and practical and innovative abilities in the blended teaching mode and more emphasis on exploring and expanding learners' potential abilities.

A. Delphi Method

1) Traditional delphi method: The Delphi method emerged in the early 1950s as a predictive technique invented by Dalktey and his associates and has been widely used in curriculum teaching. By conducting a questionnaire for a decision-making group, not only can a brainstorming effect be achieved, but it can also be revised repeatedly to obtain a final result. The characteristics of the Delphi method are as follows.

a) The Delphi method relies on the experience and judgment of the participants, and the intervention of individual subjectivity is inevitable but is, therefore, fully inclusive of a diversity of views.

b) The different participants participate in the analysis of the thesis anonymously to avoid human interference.

c) The indicators of prediction and judgment in the questionnaire need to be studied carefully and focus on the feedback of participants' opinions. The final results will converge to reach a consensus through the analysis of the questionnaire results and repeated surveys.

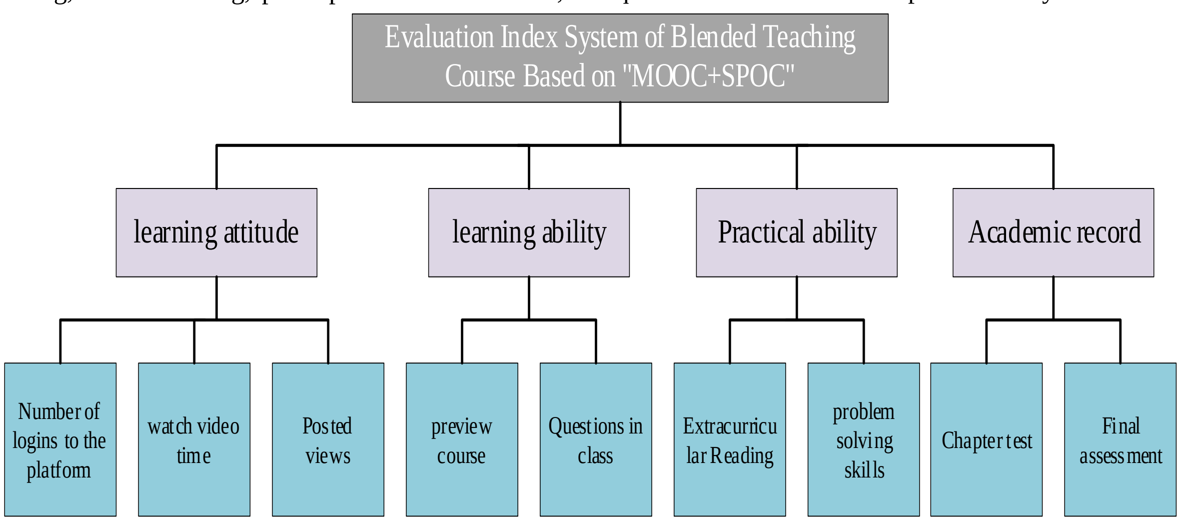


Fig. 3. Evaluation index system of the blended teaching mode.

TABLE I. Weighting of Evaluation Indicators for Blended Learning and Teaching

First-level indicator	Weights	Secondary indicators	Weights	Combined weights
learning attitude	0.128	Number of logins to the platform	0.151	0.019
		watch video time	0.524	0.067
		Posted views	0.325	0.042
learning ability	0.234	preview course	0.456	0.107
		Questions in class	0.544	0.127
Practical ability	0.234	Extracurricular Reading	0.264	0.062
		problem-solving skills	0.736	0.250
Academic record	0.404	Chapter test	0.413	0.167
		Final assessment	0.587	0.237

