Design and Application of Visual Evaluation Platform for Art Major

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Abstract. Professional evaluation is a process in which the evaluation subject judges the value of University Majors by using feasible evaluation means according to certain purposes and standards. It is an important link in the guarantee of higher education quality monitoring and evaluation. Its three core concepts are "output oriented", "student-centered" and "continuous improvement". Since the professional evaluation of Chinese universities began in the 1970s and 1980s, it has gone through decades of development. In the evaluation process, how to reflect the measures and results of "continuous improvement" is a problem that needs to be solved by all disciplines. Taking the art major as an example, this paper constructs a visual platform for the evaluation of art major, records and analyzes the construction process of the major and curriculum by means of data, and puts forward the basis for the improvement of the major and curriculum, so as to provide data support for the evaluation of art major.

Keywords: System platform · Professional assessment · Professional certification · Specialty construction

1 Introduction

Professional evaluation is not only the evaluation of the quality of various professional education in colleges and universities, but also an important part of the evaluation of the running level of colleges and universities. As a quality assurance activity of higher education, it is a process in which the evaluation subject makes value judgments on the majors of colleges and universities by using feasible evaluation means according to certain evaluation purposes and standards. Since the professional evaluation of China's colleges and universities began in the 1970s and 1980s, it has become an important form of China's higher education evaluation [2].

In the process of specialty construction, improving the quality of talent training and participating in specialty evaluation, art colleges and universities are facing a series of difficulties and problems: how to scientifically set the training objectives and graduation requirements of art specialty and implement them in the course teaching? How to carry out process management and record for practical courses of art major to reduce the

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randomness of teaching? How to scientifically and reasonably accumulate students' learning output and test the achievement of ability goals? How to build a guarantee system for continuous improvement in line with the characteristics of art major? All art colleges and universities need to improve the talent training system and quality evaluation system based on the concept of professional evaluation. This paper aims to solve the problems in the construction and evaluation of art specialty, and specially constructs a visual evaluation platform suitable for art specialty.

2 Design Strategy and Value of Visual Evaluation Platform for Art Major

The word "visualization" originally means "visible and clear presentation" [7]. It refers to the clear presentation of visual information that is difficult to be visually represented by human beings through various technical means. The ultimate purpose of this platform is to visually display the information logic hidden behind the data by means of visualization, so as to meet the needs of professional construction and professional evaluation process.

The overall design concept of the visual platform for professional evaluation is output oriented, student-centered, and continuous improvement. It is an integrated solution for professional construction, monitoring, diagnosis, and improvement. Through the reverse design and positive implementation of the ability objectives, curriculum system, and classroom teaching, it supports professional evaluation and professional construction in an all-round and intelligent way (Fig. 1).

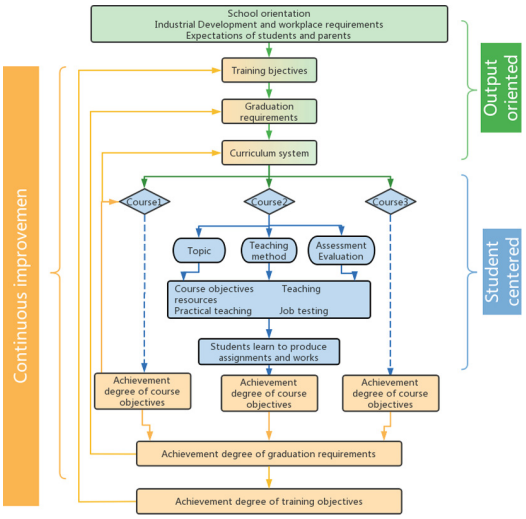

Fig. 1. Framework of art specialty construction based on specialty certification

2.1 The Visual Platform for Professional Evaluation Can Effectively Support the Construction of Art Specialty

The art major can import the professional training objectives, graduation requirements, index points and course matrix that meet the output orientation into the platform system. The platform automatically generates the achievement of graduation requirements based on the combination of direct evaluation and indirect evaluation. The major can formulate continuous improvement measures according to the evaluation results. The teaching manager can also view the construction of each major at any time, so as to facilitate the development of problems and provide supervision and guidance, Make the quality of talent training controllable, verifiable and visible, better support the construction of first-class majors in the University, and improve the quality of talent training.

