

Applied Mathematics and Nonlinear Sciences

<https://www.sciendo.com>

Research on Multiple Paths of Aesthetic Education Immersion in Colleges and Universities in the Context of Digital Transformation

Wenzhe Dai^{1,†}

1. Shandong Management University, Jinan, Shandong, 250002, China.

Submission Info

Communicated by Z. Sabir
Received November 3, 2024
Accepted February 3, 2025
Available online March 19, 2025

Abstract

Under the background of digital transformation of aesthetic education immersion in colleges and universities, the analysis of multiple paths of aesthetic education immersion has become one of the focuses of attention in the academic world. In this paper, we investigated the deficiencies and different paths of aesthetic education immersion in the current process of aesthetic education immersion through questionnaires, and designed an online aesthetic education service system. The designed system has been optimized and improved in terms of service contact points and aesthetic education big data platform construction to enhance students' experience and teachers' curriculum design. More than 65% of the students in the experimental group had a positive attitude towards the blended aesthetic education teaching method based on the aesthetic education service system, and 87.22% of the students preferred the blended aesthetic education teaching method. After using the system in this paper, the excellence rate increased by 6.12% and the average grade increased by nearly 10 points.

Keywords: Questionnaire survey; Aesthetic education service system; Aesthetic education big data platform; Multi-path study.

AMS 2010 codes: 97B20

[†]Corresponding author.

Email address: 15562625902@163.com

1 Introduction

Beauty is a common essential attribute of objective things that can arouse people's sense of beauty, and has an important role in enriching the spiritual world. Aesthetic education in colleges and universities can improve the aesthetic level and humanistic literacy of college students, so it has attracted more and more attention and emphasis [1-3]. Aesthetic education is a compulsory course in life, an essential part of human education in higher education, and plays a vital role in enhancing aesthetic literacy, improving innovative thinking, cultivating sentiment, warming the soul (emotional comfort) and shaping personality [4-6]. First, aesthetic education can improve students' aesthetic literacy and humanistic spirit. Secondly, aesthetic education can improve students' innovative thinking, imagination and executive power. Third, aesthetic education can improve students' appreciation of beauty and enrich their spiritual life. Fourthly, aesthetic education can moisturize students' hearts and play the function of regulating and soothing emotions. Fifthly, aesthetic education can shape students' personality and improve their ability to distinguish between right and wrong [7-10]. Aesthetic education can play an important role in the growth and success of students in colleges and universities, and in recent years, the Ministry of Education has issued a series of policy documents to promote the development of aesthetic education in colleges and universities. The relevant documents pointed out that the aesthetic education in colleges and universities should adhere to the reform and innovation. "Reform and innovation" refers to the integration of university aesthetic education resources, and effectively promote the reform and development of professional artistic talents and higher education, and strive to promote dynamic, multi-party cooperation, open and orderly university aesthetic education new pattern [11-13]. Both require to further strengthen the function of school aesthetic education, build moral, intellectual, physical, aesthetic and labor comprehensive cultivation of the education system, but also require efforts to promote curriculum innovation, education and teaching method innovation, enrich the online and offline curriculum resources, improve the effect of aesthetic education infiltration [14-16]. Construct an artistically active classroom to improve student participation and fully display students' style. Colleges and universities shoulder the important responsibility of cultivating high-quality vocational and application-oriented talents for the society. Under the background of digital transformation, with the deepening of comprehensive reform in the field of education, many colleges and universities have explored the innovative reform path of teaching university aesthetic education courses [17-20].

This paper explores the multiple paths of aesthetic education immersion in colleges and universities in the context of digital transformation. The questionnaire method was utilized to investigate the shortcomings of the current aesthetic education immersion in colleges and universities, and three paths for aesthetic education immersion were proposed. For one of the multi-level aesthetic education teaching paths, a digital online aesthetic education service system was designed to realize hybrid multi-level aesthetic education teaching. The overall structure of the aesthetic education service platform system is first designed, followed by the identification and optimization of the physical by-contacts, digital by-contacts, and interpersonal touchpoints to enhance the experience of using the service system. To address the current problems of boring learning content and low motivation of students, aesthetic education big data is collected from microblogging platforms through web crawlers, which is used to demonstrate the mainstream attitude of the public towards aesthetic education content, thus assisting aesthetic education teachers in course content design. In addition, the proposed improvements include integrating network behavior monitoring systems, elastic transformation of EMR clusters, and containerization using EKS hosted container services.

2 Exploring the deficiencies and paths of aesthetic education immersion in higher educational institutions

Aesthetic education can expand knowledge, cultivate sentiment, enlighten wisdom, and is particularly important in the cultivation of high-quality innovative talents [21]. “Infiltration” is a kind of subtle concept. The infiltration of aesthetic education refers to the process of accepting the inculcation of beauty, touching the experience of beauty, generating the action of beauty, and generating the heart of beauty in a constant and gentle environment.