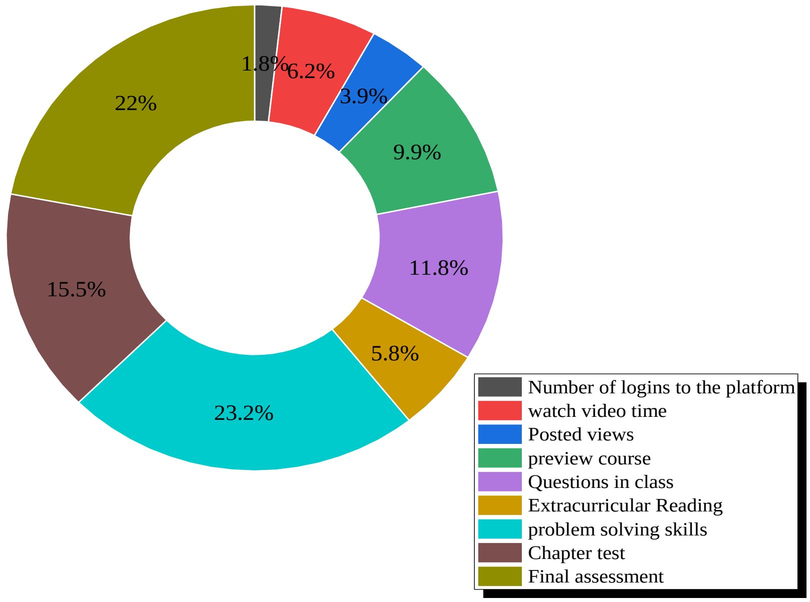


Fig. 4. Comparison of composite indicator weights for blended learning.

2) Fuzzy Delphi Method (FDM): As the Delphi method is used to make decisions through multiple questionnaires and integrate expert opinions, its conclusions are more rigorous and reasonable, so it is more widely used. However, it has drawbacks, such as poor questionnaire design and convergence due to widely differing expert opinions. The Delphi method may ignore the correct and unique opinions of a few experts, and the method expresses expert opinion in precise numerical terms, which is not in line with the ambiguity of human thinking. The steps are as follows:

a) Building set of influencing factors.

b) Summarizing expert opinion

Based on the different influencing factors obtained from the aggregation, a questionnaire was designed, and an expert questionnaire was administered. Considering human thinking judgments

To make the expert's opinion complete, the expert is asked to fill in the questionnaire, according to his professional knowledge, to determine the degree of influence of each influencing factor on the selection and to give a value between 1 (no influence) and 10 (absolute influence), the higher the score means the greater the influence, the maximum value of the interval represents the maximum influence of the factor in the expert's opinion. In contrast, the interval's minimum value represents the factor's minimum influence on the expert's opinion. The range's maximum value represents the factor's maximum influence as perceived by the expert. In contrast, the range's minimum value represents the factor's minimum influence as perceived by the expert.

3) Establishing trigonometric fuzzy functions [19] and integrating expert opinion.

The expert opinions obtained from the questionnaire were collated and organized.

$$\underset{\sim}{n} = (l_A, m_A, u_A) \tag{1}$$

$$\underset{\sim}{N} = (L_A, M_A, \quad U_A) \tag{2}$$

Create fuzzy sets of the minimum and maximum influence of each influence factor and,$\underset{\sim}{N}$ respectively, where

$l_A: min(x_{Ai})\,, \quad i = 1 \sim n$

$m_A: (x_{A1}, x_{A2}, \dots \dots x_{An})1/n, \quad i = 1 \sim n$

$u_A: max(\,xAi), \quad i = 1 \sim n$

$L_A: min(X_{Ai})\,, i = 1 \sim n$

$M_A: (X_{A1}, X_{A2}, \dots \dots X_{An})^{1/n}, i = 1 \sim n$

$U_A: max(X_{Ai})\,, \quad i = 1 \sim n$

X_{Ai}: The value of *ith* expert's maximum influence on the *A* influencing factor.

L_A: Lower limit for the value of the maximum influence of the expert group on the impact factor *A*.

M_A: Geometric mean of the expert group's assessment of the maximum impact of influence *A*.

U_A: The upper limit of the value of the maximum influence of the expert group on the impact factor *A*.

