Evaluation of practical teaching in Artistic Design based on FCE model
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Abstract. In this paper, a fuzzy multi-criteria evaluation model is developed to study the practice teaching level in artistic design of higher education. We propose a fuzzy, multi-criteria, multi-layer evaluation model constructed with students, teachers, teaching environment, etc. We take the digital media art major in S University to apply the model, and evaluate its practical teaching score to be 81.892, indicating a good level. The assessment results provide reference for improving the quality of practical teaching in the design major.

Keywords: Fuzzy comprehensive evaluation; Practical teaching evaluation; Innovation and entrepreneurship education.

1. Introduction

The Artistic Design is a comprehensive interdisciplinary discipline, including digital media art, clothing and apparel design, animation, product design and other majors. A prominent feature of the design major is that it attaches great importance to practice, including the cultivation of knowledge such as design plans, drawing abilities, and production techniques. Its emphasis on innovation and creativity makes it highly compatible with the Innovation and entrepreneurship education in colleges and universities. However, practical teaching is often restricted by various factors during the implementation process, resulting in students' practical and innovative abilities being significantly insufficient.

Researchers have conducted many studies on practical teaching in higher education. [1] found that the current evaluation of students' teaching practices in colleges and universities is still in its infancy. He studied the core practices, teaching strategies and evaluation processes used or being developed in practice-based teacher education programs, which will help teacher education program selection based on practice. Courses to further understand teaching and assessment of core practices. [2] believes that the rapid development of information and communication technology has increasingly changed teaching methods and teacher development methods. He studied the main characteristics of these information and communication technology applications, including their functions, impact on teaching and teacher development, and factors affecting their application. factors and problems in existing applications. [3] Apply artificial intelligence to higher education to provide technical support for practical teaching in colleges and universities. He drew on the advantages of Massive Open Online Courses (MOOC) and Self-Directed Open Courses (SPOC) to build an intelligent management cloud platform for practical teaching. At the same time, artificial intelligence technology is used to achieve personalized learning and provide intelligent push services. In this teaching mode, the teaching content can match the actual work ability of college students. Since much of practical teaching is undertaken by practical teachers and full-time teachers, it involves the teaching practice process. [4] Conduct qualitative research on corporate teachers, practical teachers and full-time teachers to determine the views and expectations of corporate teachers. The research results show that the existing cooperation between universities and schools is insufficient. Practical teachers believe that the time for teaching practice is not enough and hope to increase the number and time of practical courses. [5] pointed out that traditional practical teaching mainly pursues the training of skills and highlights the characteristics of a single major, and it is difficult for talent training to adapt to the needs of diversified social development. [6] thought that the traditional practical courses of design majors lack social recognition and cannot meet the
requirements of social industry development. There are few opportunities to come into contact with real projects in practical teaching. [7] pointed out that there is a shortage of “dual-qualified” teachers, and the degree of deep integration with enterprises in the practice process is not enough.

To sum up, the current practical teaching of design majors mainly has the following problems: unreasonable arrangement of the practical teaching system, mismatch between practical teaching content and industrial needs, insufficient goal achievement, formalization of the construction of practical teaching bases, lack of cross-integration between disciplines, lack of teaching staff and other problems prevent students from giving full play to their "Innovation and entrepreneurship" potential, making it difficult for students to adapt to an increasingly competitive society. However, these studies cannot quantitatively evaluate the level of practical teaching, which is not conducive to the diagnosis of practical teaching problems in design majors and the improvement of teaching levels. Fuzzy comprehensive evaluation [8] is a method based on fuzzy mathematics theory that can evaluate the membership degree of multi-index fuzzy subsets and transform qualitative evaluation into quantitative analysis. Therefore, this article will use the Fuzzy Comprehensive Evaluation (FCE) model to transform qualitative issues into quantitative processing, and establish a relatively complete index system to accurately, objectively and scientifically evaluate the practical teaching level of design majors and diagnose Obstacle factors. The survey and research in this article is based on the digital media art major at Wuhan S College. It aims to further promote the practical teaching construction of the digital media art major and provide a high-quality method for cultivating innovative and entrepreneurial talents for all higher education institutions offering undergraduate education related to art and design majors.