In order to understand the current shortcomings of the immersion of aesthetic education in colleges and universities, this paper designed a network questionnaire to investigate the status quo. Recovered 383 questionnaires, of which 347 are valid. The results of the questionnaires were analyzed. The following are several aspects of the insufficiency of immersion in aesthetic education.

2.1 Deficiencies in aesthetic immersion

2.1.1 The effect of aesthetic immersion needs to be improved

It can be seen through the questionnaire that the interviewed students are satisfied with the effect of offline courses on aesthetic education, but there is still much room for improvement. For example, only 38.87% of the students chose the aesthetic education course to improve “aesthetic ability”, only 38.21% of the students chose the aesthetic education course to improve “appreciation”, and only 40.81% of the students chose the course to improve “teamwork”, none of which reached the total number of respondents. The students who chose the program to improve “teamwork spirit” only accounted for 40.81%, which is less than half of the total number of respondents. This result shows that the effect of aesthetic education in colleges and universities still needs to be further improved.

2.1.2 Less practical aspects in the aesthetic education program

We can see from the results of completing question 10 (i.e., “What is your vision for the future development of aesthetic education immersion?”) The results of the questionnaire on question 10 (i.e., “What is your vision for the future development of aesthetic immersion?”) and the newly added questionnaire on “Ways to improve aesthetic ability” show that the interviewed students think that the materials of the aesthetic education program are insufficient to satisfy the students’ desire for aesthetic immersion, and that the teachers of the aesthetic education program reflect the lack of links to cultivate students’ hands-on ability in the aesthetic education program.

2.1.3 Aesthetic education curriculum to be optimized

Through the questionnaire survey, the author found that the problem of fewer class hours still persists in aesthetic education courses at present. In the students’ college career, there is an obvious gap between the thirst for beauty and only one semester of aesthetic education courses. This is also one of the reasons why the majority of students in this questionnaire survey on the effect of aesthetic education immersion satisfaction need to be improved.

2.1.4 Aesthetic Education Teaching Staff to be Strengthened

Through the questionnaire survey, the author found that a relatively large number of non-majors have a strong need for the arts. Some of the students interviewed expressed the hope that in the future, the

aesthetic education program can provide aesthetic immersion in the form of music, dance, drama, film, and television. However, the number of full-time teachers of music, dance, drama, film and television in the current aesthetic education program is relatively small, which greatly limits the school's ability to offer a wider range of aesthetic education courses and affects the effectiveness of the aesthetic education immersion.

2.2 Multiple path analysis of aesthetic immersion

2.2.1 Multi-level teaching of aesthetic education

First of all, colleges and universities should fully combine the characteristics of students, subdividing the audience, and accurately applying measures to meet the diversified needs of students of different majors for the enhancement of aesthetic education, and to promote the comprehensive enhancement of students' aesthetic literacy and innovative and creative consciousness. Colleges and universities should implement classroom teaching reform, guide students to discover the interest points of aesthetic education through independent inquiry, stimulate students' creativity through situational experience, teamwork, etc., and encourage teachers to carry out teaching practice in the process of aesthetic education infiltration. Secondly, colleges and universities should reasonably set up aesthetic education courses and enhance the diversity of aesthetic education courses. Curriculum is the main carrier of education, and it is also the main channel to carry out aesthetic education in colleges and universities in the new era, and the establishment of a systematic aesthetic education curriculum system is the first part of the work of aesthetic education in colleges and universities.

2.2.2 Creating aesthetic education faculties

First, to cultivate teachers' aesthetic sensibilities. Teachers should improve the concept of aesthetic education through aesthetic training and experience, and enhance the aesthetic cultivation. Colleges and universities improve their own aesthetic education coordination mechanism in the top-level design to create an environment for aesthetic education. Secondly, strengthen the aesthetic awareness of teachers in all disciplines. Colleges and universities should incorporate the content of aesthetic literacy into teacher qualification exams and professional teacher training programs to motivate professional teachers to take the initiative to improve their aesthetic cultivation and build charisma. Teachers to improve the overall aesthetic literacy, help in vocational skills teaching to explore the elements of beauty in the relevant professions, to convey to the students the beauty of skills, the beauty of creation and other connotations, to cultivate the students' artisanal spirit.

2.2.3 Tapping local resources for aesthetic education

Regional culture is an important part of the excellent traditional Chinese culture, which contains rich resources for aesthetic education. On the one hand, colleges and universities should be based on the local, in-depth excavation of excellent regional culture in the resources of aesthetic education, to realize the school-land linkage and aesthetic education synergy. On the other hand, colleges and universities can be based on the practice and transformation of the results of campus aesthetic education, to school aesthetic education to infiltrate the community, to achieve and regional high-quality development in the same direction, the same frequency resonance. Through the joint efforts of all parties, we can build a multi-party linkage and dynamic pattern of aesthetic infiltration work to create a long-term mechanism of aesthetic infiltration in colleges and universities.