Then, the affiliation functions of the fuzzy sets$\underset{\sim}{n}$and$\underset{\sim}{N}$ can be expressed respectively as,

$$\mu_n(x_i) = \begin{cases} 0 & 0 < x < l_A \\ \dfrac{x - l_A}{m_A - l_A} & l_A \le x < m_A \\ \dfrac{-x + u_A}{u_A - m_A} & x = m_A \\ x > m_A & \end{cases} \tag{3}$$

$$\mu_N(x_i) = \begin{cases} 0 & 0 < x < L_A \\ \dfrac{x - L_A}{M_A - L_A} & L_A \leq x < M_A \\ 1 & x = M_A \\ \dfrac{-x + U_A}{U_A - M_A} & x > M_A \end{cases} \quad (4)$$

4) Calculate the quantitative value of each influencing factor: If the opinions of the interviewed experts have converged, i.e.$u_A \geq L_A$, and$G_A < Z_A$, then the intersection of the two fuzzy setsCP can be found as the quantitative value of this influence factor, which represents the degree of influence of this influence factor on the target as agreed by the experts as a whole, and can be used as the basis for screening the influence factor. From the above figure, the intersection pointCP can be solved by the following equation.

$$\frac{-x + u_A}{u_A - m_A} = \frac{x - L_A}{M_A - L_A} \quad (5)$$

$$CP = x = \frac{u_A * M_A - m_A * L_A}{M_A - L_A + u_A - m_A} \quad (6)$$

5) Set domain values and filter influencing factors: According to the principle of setting indicators for equipment selection, set suitable indicators and indicator filtering domain values α, and filter the CP values of each influencing factor obtained above, with the rule that if $CP \geq \alpha$, the influencing factor will be used as a criterion or indicator, and if $CP < \alpha$, the influencing factor will be ignored.

The advantage of using the fuzzy Delphi method is that integrating expert opinion with fuzzy functions better expresses the vagueness of human thinking and the lack of Certainty. The overlap region is checked to determine whether the expert opinion has converged, making the analysis more rigorous and reasonable. Using the concept of 'maximum and minimum values within the range of possibilities' instead of 'most probable' and 'least probable' enhances the usefulness of the Delphi method.

B. Hierarchical Analysis

Hierarchical analysis is a method that combines quantitative and qualitative approaches by organizing and synthesizing the opinions of people's subjective judgments. It is also effective in dealing with complex problems difficult to analyze by quantitative methods, breaking down complex problems into levels for step-by-step analysis [20]. The method allows one's subjective judgment to be expressed and processed in quantitative form and can also suggest whether one's subjective judgment on a particular type of problem is inconsistent. The method is now widely used on multi-objective optimization problems and can determine the weights of individual objectives, thus assisting in decision-making. With the rapid development of technology, deep learning, as an important branch of artificial intelligence, has gradually penetrated into every corner of schools [21]. The introduction of this technology not only brings new teaching methods to education, but also poses challenges to traditional educational models. How to understand and grasp the relationship between deep learning and education has become a topic that we need to explore in depth at present. The entry of deep learning into schools signifies a change in teaching methods. The traditional education model often centers on teachers, while deep learning emphasizes student-centered learning, utilizing artificial intelligence technology to provide personalized learning experiences [22]. Through the analysis of a large amount of data, deep learning can accurately grasp the learning needs and habits of students, and provide teachers with more scientific teaching suggestions. At the same time, it can also help students better understand knowledge and improve learning efficiency. However, the introduction of deep learning has also brought some challenges. Firstly, data privacy and security issues cannot be ignored. During the process of using deep learning technology, students will generate a large amount of data, and how to ensure the privacy and security of this data has become a major challenge. Secondly, the effective application of deep learning technology requires teachers to possess corresponding technical literacy, which is a significant challenge for many teachers [23]. In addition, excessive reliance on technology may lead to the neglect of humanistic care in education, which is a problem that we need to be vigilant about while pursuing technological progress.

In brief, the hierarchical approach begins with a description of the problem, followed by identifying the influencing factors and establishing a hierarchy of relationships. The relative importance of the decision factors at each level is identified by using pairwise comparisons on a scale of proportionality, from which positive and negative comparisons are established, calculating the eigenvalues and eigenvectors of the matrix, and finding the weights of each attribute, the important steps are explained below.

1) Description of the problem: When conducting an AHP, the system in which the problem is situated should be analyzed in as much detail as possible, with all the factors that may affect the problem being included in the problem and the main objectives of the problem being determined, but with attention to the interrelationship and independence of the factors.