2. Construction of practical teaching in digital media art major

The digital media art major of Wuhan S College was established in 2019. The professional training goal is to master the basic knowledge and methods of artistic creative design, film and television short films and post-production, online media production, interactive design and other applications, and to be able to work in game companies, film and television cultural media companies, network technology companies, art design companies, and animation companies and other enterprises, which are mainly engaged in the planning, creation and production of online interactive media and film and television media with high-quality applied talents. The following will introduce the practical teaching construction of the digital media art major of S College from the perspective of practical teaching system, teaching staff and practical conditions.

(1) Practical teaching curriculum system

The digital media art major of S College is based on the regional advantageous industrial clusters and the concept of "industry demand drives teaching, teaching boosts scientific research, and product drives teaching" to organically integrate social needs and students' comprehensive practical abilities. Construct a "mass entrepreneurship" curriculum system that combines theory and practice in a trinity of "curriculum practice - unit practice - comprehensive practice".

In the practical teaching system, attention is paid to the relationship between the summation of individual knowledge points in a single course, the practice of course group units, and the comprehensive knowledge structure. Multiple single-subject knowledge points only solve local problems respectively, and do not have a systematic and holistic knowledge framework. Multiple single-subject knowledge needs to be reasonably combined into unit practices and then summarized into comprehensive and systematic knowledge to handle the local and local issues well. , the relationship between part and whole.

(2) Teaching team

Teachers are a key part of the practical teaching reform, and the quality of the teaching team directly determines the quality of the teaching effect. For a highly practical major like digital media art, having a team of teachers with solid theoretical knowledge and rich practical experience is a strong guarantee for the quality of professional practical teaching. At present, the construction of
"double-qualified" teaching teams in colleges and universities in our country is insufficient, and there is a lack of high-quality teachers with excellent professional qualities, rich practical experience, and industry backgrounds. In other words, the growth rate and quality improvement of high-quality teachers cannot meet the urgent needs of current practical education. Due to the lack of "double-qualified" teachers among professional teachers, in practical teaching, majors also hire some industry and enterprise leaders and masters to teach part-time, allowing on-campus tutors to connect with corporate tutors to jointly complete practical activities inside and outside the school.

(3) Practical conditions

Practice conditions include practice platform and software, hardware conditions. In the construction of practice platforms, the digital media art major of S College relies on outstanding enterprises to actively build on-campus practice platforms such as "Innovation and entrepreneurship classrooms" and "design workshops". It also actively cooperates with high-quality enterprises inside and outside the province to develop off-campus school-enterprise cooperation practice bases. Rely on "Internet +" and other information technologies to build cloud practice platforms such as "Maker Space". Rely on multi-dimensional practical teaching platforms to explore and create a full industry chain practice of "creativity-design-innovation-manufacturing-intellectual property-brand-sales" closed loop of teaching.

In terms of practical equipment, the latest graphics workstations, digital movie machines, cameras and other equipment are equipped for students to create, and strive to reach the advanced level among universities at the same level in the province.

3. Practical teaching assessment based on FCE model

3.1 FCE of practical teaching model

This article is based on the principles of scientifcality, systematicity, comprehensiveness, practicality, and innovation, fully considering the systematic factors of practical teaching effectiveness, taking practical teaching as the breakthrough point, strengthening practical teaching as the focus, and targeting students, teachers, practical teaching environment, etc. Based on investigation, research, and expert argumentation, it constructs a practical curriculum system, comprehensive level of teachers, practical teaching conditions, innovation and entrepreneurship ability. A teaching evaluation index system for digital media art practice courses with five criteria and a total of 15 indicators for employment influence. Based on this system, a survey questionnaire on the effectiveness of practical teaching was designed. 160 online survey questionnaires were distributed to students who have graduated and engaged in related work, and 150 valid questionnaires were collected. The results of the questionnaire statistics for each indicator are shown in Table 1.