3 Online aesthetic education service system design

This paper explores the path of aesthetic immersion, and in response to the requirements of a multi-level aesthetic teaching path, this paper designs an online aesthetic service system to assist students in their learning and aesthetic teachers in their teaching work.

3.1 General construction of the aesthetic education service system

The structure diagram of the aesthetic education service platform system proposed in this paper is shown in Fig. 1, which shows college student users, school teachers, aesthetic education service organizations, database and aesthetic education system service design:

- 1) College student users get professional competition or art examination help and basic course services from the aesthetic education service organization. They upload their basic personal information, course assignments, and chat comments to the aesthetic education service system, and watch course materials, download course notes, share learning results, and interact socially from the aesthetic education service system.
- 2) School teachers provide basic information of students in their classes, basic course plans and course materials to the AES, and update user information and course information on the database.
- 3) The aesthetic education service organization provides professional aesthetic education help and value-added services to college student users, obtaining school information including basic information about students in the class as well as course plans and contents.
- 4) The database serves as the processing center of all data, with the functions of inputting information and outputting information.
- 5) The aesthetic education system is the medium that connects university users, school teachers and aesthetic education service providers with each other and helps all parties to realize their interests.

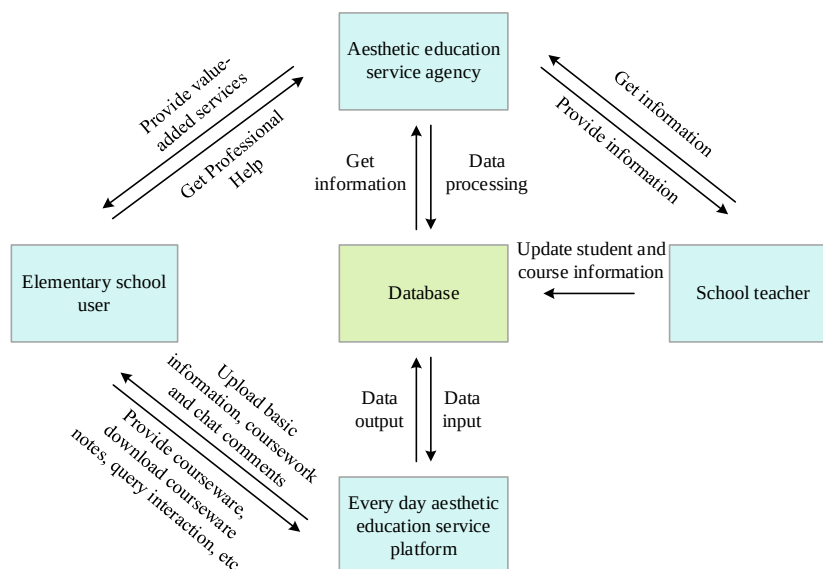


Figure 1. Aesthetic education service platform system diagram

3.2 Service touchpoint analysis and optimization

Service press touch points are the basic elements connecting the whole service system, including physical press touch points, digital press touch points, and interpersonal contact points. In the whole service process, the user's behavior is connected by one pressable point after another, and all these points that have contact with the user are called contact points. Users interacting through smart devices belong to digital contact points (also called media contact points), physical objects that users can see and touch belong to physical contact points, and people providing services to users, such as receptionists, attendants, security guards, etc., belong to interpersonal contact points. Take digital contact points as an example, because digital press contact points are digital interfaces based on the Internet to connect with users, and they are an important component of the online aesthetic education system. Because every contact point is intended to convey feelings to users, whether it is necessary or superfluous, efficient or inefficient, it determines the feelings of users. Therefore, what service design should do is to increase the necessary and efficient contact points and cut down the redundant and inefficient contact points, so as to improve the user's satisfaction with the contact points.

Learning about aesthetics is the key contact point between online aesthetics service systems and users, and the effectiveness of learning will directly affect the user's perception of the online aesthetics service. The use of the online aesthetic education service system transforms the offline face-to-face teaching process between aesthetic education teachers and students into a closed-loop experience process in which aesthetic education teachers or institutions "upload" courseware to the online aesthetic education service system, and the online aesthetic education service system provides students with a way to receive specialized, diversified, and personalized online aesthetic education at anytime and anyplace, and to receive timely feedback and evaluation. The online aesthetic education service system provides students with a closed-loop experience process where they can receive specialized, diversified, and personalized online aesthetic education anytime and anywhere, and receive timely feedback and evaluation.

Although the current online aesthetic education model such as Boya's aesthetic education equipment has improved the popularity and content expansion of aesthetic education, it also has the problems of low conversion of students' learning utility and low utilization rate due to the decreasing freshness. In other words, the learning and feedback service contact points in the online aesthetic education service system for college students are the "pain points" of the online aesthetic education service, which will directly affect the students' experience and feelings towards the online aesthetic education service.

Based on the analysis and research of service contact points in terms of contextual process and effect, we construct service contact points by analyzing typical scenarios of service contact points, identifying user elements, service provider elements, and media elements that are the key contact points in the whole process, and analyzing the role of each element in relation to each other.