2) Creating hierarchy: The interaction of many factors influences the selection of equipment. This study uses a logical thinking approach to consider the factors that may affect equipment selection, divides the criteria and indicators for evaluation into different levels of varying importance, and then examines the following levels, starting with the highest level of objectives.

3) Building a judgment matrix: The judgment matrix is created by using one of the factors at a higher level in the hierarchical mode as an evaluation criterion, and the experts make a two-by-two comparison of the factors at this level, using a judgment scale to determine the matrix elements. To assess the relative importance of indicators, a common practice is to employ the nine-point scale ranging from 1 to 9. If a criterion has n factors at the lower level, the judgment matrixF_1、 $F_2 \cdots F_n$ A is created, as shown in Fig. 7.

$$A = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n-1} & a_{1n} \\ 1/a_{12} & 1 & \cdots & a_{2n-1} & a_{2n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ 1/a_{1n-1} & 1/a_{2n-1} & \cdots & 1 & a_{n-1n} \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1/a_{n-1n} & 1 \end{bmatrix} \quad (7)$$

Making use of the judgment matrix A to determine each factor's weight at each level concerning the corresponding elements from the level before, i.e., calculate the highest attribute root λ_{max} of A , matching the normalized value eigenvector v, i.e.

$$Av = \lambda_{max} \quad (8)$$

and

$\sum_{i=1}^{n} v_i = 1$, where $v = (v_1, v_2, \cdots, v_n)^T$.

To achieve a scientific and objective calculation of each factor's weight, it becomes essential to establish the equilibrium of the judgment matrix A. The judgment matrix's consistency assessment is measured by the indicator known as,

$$CI = \frac{\lambda_{max}}{n-1} \quad (9)$$

As the size of the index of consistency (CI) increases, the consistency of the judgment matrix worsens. On the other hand, when CI equals zero, it indicates complete satisfaction with the consistency of the judgment matrix.

Consistency test coefficient

$$CR = \frac{CI}{RI} \quad (10)$$

where, RI is the random consistency indicator associated with the order of the judgment matrix, and its correspondence can be found in Table II.

The correlation between the judgment matrix's order and the random consistency index is shown in Fig. 5, and it shows that an increase in the corresponding random consistency index accompanies an increase in the judgment matrix's order.

When $CR < 0.1$, the consistency test is passed by the judgment matrix, when $CR \geq 0.1$, the judgment matrix fails to meet the consistency test and thus requires correction.

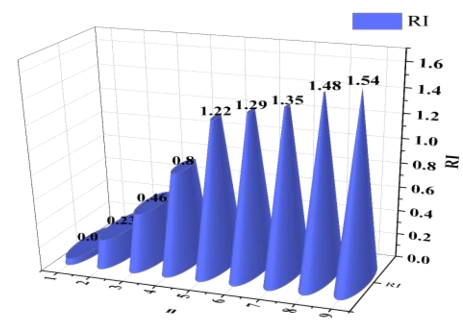


Fig. 5. Plot of the order of the judgment matrix against the random consistency index.

TABLE II. RANDOM CONSISTENCY INDICATORS

n	1	2	3	4	5	6	7	8	9
RI	0.05	0.23	0.46	0.80	1.22	1.29	1.35	1.48	1.54

IV. ANALYSIS OF THE EFFECTIVENESS OF THE BLENDED TEACHING MODE

A. Analysis of the Learning Process

This article uses online platforms to publish questionnaires and extensively collect data from different regions and types of schools. Go deep into specific universities, have face-to-face communication with teachers and students, and obtain first-hand information. Utilize the school's academic management system and other database resources to obtain data on course teaching modes, student grades, and other aspects. To provide a reasonable analysis of the blended teaching model, 226 students were selected from the art and design majors of the China Academy of Art. By dividing these students into two groups, both groups' basic theoretical knowledge and practical design ability were tested, and the experimenter's entry grades were determined based on the test results. The first group consisted of 112 students with an average entry score of 159.56, including an average score of 103.84 in theory and 183.63 in practical design; the second group consisted of 114 students with an average entry score of 158.73, including an average score of 103.21 in theory and 183.33 in practical design, which was generally consistent between the two groups. Group 1 used a hybrid teaching method, and Group 2 used a traditional lecture method. Both groups' teaching hours were 48 hours, as shown in Table III.