Definition the Factor Set of evaluation object, that is $U = \{u_1, u_2, u_3, u_4, u_5\} =$ {Practice curriculum system, teacher comprehensive level, practical teaching conditions, innovation and entrepreneurship ability, employment influence} , where $u_i$ means $i$ th evaluation indicator. Determine 15 evaluation elements of the index layer are used the index set $u_i = \{u_{i1}, u_{i2}, \cdots, u_{ij}\}$, and $i=(1, 2, 3, 4, 5), j = (1, 2, \cdots, \text{numbers of index layer of } i \text{th evaluation layer})$.

Definition the assessment vector set is denoted as $V$, which consists of five values. $V_i = \{v_1, v_2, v_3, v_4, v_5\} =$ {Excellent, good, medium, poor, fail}, among which, excellent: $100 \geq v_1 \geq 90$, good: $90 > v_2 \geq 80$, medium: $80 > v_3 \geq 70$, poor: $70 > v_4 \geq 60$, fail: $v_5 < 60$.

The weight set vector corresponding to the evaluation layer is denoted as $A = (0.2, 0.25, 0.2, 0.25, 0.1)$, and the weight set vector corresponding to index layer is $A_i = (w_{i1}, w_{i2}, \cdots, w_{ij})$. $i$ is the index of weight of evaluation layer and $j$ is the index of weight of
index layer, \( w_j \) is the value, for a example \( \mathbf{A}_i = (0.3 \ 0.35 \ 0.35) \). Weights are obtained through expert ratings.

Table 1. Evaluation indicators and weights for practical teaching in artistic design majors

<table>
<thead>
<tr>
<th>Evaluation object</th>
<th>Weight of evaluation layer</th>
<th>Weight of index layer</th>
<th>Survey questionnaire results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Excellent</td>
</tr>
<tr>
<td>Digital Media Art Practice Teaching Level</td>
<td>0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practical course system</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Content Design</td>
<td>0.3</td>
<td>69</td>
<td>75</td>
</tr>
<tr>
<td>Comprehensive Practice</td>
<td>0.35</td>
<td>33</td>
<td>109</td>
</tr>
<tr>
<td>Graduation Practice</td>
<td>0.35</td>
<td>45</td>
<td>98</td>
</tr>
<tr>
<td>Comprehensive level of teachers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional competence</td>
<td>0.3</td>
<td>63</td>
<td>76</td>
</tr>
<tr>
<td>Scientific research projects</td>
<td>0.15</td>
<td>41</td>
<td>73</td>
</tr>
<tr>
<td>Course content</td>
<td>0.25</td>
<td>52</td>
<td>71</td>
</tr>
<tr>
<td>Double-qualification Teacher</td>
<td>0.3</td>
<td>34</td>
<td>79</td>
</tr>
<tr>
<td>Practical teaching conditions</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software and hardware facilities for practical environments</td>
<td>0.3</td>
<td>97</td>
<td>52</td>
</tr>
<tr>
<td>Number of off campus practice bases</td>
<td>0.4</td>
<td>69</td>
<td>73</td>
</tr>
<tr>
<td>On campus workshops</td>
<td>0.3</td>
<td>59</td>
<td>67</td>
</tr>
<tr>
<td>Innovation and entrepreneurship ability</td>
<td>0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepreneurship projects</td>
<td>0.2</td>
<td>8</td>
<td>84</td>
</tr>
<tr>
<td>National Award for Discipline Competition</td>
<td>0.5</td>
<td>36</td>
<td>67</td>
</tr>
<tr>
<td>Provincial Award for Discipline Competition</td>
<td>0.3</td>
<td>65</td>
<td>73</td>
</tr>
</tbody>
</table>
Definition the evaluation matrix of the vector $R$ reflects the fuzzy correlation relationship from the evaluation indicator set $U$ to the assessment vector set $V$. And $R = (R_1,R_2,R_3,R_4,R_5)^T$. The final assessment $B$ is obtained by $B = A \times R$.