The design process of an online aesthetic education service system can start from the service contact points and be guided by the three-layer experience theory of service-oriented design. By identifying the service touchpoints (including potential service touchpoints) of the online aesthetic education service system, situational motives and experiences, i.e., pain points, are obtained in the process of sorting out the complete service process of the college students' online aesthetic education user experience.

After determining the service contact points of the experience process of the online aesthetic education service system for college students, the next step is to optimize and reshape the overall service process according to the target users' learning needs, motivation, behavior, and emotions. In

order to make the optimization plan clear, this study starts from the overall service process and the service contact points in the use scenario, the overall service process optimization direction of the online aesthetic education service system for college students can be divided into physical contact points (mainly the equipment used), digital contact points (visual, auditory and digital information) and interpersonal contact points (the user's relationship with other learning users, with teachers, and with the system operation and maintenance personnel). These three categories are:

- 1) For digital contact points, on the one hand, it is necessary to focus on the transparency of user information in the entire service process, establish a real-time tracking and updating information terminal, so as to reduce the cognitive load of the user and enhance the user's sense of body, and on the other hand, it is necessary to strengthen and optimize the real-time interaction between the user and the contact point of the experience and feeling.
- 2) For physical contact points, it is necessary to pay attention to and enhance the immediate interaction between users and contact points, so that the service contact points are evenly distributed throughout the service process as much as possible, to avoid missing contact points, resulting in a disconnected user experience.
- 3) For interpersonal contact points, it is necessary to mobilize the subjective initiative of other stakeholders, such as on-campus aesthetic education teachers in the online aesthetic education learning process of college students to assist in answering questions, homework feedback and evaluation and other tasks, student parents can encourage and praise their children's homework and so on.

3.3 Design and Improvement of the Application Layer of the Big Data Platform for Aesthetic Education

3.3.1 Aesthetic Education Big Data Platform Application Layer Design

In order to enrich the aesthetic education content of the platform system and improve its attractiveness to college students, it is necessary to design the aesthetic education big data platform. At the initial stage of platform construction, it is necessary to choose a mainstream community as an information source, taking into account the daily Internet access habits of college students and the difficulty of obtaining information and other factors. In the experimental stage, Sina Weibo was chosen as the test platform for the information source. Using a test account to pay attention to several fields of aesthetic education (e.g., painting, photography, design, film, animation, etc.), selecting the microblog comment area of a specific topic (e.g., such-and-such an animation), collecting information through a web crawler, and then sorting and analyzing the keywords, categorizing them in accordance with the positive, negative, and neutral semantics, and displaying them in order of their frequency of occurrence. To solve the development cost, the categorization of vocabulary can be realized by using the Tencent word vector tool. By displaying the information to analyze the mainstream attitudes of the current Internet user community towards a certain work or topic, it can be used in the aesthetic education classroom to explain and positively guide the audience's points of interest. The data collection function can be realized through the open-source tool Scrapy framework, together with the web crawler written in Python language, and the specific logical structure is shown in Figure 2.

With the support of the Scrapy engine, the crawler sends the URL to be accessed to the scheduler to manage the request queue, the engine accesses the URL according to the request queue of the scheduler and downloads the webpage content through the downloader and hands it over to the crawler for further processing, and then Scrapy sends the data items collected by the crawler to the

data item pipeline for further processing. The collected keyword summaries can be categorized by the Tencent Word Vector tool based on lexical and other conditions to summarize the mainstream attitudes of users of the platform towards a particular topic.