2.2 The Professional Evaluation Visualization Platform Can Effectively Support the Course Construction

Art majors can import the evaluation concepts and standards into the platform system, and define the course objectives, course contents, teaching methods and assessment methods around the corresponding graduation requirement index points. The platform system collects and standardizes the teaching process, saves the teaching process data, and reduces the randomness of teaching. At the same time, it can analyze the achievement rate of ability objectives according to the assessment, and realize the quality monitoring of the teaching process based on the results. Teachers and managers analyze and improve teaching methods, carry out education and teaching reform, and improve the level of curriculum construction according to the retained teaching process records and the achievement of ability objectives.

2.3 The Professional Evaluation Visualization Platform Can Effectively Promote Continuous Improvement

Managers at all stages of teaching in art colleges can take improvement measures according to the assessment report on the achievement of relevant ability goals generated by the platform: the school analyzes the achievement of students' individual ability goals, gives early warning to students, and gives timely help and guidance, so that students can successfully complete their studies; The professional committee analyzes the evaluation results, reviews whether the curriculum system and training program are reasonable, and optimizes the curriculum; Teachers adjust teaching contents and methods according to the achievement of ability objectives, constantly improve teaching, and help students successfully obtain the expected graduation ability.

3 Output Oriented Data Model and Evaluation Calculation

Many literatures have put forward relevant models for the three core competencies of professional evaluation [1, 4, 6]. These models are basically based on describing the relevant support of each link of professional evaluation. They are a full closed-loop model

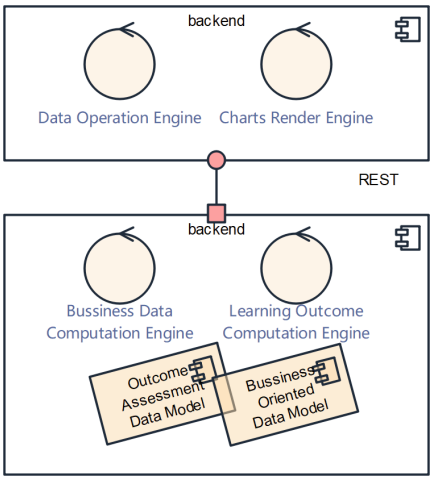

Fig. 2. Core data model, computing engine and control engine

to ensure the effect of professional evaluation. In the design of this platform, in view of the actual class situation of art major and the complicated course activities and course assessment data, the purpose of continuous improvement is obtained. The organization object of the learning process and the assessment output object are taken as the main line of the system to establish the relevant data model. Therefore, the system is required to express the business association based on the rigorous business oriented data model (Fig. 3). However, the rigorous business relationship changes frequently in the early stage of construction, which is not conducive to the expression of output calculation. Therefore, this paper designs the "data model of output evaluation" (Fig. 3) to better achieve the goal. The output evaluation model ignores the details. It is an abstract model and a sub projection of the greatly simplified business data model. The business data processing engine is the data access engine, which is used for data insertion, update, query, filtering and general computing. The output calculation engine is often linear matrix data, such as ability requirement matrix, curriculum ability coefficient distribution matrix, etc. it is mainly used for aggregation calculation and matrix operation (Fig. 2).

In the front end, the data operation interaction engine is used for human-computer data interaction, including data import, query, screening, etc., while the visual chart engine mainly uses the powerful charts middleware to visualize the output related data; Facilitate data observation, find out the problems in various links such as the course, and carry out continuous improvement of the course through corresponding methods.