A visual comparison of the entry scores of the two groups of students is represented in Fig. 6. It is clear from Fig. 6 that the difference between the entry scores of the two groups of students is not significant. However, the scores of all indicators of the blended teaching mode are higher than those of the traditional teaching, which shows the superiority of the blended teaching mode.

An independent samples t-test was first conducted for each of the two groups of students' scores, and the results are shown in Table IV.

TABLE III. COMPARISON OF ENTRY SCORES OF STUDENTS IN THE TWO GROUPS

Category	Entrance grades	Theoretical score	Design in Practice
First group	159.56	103.84	183.64
Second Group	158.73	103.21	183.33

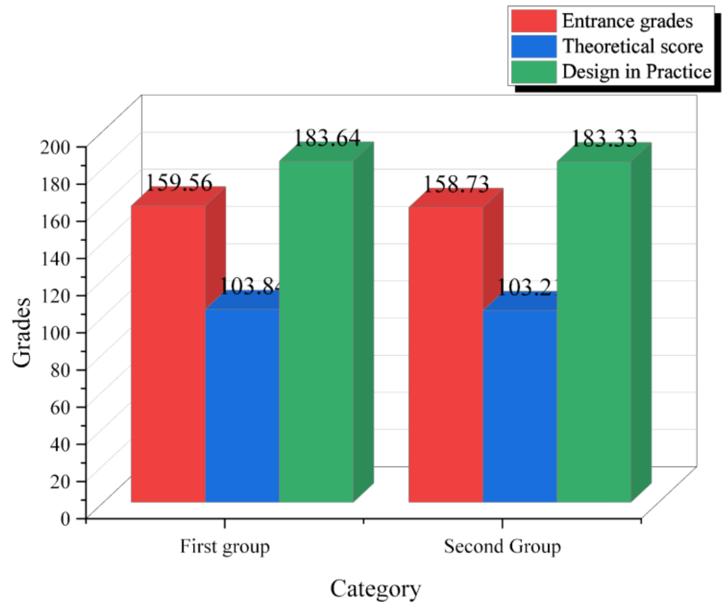
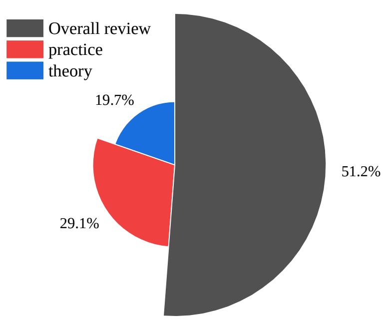


Fig. 6. Visual comparison of the entry scores of the two groups of students.

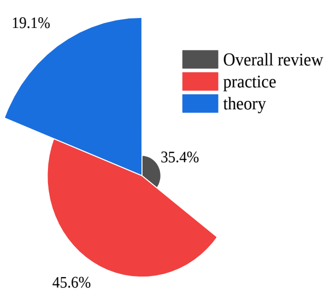
TABLE IV. T-TEST FOR INDEPENDENT SAMPLES OF STUDENTS' PERFORMANCE IN EACH OF THE TWO TEACHING STYLES

Category	blended teaching	traditional teaching	T	Sig
Overall review	82.77	78.14	2.224	0.030
practice	47.02	42.33	2.868	0.150
theory	31.84	32.64	1.199	0.234

A visual comparison of the three-sample t-tests of achievement in the blended and traditional teaching modes in the art and design course is shown in Fig. 7.



(a) Teaching mode comparison.



(b) T and Sig

Fig. 7. Independent sample T-test for two student grades (a) Teaching mode comparison (b) T and Sig.

1) Regarding the overall assessment results, the standard deviation of students' performance under the traditional way of teaching was 11.594, indicating a wide range of performance distribution indicating the existence of polarization of students. Meanwhile, the t-test result is: $t = 2.224, P = 0.03 < 0.05$, indicating that there is a significant difference between the two teaching effects. Hence, it can be inferred that the hybrid teaching mode is considerably more effective in terms of teaching than the traditional teaching method.