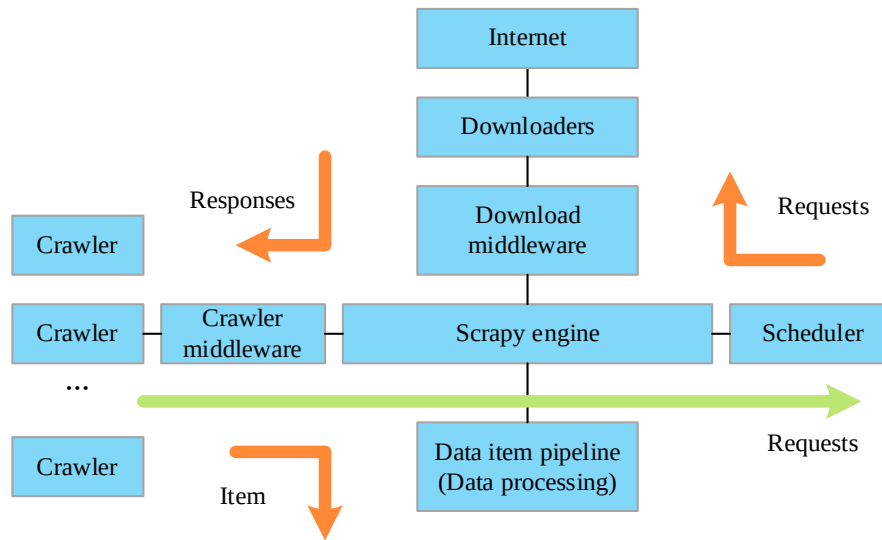


Figure 2. Crawler design based on Scrapy framework

3.3.2 Improvements in the application layer design of the big data platform for aesthetic education

The current platform collects information directly through mainstream Internet platforms, which cannot accurately respond to the overall evaluation of a certain work or topic by students in our school. In this paper, by integrating with the campus network behavior monitoring system in charge of the school's Internet Information Office, we collect information sent from the campus network ports and unpack the information, and select data with relevant keywords for analysis in order to more accurately obtain the interactions of our school's students on the Internet platforms on the topic of aesthetics and education.

Elastic transformation of the EMR cluster, adding cluster servers to the elastic scaling group, if later encountered offline computing time is longer, you can consider using AWS provided Spot instance to increase computing resources at a very high cost-effective price, Spot instances for AWS idle resources with high discount, as long as there is no other bidding for a higher price of the user, you can use this instance at a very low price. It is suitable as a cluster server for offline computing [22]. However, a bidding cap needs to be set. Currently, the automatic fault recovery function realized by CloudWatch is only triggered when the hardware layer fails, and cannot respond to failures in the application layer. The Lambda function can determine the HTTP status of the application server by executing the code periodically, and once the service status is found to be abnormal, it can send an alarm to CloudWatch, thus triggering the recovery command and further improving the system reliability.

The current application is still directly deployed on the server, and its availability is still limited by the reliability of the hardware. Additionally, the operating system on which it runs also requires regular maintenance. Therefore, it is necessary to utilize the EKS hosted container service on the AWS platform for containerization transformation at the appropriate time. EKS service is compatible with the mainstream open source Docker container management tool Kubernetes (K8S), so it is

convenient to make the application and the required operating environment into a K8S image to be deployed in EKS hosted containers, and it will be very convenient to recover from failures and expand the performance, and the team is freed from the hardware layer and operating system layer operation and maintenance work to focus on the hardware layer and operating system layer. The team is also freed from the operation and maintenance work at the hardware and operating system layers to focus on the use of the platform and the design of teaching content [23].

4 Utilization of the Aesthetic Services System

Two teaching classes were selected as experimental and control classes in a university that offers aesthetic education teaching. The experimental class (N=48) used the online aesthetic education service system designed in this paper to conduct blended aesthetic education learning, and the control class (N=50) received traditional aesthetic education methods. Taking the Art Appreciation course as an example, an art appreciation knowledge test was conducted before the course and a post-test was administered at the end of the course to compare the differences in the pre and post-test scores to test the effect of the AES on the immersion of aesthetic education. At the same time, a questionnaire was created to examine and evaluate the learning experiences of students using the AES.

4.1 Survey on students' attitudes towards the AES system

The survey data show that 68.02% of the respondents very much approve of this blended learning method carried out based on the AES, 66.45% of the respondents are very much in favor of other public art courses also using the AES to carry out blended teaching, 68.836% of the respondents think that the blended learning carried out based on the AES can make up for the shortcomings of the traditional teaching, and 78.44% of the respondents think they like the way of teacher-student interaction conducted based on the AES system very much.

The number of respondents with positive evaluation attitudes such as “very much approve, very much, approve, very much like” is relatively large, which indicates that the teaching practice of blended learning based on the AES in art appreciation courses is welcomed by the respondents, and the respondents support the use of the AES for blended learning in other public art courses and believe that this teaching mode can make up for the shortcomings of the traditional teaching methods. Service system for blended learning, and that this teaching mode can make up for the shortcomings of traditional teaching methods.

4.2 Survey on Learning in Aesthetic Education Courses

Figure 3 shows the results of the survey on the functions of the MES system. As can be seen from the figure, the functions that were used more frequently in the AES system were in the following order: signing in (92.247%), quiz test (72.072%), interactive questioning (63.885%), and watching learning videos (63.163%). During the learning process, 87% of the students were able to read carefully the pre-course materials pushed by the teacher through the AES system before class, 72% of the respondents indicated that they had interacted with the teacher and their classmates through the AES system, about 67% of the respondents indicated that they completed the post-course assignments carefully and submitted them, and 55% of the respondents took quizzes through the AES system to test the AES learning Results.

Most of the learners completed activities such as pre-class pre-study, in-class communication, and post-class homework on the interactive learning platform of the AES, and about half of the learners used the quiz and test function. The teacher-student interaction methods carried out based on the AES

system, such as top-pedaling, liking, taking photos on the wall, and highlighting outstanding assignments, were also recognized by the interviewees. Although the time for implementing blended teaching in the Art Appreciation course is limited, both teachers and students are making efforts to explore and adapt to this new teaching mode, which provides many possibilities for effective communication between students and teachers.