3.1 Conceptual Data Model of Major, Course and Assessment

The output evaluation data model is mainly used to express the data model of the relationship between major and graduation required ability, which can be simply expressed in Fig. 3. The major is composed of multiple ability indicators. After the ability indicators are assigned to the course, they are materialized into the course objectives. Each course objective corresponds to the specific course teaching content. The assessment items are

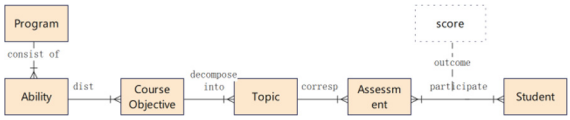

Fig. 3. Er description of course objectives, course content and assessment relationship

set to determine whether the students master the course content. Students corresponding to each assessment item need to participate in the assessment. The output of assessment participation will result in a score, which is the basis of professional assessment.

3.1.1 Professional Competence Composition and Weight Distribution

Suppose the required ability set for graduation of an art major is Ø: then the required ability set is:

$$\emptyset = \{A_1, A_2, A_3, \ldots, A_m\} \tag{1}$$

According to the investigation and discussion of many parties, the weight of professional ability is configured in the design of professional training program. If the proportion of each ability in the whole graduation requirements is a_i, the proportion coefficient of all abilities in the major can be expressed as: $(a_1, a_2, a_3, a_4 \ldots, a_m)$, and the sum of these coefficients is expressed as 1:

$$\sum_1^m a_i \equiv 1 \tag{2}$$

3.1.2 Course Capability Allocation Matrix

In the construction of professional training program, as shown in Table 1, each ability training task is shared by multiple courses, and one course can involve one or more ability training. According to the characteristics of the courses, the proportion of each course in cultivating the ability will be different. We express the proportion of the courses C_j in the ability A_i as follows $w_{A_iC_j}$:

$$\sum\nolimits_{C_j} w_{A_iC_j} \equiv 1 \tag{3}$$

The above identity indicates that the sum of the training percentages of multiple courses on a certain ability must be 1. For example, the training of ability A_1 in Table 1 is jointly undertaken by courses C_1, C_2 and C_3, whose percentages are 0.4, 0.3 and 0.3 respectively, and the sum is 1. These three courses cover the training and assessment of this ability.

3.1.3 Relationship Model Between Course Objectives and Assessment

The teaching content of curriculum design depends on whether it meets the achievement of the ability objectives required for graduation, that is, whether it meets the achievement of the index points required for graduation. The major corresponds the graduation

Table 1. Example of course list and graduation required ability coefficient matrix scheme for an art major

Weight $w_{A_i C_j}$	Skills of film and television creation A_1 (0.20)	Ability to create humanities documentaries A_2 (0.15)	Ability to create new media programs A_3 (0.15)	…	Ability to manage the whole process of film and television media projects A_m (0.10)
Fundamentals of film and television directors C_1	0.4	0.3	0.2	–	0.1
Fundamentals of film and television lighting C_2	0.3	0.2	0.1	–	–
Fundamentals of film and Television Art C_3	0.3	0.2	0.1	–	–
…	–	…	…	…	…
New media communication C_n	–	–	0.3	–	0.4

requirement index points to the course objectives one by one. The course team designs the course content according to the course objectives and designs the corresponding assessment items for the teaching content. Table 2 uses the course examples in Table 1 to divide the two required abilities for graduation into two specific course objectives: Audience investigation and analysis ability and Ability to manage the whole process of film and television media projects. Each course objective contains the corresponding course content (topic), and each course content is assessed through its own assessment. Each student's learning output corresponding to a specific assessment item will generate an assessment score.

The above relationship can be expressed in entity relationship (ER), as shown in Fig. 3. This figure adds a student entity. Students who participate in the assessment on any assessment item will get an assessment score, which can be used for subsequent analysis of course goal achievement and for continuous improvement of course teaching or assessment. This score can also be transferred to calculate the achievement of graduation requirements indicators in the macro (target student group), and then calculate and visualize the achievement of the whole major.