2) Regarding practical performance, the independent sample t-test result indicates a significant difference in practical operation between students of hybrid teaching and traditional teaching mode. It indicates that the hybrid teaching mode is more helpful to the exercise and improvement of students' practical skills.

3) The results of the independent samples t-test from the test paper quiz scores were: $t = 1.119, P = 0.0.234 > 0.05$, indicating no significant difference in theoretical knowledge learning between the students in the two modes of teaching.

B. Evaluation of the Learning Process

To analyze the effect of the blended teaching approach and understand the students' experience and feelings towards the teaching organization. A questionnaire was designed and administered to the experimenters, which contained questions on interest in learning art and design courses, knowledge acquisition, learning attitudes and motivation, knowledge transfer and application, and improvement of abilities, each containing multiple questions. The analysis and summary of the survey results are as follows:

1) The data on students' interest in studying art and design courses before and after the course was offered are shown in Tables 5 and 6**,** respectively.

A comparison of the data in Tables V and VI is shown in Fig. 8. It can be seen from Fig. 8 that student interest is significantly increased under blended learning.

2) The survey counted the seriousness of students' learning under the two modes and investigated the degree of influence of learning attitudes on practical ability. The results indicated that when students' seriousness of learning was comparable under the two modes. Still, there was a certain difference in practical ability; students with the blended teaching model had a certain advantage in practical ability, indicating that blended teaching was more helpful in improving students' practical ability. The result of the survey shows that most students are more open, diverse, and innovative in their problem-solving when using the blended teaching mode.

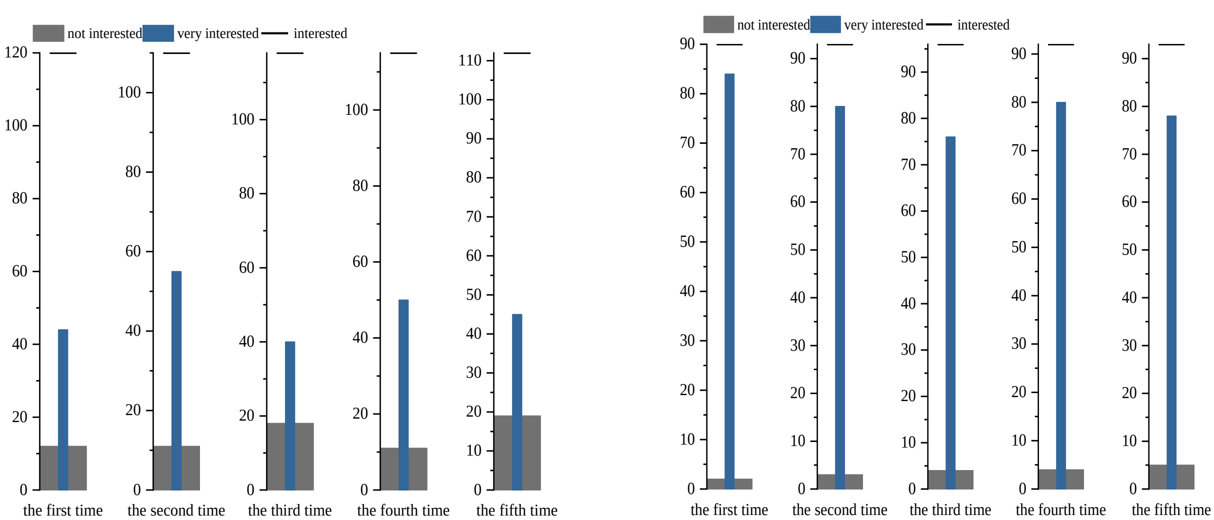
3) The ability of students who adopted the blended teaching mode is also investigated regarding knowledge transfer. The specific data are shown in Table VII.

TABLE V. DATA ON STUDENTS' INTEREST IN STUDYING ART AND DESIGN COURSES BEFORE THE COURSE WAS OFFERED

Before class starts	very interested	interested	not interested
the first time	44	120	12
the second time	55	110	11
the third time	40	118	18
the fourth time	50	115	11
the fifth time	45	112	19

TABLE VI. DATA ON STUDENTS' INTEREST IN STUDYING ART AND DESIGN COURSES AFTER THE COURSE WAS OFFERED

End of the school term	very interested	interested	not interested
the first time	84	90	2
the second time	80	93	3
the third time	76	96	4
the fourth time	80	92	4
the fifth time	78	93	5



(a) Before class starts. (b) End of the school term.