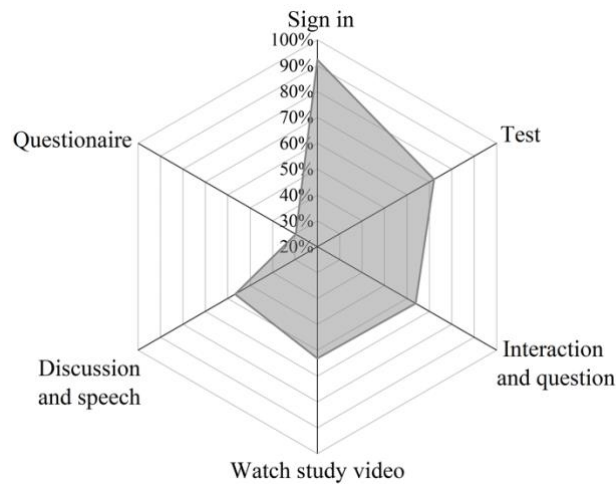


Figure 3. System function survey results

4.3 Evaluation of the design and organization of the aesthetic education curriculum

Figure 4 shows the statistics of the survey results of blended instructional design. As can be seen from the figure, 76.28% of the respondents indicated that the course design and organization of Art Appreciation was “very reasonable” (A), 83.38% of the respondents believed that the teacher’s guidance and management of the whole blended learning activities were effective (B), 76.11% of the respondents indicated that the teacher’s feedback on their questions were very timely and effective (C), and about 81.92% of the respondents thought that it was “reasonable” to incorporate the learning data of the AES platform into the course evaluation criteria (D).

It can be seen that most of the learners have a positive and active attitude towards the evaluation of the course design and organization that combines the AES, and they are brave enough to try new things, try out new learning modes, and make objective evaluations of them. In the blended teaching process of Art Appreciation, the teacher organically combines the classroom with the smart terminal, takes the teacher as the leading role and the students as the main body, and organically combines various teaching methods such as lecture-type, discussion-learning-type, exploratory-learning-type, and collaborative-learning-type, and guides the students to actively participate in the learning. In this new teaching mode, the teacher utilizes the support of the MES system to expand the teaching process, and for the students’ learning progress and learning situation, timely exchanges, communication, and feedback with the students, increasing the interaction between teachers and students.

It can be seen that most of the learners have a positive and active attitude towards the evaluation of the course design and organization that combines the AES, and they are brave enough to try new things, try out new learning modes, and make objective evaluations of them. In the blended teaching process of Art Appreciation, the teacher organically combines the classroom with the smart terminal, takes the teacher as the leading role and the students as the main body, and organically combines various teaching methods such as lecture-type, discussion-learning-type, exploratory-learning-type, and collaborative-learning-type, and guides the students to actively participate in the learning. In this new teaching mode, the teacher utilizes the support of the MES system to expand the teaching process,

and for the students' learning progress and learning situation, timely exchanges, communication, and feedback with the students, increasing the interaction between teachers and students.

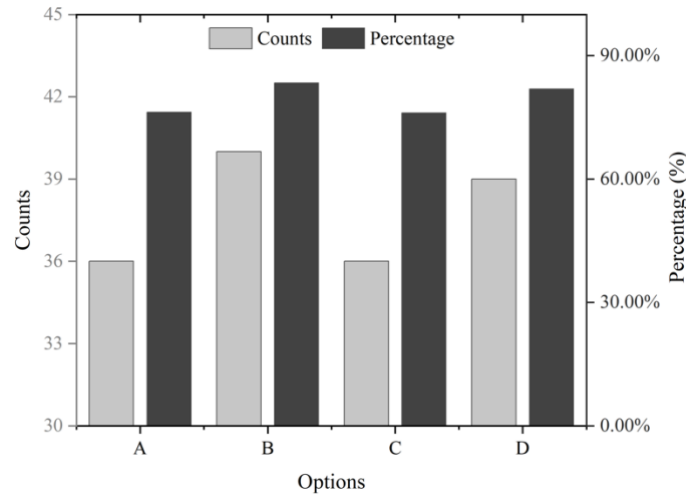


Figure 4. Teaching design survey

4.4 Students' satisfaction with blended learning

According to the survey, 72.85% of the respondents indicated that “compared with the traditional classroom lectures, the blended learning mode through the AES has greatly increased the learning interest in this course”, and that students agree with the convenience, quickness and spatial limitations of the blended learning mode based on the AES as compared with the traditional lecture mode. Students agreed that the new learning method is convenient, fast, and not limited by space.

Figure 5 shows the constraints affecting the use of the MES system. As shown in the figure, the reasons affecting learners' use of the AES system for learning are A-“poor personal self-control” (65.84%), B-“insufficient proficiency in platform operation” (60.81%), C-“Unable to complete the learning tasks in time” (57.63%), D-“New learning methods increase the burden of learning” (49.38%), and G- “Lack of learning atmosphere” (34.65%), etc.