### 3.2 Evaluation procedure

From the table 1, the normalization evaluation matrix $R_i$ for $u_i$ is:

$$R_i = \begin{pmatrix} 0.46 & 0.5 & 0.033 & 0.007 & 0 \\ 0.22 & 0.727 & 0.04 & 0.013 & 0 \\ 0.3 & 0.653 & 0.027 & 0.013 & 0.007 \end{pmatrix} \quad (1)$$

And weights for these factors are $A_i$, so we can get the evaluation results $B_i$ for practical course system:

$$B_i = A_i \times R_i = (0.32, 0.633, 0.033, 0.011, 0.002) \quad (2)$$

As an analogy, we can get:

$$B_2 = A_2 \times R_2 = (0.3, 0.15, 0.25, 0.3) \begin{pmatrix} 0.273 & 0.487 & 0.233 & 0.007 & 0 \\ 0.347 & 0.473 & 0.167 & 0.013 & 0 \\ 0.227 & 0.527 & 0.207 & 0.04 & 0 \end{pmatrix} = (0.3218, 0.5015, 0.1547, 0.0223, 0) \quad (3)$$

$$B_3 = A_3 \times R_3 = (0.496, 0.433, 0.0509, 0.0187, 0.0021) \quad (4)$$

$$B_4 = A_4 \times R_4 = (0.2605, 0.4816, 0.2045, 0.0579, 0.0149) \quad (5)$$

$$B_5 = A_5 \times R_5 = (0.299, 0.5412, 0.151, 0.007, 0.0028) \quad (6)$$

so the final evaluation vector

$$R = \begin{pmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \\ B_5 \end{pmatrix} = \begin{pmatrix} 0.32 & 0.633 & 0.033 & 0.011 & 0.002 \\ 0.3218 & 0.5015 & 0.1547 & 0.0223 & 0 \\ 0.496 & 0.433 & 0.0509 & 0.0187 & 0.0021 \\ 0.2605 & 0.4816 & 0.2045 & 0.0579 & 0.0149 \\ 0.299 & 0.5412 & 0.151 & 0.007 & 0.0028 \end{pmatrix} \quad (7)$$

The final evaluation result $B$ is computed as:

$$B = A \times R = (0.3387, 0.5131, 0.1217, 0.0267, 0.0048) \quad (8)$$

Finally we determine system score. Definition F is the total score of the system and S is the level score of the corresponding factor in V. If the scores of Excellent, Good, Medium, Poor, and Fail are set to 90, 80, 70, 60, 50, and $S = \{90, 80, 70, 60, 50\}$.  

<table>
<thead>
<tr>
<th>Empoyment influence</th>
<th>n</th>
<th>Employability</th>
<th>Adaptability to society</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td></td>
<td>0.6 34 84 31 1 0</td>
<td>0.4 61 77 10 1 1</td>
</tr>
</tbody>
</table>
The system score is 81.892, so the practice teaching level can be evaluated as good. This indicates that the practical teaching system of the digital media art major at S school has reached a certain level of cultivation for students' professional and comprehensive practical abilities. Students have a good professional foundation, high comprehensive practical qualities, and innovative and entrepreneurial abilities.

4. Summary

The fundamental purpose of education and teaching reform is to improve the quality of talent cultivation. The construction of a sound practical teaching system can help cultivate professional talents with solid disciplinary foundations, strong practical abilities, and innovative and entrepreneurial abilities. The evaluation model for the effectiveness of practical teaching in design based on the FCE model not only intuitively reflects the advantages and disadvantages of the implementation process of the practical teaching system, but also effectively diagnoses the crux of its problems, solves fuzzy and difficult to quantify problems in teaching evaluation, avoids the subjectivity of a single qualitative evaluation, and reflects the rationality of fuzzy reasoning and decision-making. To provide decision-making support for improving the implementation process management of the practical teaching system for the design major in the future, enhancing teachers' self-awareness, and improving weak links in system construction.

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References