Fig. 8. Data on students' interest in learning art and design courses before and after the course was offered (a) Before class starts (b) End of the school term.

TABLE VII. DATA ON KNOWLEDGE TRANSFERABILITY BETWEEN THE BLENDED AND TRADITIONAL MODES OF TEACHING AND LEARNING

Category	Ability to transfer knowledge	No knowledge transfer	Practical tasks can be completed	Practical tasks not completed
blended teaching mode	61	51	69	43
traditional teaching mode	42	72	47	67

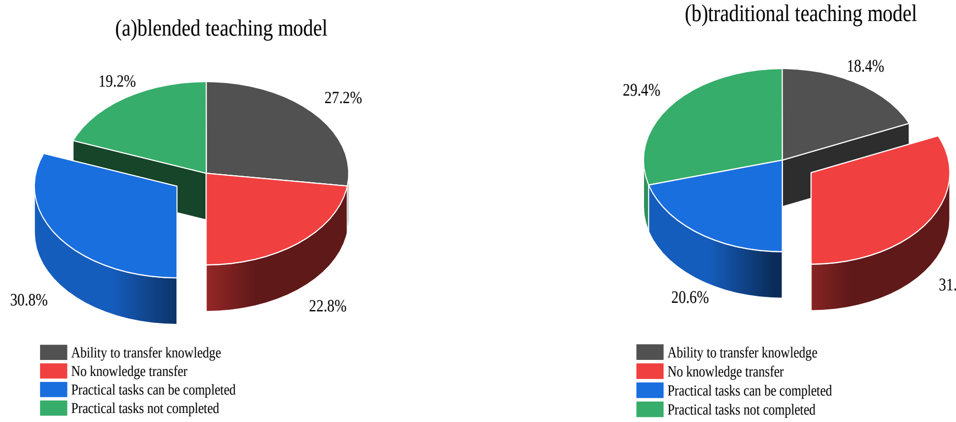


Fig. 9. Pie chart of knowledge transferability and task completion (a) Blended teaching mode (b) Traditional teaching mode.

A comparison of the knowledge transfer ability data and task completion pie charts for the two teaching modes is shown in Fig. 9. The results show that 54.1% of students in the blended mode could make connections between old and new knowledge, and 61.3% of students reported that they could complete the practical tasks as required. This figure is much higher than that of the students using the traditional teaching method (36.5% and 41.2% respectively). The difference between the two modes of teaching is not entirely a difference in the amount of knowledge acquired but rather a difference in the ability to link theory and practice and to connect old and new knowledge. This also shows that the mixed teaching mode is more conducive to transferring knowledge and cultivating practical problem-solving skills.

4) In terms of learning motivation, the survey found that 85.3% of students would use their spare time for pre-study and revision when using the blended teaching mode and 67.4% would actively consult extra-curricular materials related to the course, which is much higher than those using the traditional teaching mode (64.6% and 43.8% respectively). This indicates that the willingness and ability of students to learn have been significantly improved by using the blended teaching mode.

In addition, the responses to the open-ended questions in the questionnaire showed that students who adopted the blended teaching mode identified more strongly with the new teaching mode and generally felt that their interest in learning, confidence, and learning ability had increased significantly.

The analysis of students' performance and questionnaires reveals that the blended teaching mode is more likely to stimulate students' interest in learning, enhance their awareness of independent learning and learning ability, promote the acquisition, transfer, and application of knowledge, and improve their practical skills and problem-solving abilities.

In terms of effectiveness evaluation, the application of big data principles makes the evaluation of teaching effectiveness more objective, accurate, and comprehensive. By comparing the learning outcomes and processes under different teaching modes, teachers can have a clearer understanding of the advantages and disadvantages of the new teaching mode. At the same time, the application of correlation analysis and predictive analysis also makes the evaluation of teaching effectiveness more scientific, refined, and forward-looking, providing teachers with more personalized and targeted teaching suggestions. In addition, we also found that integrating the principles of big data into teaching mode design and effectiveness evaluation requires teachers to have corresponding technical literacy and abilities. Therefore, strengthening the training and guidance of teachers is one of the key to achieving the design of teaching modes and evaluation methods for art and design courses from the perspective of big data.