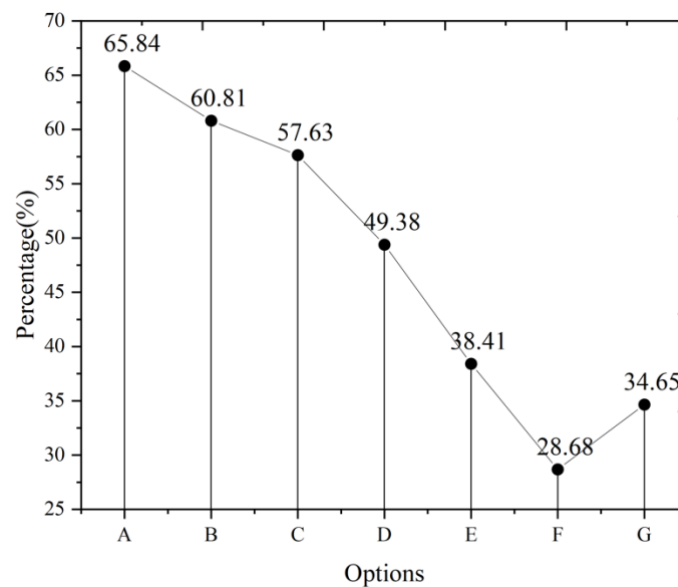


Figure 5. The constraints of the use of the aesthetic education service system

Regarding the comparison between blended learning using AES and traditional classroom teaching, 87.22% of the respondents indicated that they “feel that blended learning using AES is more effective than traditional classroom teaching”, while 10.78% of them indicated that they “preferred traditional classroom teaching to blended learning”, and about 2% were indifferent.

From the data of the survey, learners rated the blended learning mode based on the aesthetic education service system very highly, and believed that this learning mode had increased their interest in learning the aesthetic education course. For the blended learning mode based on mobile smart terminals, learners think that it is convenient to use smart phones to learn, and there is no restriction on the time and place of learning, so they can watch back or ask teachers and classmates for advice at any time for what they didn’t understand in class. However, this mode requires cooperation between students and teachers. Especially, students need to improve their self-control and be able to familiarize themselves with the operating platform to complete learning tasks in time. After trying the new blended learning, most of the interviewees said that the new way of learning is better than traditional classroom teaching in terms of learning effectiveness.

4.5 Analysis of Achievement in the Aesthetic Education Program

We conducted a before-and-after comparison of the course grades of the two groups of students, and the results of the grade comparison are shown in Table 1. From the course grades of Art Appreciation, the teaching effect has been significantly improved after using the AES system. The pre- and post-test scores of the experimental group and control students were compared with the important reference indexes of the excellence rate (percentage above 90 points), the failure rate (percentage below 60 points) and the average score.

Comparison of the pre-test scores showed that there was no significant difference in the performance of the students in the two classes, with average scores around 68 and roughly equal rates of excellence and failure. After the experimental group adopted the AES system for blended AES learning, their course grades significantly changed. The success rate went up from 12.21% to 18.33, and the failure rate went down from 16.81% to 5.3%. In particular, the average grade pre-test improved by nearly 10 points, while the course grades of the students in the control group did not change significantly.

Table 1. Comparison of course achievements

	Test	Excellence rate (%)	Failed rate (%)	Mean
Control group	Pre-test	13.82%	17.2%	67.82
	Post-test	14.41%	13.38%	68.51
Experimental group	Pre-test	12.21%	16.81%	68.21
	Post-test	18.33%	5.3%	78.68

5 Conclusion

This paper focuses on the design of an online aesthetic education service system to assist colleges and universities in their efforts to immerse themselves in aesthetic education. Students who have used the system were surveyed through a questionnaire, and it was found that more than 65% of the respondents liked or supported the blended aesthetic education teaching based on the aesthetic education service system, in which the system’s quiz test, interactive questioning, and watching learning video functions were used more frequently. 76.28% of the respondents said that the designed aesthetic education service system is very reasonable, which indicates that the aesthetic education big data platform designed in this paper can better well enrich the design of course content. 72.85% of

the students indicated that the blended learning approach through the AES system could increase their interest in the AES course, and 87.22% of the respondents preferred using the AES system to the traditional classroom mode of teaching for learning. After using the system, the excellence rate of the experimental class increased from 12.21% to 18.33%, the failure rate decreased from 16.81% to 5.3%, and the average grade increased by nearly 10 points. Therefore, the aesthetic education service system proposed in this paper can enrich the level of aesthetic education immersion and is one of the effective ways to immerse in aesthetic education.

Funding:

This research was supported by the Shandong Province Education Science Planning Project: Research on Multiple Paths of Aesthetic Education Infiltration in Rural Schools under the Background of Digital Transformation (2023YB258).