Table 2. Proportion of teaching content design, assessment design and assessment scores of new media communication

Course objectives	Topic	Assessment items	Assessment score (s_{A_i})
Audience investigation and analysis ability (Corresponding A_3)	Introduction to new media	1_1: Understand the media ecology in the new media era	3
	Communication: audience research	2_1 Master the basic principles of content communication in the new media era 2_2 Understand the significance and methods of audience research 2_3: Master common methods of audience analysis	4, 6, 6
Ability to manage the whole process of film and television media projects (Corresponding A_m)	Overview of data analysis	3_1: Understand the significance and methods of data analysis	2
	Third party data platform and its usage	4_1: Master the usage of Baidu Index 4_2: Master the usage of micro data 4_3: Master the usage of flying melon data 4_4: Master the usage of new ranking index	2, 2, 2, 2,
	Public opinion analysis	5_1: Master the collection of public opinion data 5_2: Master the writing method of public opinion report 5_3: Grasp the methods of public opinion early warning	2, 6, 6

3.2 Output Calculation Based on Business and Output Benchmark Data

The output of learning includes direct assessment and indirect assessment [3, 5]. The actual output calculation requires the joint calculation of business data and output benchmark data. Business based calculation will make the granularity of calculation data smaller and the level of analysis statistics richer. Figure 4 is a basic business data model

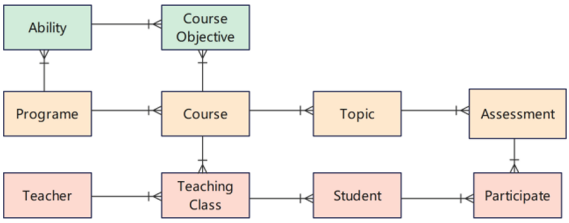

Fig. 4. Business data model with finer granularity

of the teaching organization process. It can analyze and evaluate various outputs of a single student, evaluate the outputs of each teaching class, horizontally compare the outputs of different teaching classes of teachers, analyze the output comparison of courses or different teachers in the course, and calculate the output matrix data of all courses corresponding to the target specialty.

3.2.1 Basic Assessment Acquisition of Business Data Model and Output Benchmark Data Model

For course, course objective, topic, assessment and teaching classes based on teaching tasks, the teaching classes here are used to distinguish the situation that multiple teachers of the same course participate in different classes, so as to facilitate horizontal fine-grained comparison. The following code expresses the basic operation of querying students' scores in different assessment items under the rough data model, which is used as the basic data for subsequent visual analysis. The actual data acquisition is more targeted than the code, and will not be repeated here.

```
SELECT student.id, assessment.score

FROM assessment
LEFT JOIN student on student.id =
assessment.student_id
LEFT JOIN topic on topic.id =
assessment.topic_id
LEFT JOIN course_objective on course_object.id
= topic.course_object_id
LEFT JOIN teaching_classes TC on TC.course_id
= course_object.course_id
LEFT JOIN teacher on teacher.id =
performed_course.teacher_id
LEFT JOIN course on course.id = TC.course_id
WHERE TC.id=?1 OR course_id=?2
```

3.2.2 Data Aggregation Calculation and Analysis for Course Content Topics

The analysis on the achievement of course objectives includes the analysis of topics of various teaching contents, which is conducive to the continuous improvement of