In summary, the design of teaching modes and evaluation methods for art and design courses from the perspective of big data has important practical significance and application value. By deeply exploring and analyzing the application of big data principles in teaching mode design and effectiveness evaluation, we can better understand students' learning needs and habits, develop more scientific, accurate, and personalized teaching plans, and improve teaching effectiveness and learning experience. Meanwhile, strengthening the technical literacy and ability cultivation of teachers is also an important guarantee for achieving this goal.

V. Discussion

From the perspective of big data, the teaching mode design of art and design courses needs to fully consider the learning needs and practical ability cultivation of students. By collecting learning data from students and analyzing their learning behaviors and habits, teachers can develop teaching plans and plans that are more in line with their actual needs. For example, teachers can use data mining techniques to analyze students' learning trajectories, stay times, and review times, understand their learning difficulties and needs, and thus develop more accurate teaching plans. The blended learning mode requires corresponding technical support, including network platforms, teaching software, etc. However, some schools are unable to provide sufficient technical support due to funding, technology, and other reasons, leading to limitations in the implementation of blended learning models. The blended learning model requires teachers to have corresponding teaching design and organizational abilities, as well as a certain level of information technology skills. However, some teachers find it difficult to effectively implement blended learning models due to a lack of relevant experience and skills. The blended learning model requires active participation and cooperation from students. However, some students lack learning motivation and self-discipline, resulting in low participation and poor teaching effectiveness.

Schools should strengthen the training and guidance of teachers, improve their teaching design and organizational abilities, and cultivate their information technology skills in order to better implement blended learning models. Teachers should take effective measures to increase student engagement, such as setting interesting learning tasks, providing personalized learning support, etc., to stimulate students' interest and motivation in learning.

VI. Conclusion

This paper explores the design of teaching modes and methods for art design courses using massive data. With massive data thinking, a comparative evaluation study assesses different curriculum teaching methods. A blended teaching mode combining MOOC and SPOC is adopted for the art design course to innovate the traditional teaching mode and plan. The study's results indicate that the utilization of blended teaching mode can potentially enhance student's performance and knowledge transfer ability and foster an improved learning motivation. Simultaneously, the awareness and learning capability of students' autonomous learning has also been enhanced, which promotes the acquisition, transfer, and application of knowledge and enhances students' practical skills and problem-solving capabilities. The teaching method and evaluation system proposed in the current work also have many areas that need to be revised and improved. However, the practice has proved that the blended teaching mode has great advantages in improving the effect of classroom teaching, improving the learners' autonomous learning ability, practical innovation ability, and sustainable development ability. It is believed that the blended teaching mode will become one of the important learning methods in the future.

Although big data provides a wealth of information, how to effectively and accurately process and analyze this data remains a challenge. Especially when dealing with unstructured data such as text comments, student works, etc., data cleaning, annotation, and mining require a lot of time and manpower. Privacy and security issues cannot be ignored in the process of collecting, storing, and using student data. How to ensure the security, compliance, and anonymity of data, prevent data leakage and abuse, is a challenge that big data must face when applied in the field of education.

In order to overcome the limitations of insufficient infrastructure, future research can focus on developing more efficient and low-cost big data storage and analysis technologies, providing better technical support for the education field. With the increasing prominence of data security and privacy issues, future research should focus more on how to effectively utilize data for educational analysis and evaluation while ensuring data security and compliance.

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1) “The New Liberal Arts” Research and Reform Practice Project of Henan Province: Research and practice on collaborative education mechanism of integration of industry and education for design majors in local colleges under the background of new liberal arts construction, Project No.2021JGLX046.

2) Research Project on Integration of Production and Teaching in Higher Learning Institutions of Henan Province in 2023: “Focus on Design Henan” ——Research and Practice on Integration Education Mechanism of Production and Teaching of Design Major in Local Universities， Announcement No.79.

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