References

- [1] Wang, J. (2018, February). Cause analysis and countermeasures of the absence of aesthetic education. In 6th International Conference on Social Science, Education and Humanities Research (SSEHR 2017) (pp. 144-147). Atlantis Press.
- [2] Ebrahimiinia, A., Zanganeh Motlagh, F., Jafarian Yasar, H., & Mohammadi Naeeni, M. (2020). Analysis of aesthetics education curriculum and identification of aesthetic education strategies in Farhangian University. *Research in Teaching*, 8(4), 192-164.
- [3] Zhanqiang, K. (2023). Research on the Relationship between Diversity and Unity of Aesthetic Education. *Adult and Higher Education*, 5(4), 53-
- [4] Wang, X. (2022). Construction of college aesthetic education quality improvement model under big data network. *Wireless Communications and Mobile Computing*, 2022(1), 1826093.
- [5] Aliu, R., & Lertlit, S. (2023). The Factors Affecting Aesthetic Education Development of Chinese Higher Education Institutions. *Journal of Roi Kaensarn Academi*, 8(11), 498-526.
- [6] Lv, J. (2017). The Infiltration of Aesthetic Education in College Physical Education. *Art Education*, 44(2), 46-50.
- [7] Chin, C. (2017). Comparing, contrasting and synergizing Visual Thinking Strategies (VTS) and aesthetic education strategies in practice. *International Journal of Education Through Art*, 13(1), 61-75.
- [8] Gulla, A. N., Fairbank, H. C., & Noonan, S. M. (2022). Maxine Greene: an Approach to Aesthetic Education and a Vision of Social Imagination. *Beijing International Review of Education*, 4(3), 479-490.
- [9] Sierykh, L., & Kamtoah, A. (2020). Psychological and pedagogical features of teenagers in the context of aesthetic education. *Scientific Journal of Polonia University*, 40(3), 164-170.
- [10] Mo, E. (2024). The Value of Aesthetic Education of Technical Aesthetics under the Contemporary Social Background. *Research and Commentary on Humanities and Arts*, 2(1).
- [11] Mihailović, D. Z. (2021). Aesthetic Education and the Aesthetic Experience of Music in New Modes of Teaching: Can Music be Taught Online?. *FACTA UNIVERSITATIS-Philosophy, Sociology, Psychology and History*, 20(01), 87-96.
- [12] Liu, Y. (2020, December). Study on the Knowledge Map of Aesthetic Education in Chinese Universities in Recent Ten Years: Quantitative Analysis of Citespace Literature Based on CNKI. In *Proceedings of the 2020 3rd International Conference on E-Business, Information Management and Computer Science* (pp. 278-284).
- [13] Bai, T. (2023). Curriculum Reform and Evaluation Standard Exploration of Music Aesthetic Education in Colleges and Universities. *Curriculum and Teaching Methodology*, 6(14), 85-93.

- [14] Qian, B. (2022, September). The Design and Application of College Aesthetic Education Micro-course Based on Intelligent Mobile Terminal. In 2022 International Conference on Education, Network and Information Technology (ICENIT) (pp. 29-32). IEEE.
- [15] Xiao, P. (2023). Research on the teaching reform of college music aesthetic education from the perspective of core accomplishment. *Curriculum and Teaching Methodology*, 6(18), 27-34.
- [16] Mäcklin, H. M. (2020). Towards a Topology of Aesthetic Immersion. In *Aesthetics in Dialogue: Applying Philosophy of Art in a Global World* (pp. 277-288). Peter Lang.
- [17] Wenxuanzi, C., & Li, T. (2020, December). Visualized Analysis and Optimization Countermeasures of the Current Situation of College Aesthetic Education Research: Metrological analysis based on VOSViewer. In *Proceedings of the 2020 3rd International Conference on E-Business, Information Management and Computer Science* (pp. 268-277).
- [18] Zeng, S., Lyu, X., & Kang, J. (2023). Research on innovative method of human-computer collaborative aesthetic education based on hybrid of neuroaesthetics and shape grammar. *IEEE Access*.
- [19] Hou, K., & Liu, D. (2021). CONSTRUCTION OF MULTI FEATURE CURRICULUM SYSTEM OF AESTHETIC EDUCATION CONSIDERING PSYCHOLOGICAL AND WILL OBSTACLES. *Psychiatria Danubina*, 33(suppl 8), 676-681.
- [20] Shanjie, S., Yanrong, K., & Hanjin, B. (2023). Exploration of the development path of aesthetic education in colleges and universities in the digital context. *Frontiers in Educational Research*, 2023, 6 (2).
- [21] Wang Jian. (2024). Economic Analysis of Aesthetic Education in Promoting Educational Equity. *Development Economics of China*(2),121-127.
- [22] Zolfaghari Behrooz & Abrishami Saeid. (2022). A multi-class workflow ensemble management system using on-demand and spot instances in cloud. *Future Generation Computer Systems*97-110.
- [23] Orr Malcolm & Cao Eason Yang-Xin. (2023). Mastering Elastic Kubernetes Service on AWS: Deploy and manage EKS clusters to support cloud-native applications in AWS. doi:10.0000/9781803234823.