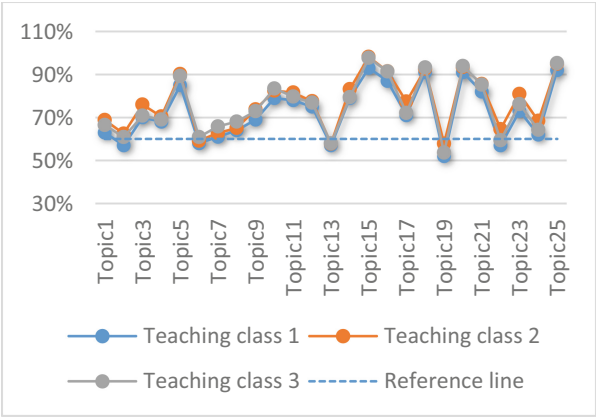

Fig. 5. Visual comparison and analysis of teaching theme achievement of multi class courses

teaching contents. On the platform of this system, teachers can directly query the scores of all students on all assessment items in the target semester, but to get the intuitive teaching effect or the effect of achieving the course objectives, the system has designed the corresponding analysis chart.

The calculation based on the achievement of course objectives can be calculated from the perspectives of individual students, teaching class groups and the same course groups according to the granularity. Here, let $\text{score}_{\text{student}}$ be the output score of student on an assessment item, the set of target student groups to be analyzed is {students}, and all evaluations under the same topic to be counted are {assessements}, , then click each topic for the teaching content. The mean output of the topic output to (topic output) to be calculated can be obtained from the following formula:

$$\overline{\mathbf{TO}} = \frac{1}{\mathbf{n}} \sum\nolimits_{\{\mathbf{assessements}\}} \sum\nolimits_{\{\mathbf{students}\}} \mathbf{score}_{\mathbf{student}} \tag{4}$$

According to the average output and the score of each assessment corresponding to the topic, the achievement degree of each topic can be obtained as shown in (5) (in this paper, the achievement degree is expressed as a percentage):

$$\text{Attain}_{\text{TO}} = \frac{\overline{\text{TO}}}{\overline{\text{gross\_score}_{\text{topic}}}} \times 100\% \tag{5}$$

The calculation data for the subject of the course teaching content can be rendered in the visual engine based on echarts. Figure 5 shows the comparative analysis of the output achievement of the three teaching classes under a total of 25 topics. The reference line allows teachers to investigate the subject of the teaching content below the achievement degree, which is convenient for the continuous improvement or adjustment of the course content, teaching methods and assessment means.

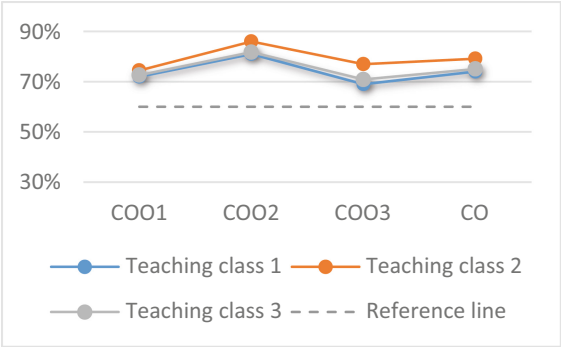

Fig. 6. Visualization of course teaching objectives and overall course achievement in different teaching classes

3.2.3 Data Aggregation Calculation and Analysis for Course Content Topics

As mentioned above, a course objective consists of multiple course topics. Therefore, the achievement degree of COO (course objective outcome) of each course objective output is calculated as shown in (6), and the achievement degree of CO (course outcome) of the corresponding course output is shown in Eq. (7).

$$\text{Attain}_{\text{COO}} = \frac{\sum_{\{\text{topics}\}} \text{Attain}_{\text{TO}}}{\text{size of topics}} \times 100\% \tag{6}$$

$$\text{Attain}_{\text{CO}} = \frac{\sum_{\{\text{course objectives}\}} \text{Attain}_{\text{COO}}}{\text{size of course\_objectives}} \times 100\% \tag{7}$$

Therefore, various graphs can be obtained in the visualization engine according to the analysis results of course objectives and course achievement. Figure 6 illustrates the comparison line chart of different teaching classes in the same course in terms of course objectives and course achievement.

3.2.4 Calculation and Visualization of Professional Ability Achievement

See Table 1 for professional ability requirements and course allocation weights. The ability of a graduation requirement corresponding to the course objective is $w_{A_iC_j}$. The weight matrix is expressed as follows:

$$W = \begin{pmatrix} w_{A_1C_1} & \cdots & w_{A_mC_1} \\ \vdots & \ddots & \vdots \\ w_{A_1C_n} & \cdots & w_{A_mC_n} \end{pmatrix} \tag{8}$$

The degree of achievement of the output of the course objectives of each course can be obtained from Eq. (6). It is known from the above that each course objective is bound to the professional ability in terms of data relationship, and $\text{Attain}_{\text{COO}_{ji}}$ represents

the degree of achievement calculated by course J on graduation ability I. In this way, the achievement of each of the N courses of the target specialty in M abilities can be calculated by (9) formulas.

$$A = \begin{pmatrix} Attain_{COO_{11}} & \cdots & Attain_{COO_{1m}} \\ \vdots & \ddots & \vdots \\ Attain_{COO_{n1}} & \cdots & Attain_{COO_{nm}} \end{pmatrix} \tag{9}$$

It can be concluded that the achievement degree of PAOs (program capability outcomes) corresponding to professional competence is (10):

$$\begin{aligned} Attain_{PAOs} &= W \times A \\ &= \begin{pmatrix} w_{A_1C_1} & \cdots & w_{A_mC_1} \\ \vdots & \ddots & \vdots \\ w_{A_1C_n} & \cdots & w_{A_mC_n} \end{pmatrix} \times \begin{pmatrix} Attain_{COO_{11}} & \cdots & Attain_{COO_{1m}} \\ \vdots & \ddots & \vdots \\ Attain_{COO_{n1}} & \cdots & Attain_{COO_{nm}} \end{pmatrix} \\ &= \begin{pmatrix} Attain_{PAO1} & Attain_{PAO2} & Attain_{PAO2} & \cdots & Attain_{PAOm} \end{pmatrix} \end{aligned} \tag{10}$$

The overall achievement degree of the specialty is relatively simple. The total achievement degree of the specialty can be obtained by taking into account the proportion coefficient a_i of each ability in (2) and the sum of the product of the achievement degree of each ability and the proportion coefficient in (10), as shown in Eq. (11).

$$Attain_{PO} = \sum_{i=1}^{m} (Attain_{PAOi} \times a_i) \tag{11}$$

According to the above calculation, the visualization platform can easily calculate the corresponding figure as follows. The Fig. 7 shows the final calculated value of a graduate with 15 graduation abilities.

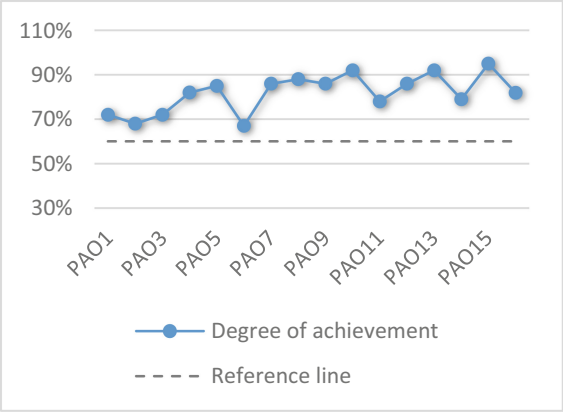

Fig. 7. Achievement of professional ability and overall achievement

4 Conclusion

By constructing a visual platform for the evaluation of art majors, this paper makes the information in the process of specialty construction and management digitalized and visualized. It not only connects the data in each link of specialty evaluation, but also visually shows the current situation of the construction of art majors and the completion of specialty evaluation goals, and solves the problems of specialty management in colleges and universities. Although this platform mainly serves art majors, since the logic of specialty construction is consistent, it can be extended to other majors only by studying and analyzing the characteristics of other majors and making customized adjustments to the teaching links of the course.

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