ISSN 2522-6398 Vol. 7, Issue 7: 94-100, DOI: 10.25236/FER.2024.070714

Research on Teaching Reform of Industrial Design CAID Series Courses Based on Hybrid Teaching Evaluation System

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Abstract: *This paper explores the methodology of hybrid teaching evaluation, tailored to the characteristics of the CAID series courses in our industrial design program and the current state of industrial design development. The study designs a suitable teaching evaluation system for CAID courses by considering professional characteristics and the goals outlined in the industrial design talent cultivation plan. The research identifies a multidimensional, multi-level teaching approach and project-oriented instructional design. By examining student evaluation strategies and course evaluation strategies, we construct a hybrid evaluation system for the CAID series courses, which has received positive feedback in practice. This framework can be extended to evaluate other courses.*

Keywords: *Hybrid Teaching Evaluation; CAID Series Courses; Industrial Design; Evaluation System Strategies; Talent Cultivation Plan*

1. Introduction

Course evaluation is a crucial indicator of quality assurance in university teaching, reflecting not only the effectiveness of course instruction but also the alignment between stage-specific talent development goals and expected outcomes[1]. It plays a positive role in providing feedback and guidance for curriculum teaching reform and the revision of talent development programs. Currently, there are three main ideologies in course evaluation: "Technical rationality," "Practical rationality," and "Emancipatory rationality." With a focus on the goal orientation of "technical rationality," it emphasizes monitoring the achievement of course objectives to adjust teaching activities and exert control accordingly[2]. "Practical rationality" views teachers and students as a whole, integrating teaching evaluation and reflection throughout the various stages of teaching[3]. "Emancipatory rationality" asserts that course evaluation and the evaluated parties engage in an equitable process of communication and subjective-objective participation under the dominance of a "pluralistic" value system[4]. Each evaluation ideology has its strengths, and mixed evaluation can combine different models to fit course characteristics[5].

2. The situation of mixed teaching evaluation system

2.1 Constructing a teaching evaluation system based on big data

To achieve better evaluation results, many domestic online systems have recorded this part. For example, the Micos teaching evaluation system includes student evaluations, peer evaluations, and supervisor evaluations[6]. In student evaluations, there are mid-term and end-of-term evaluations, as well as open suggestions for teacher course instruction. These features effectively complement the shortcomings of traditional teaching evaluation systems[7].

However, these evaluation systems are mainly teacher-focused and do not reflect a student-centered approach[8]. In particular, changes in teaching for the same course across different semesters are not clearly presented[9]. Therefore, new teaching platforms like "Rain Classroom" and "Chaoxing Erya" have emerged, allowing real-time, bidirectional evaluations from both students and teachers during the teaching process[10]. The correlation of various parameters can be observed more effectively[11].

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2.2 Emphasizing Process-Oriented Evaluation in Assessment Mechanisms

Compared to summative evaluation, process-oriented evaluation focuses more on students' performance during the learning process[12]. It does not rely solely on final exam scores or projects as the only criteria for grading[13]. Instead, it adopts a more multidimensional, comprehensive, and accurate approach[14]. By breaking down students' performance before, during, and after class, various aspects are included in the assessment, achieving a complete and well-rounded evaluation mechanism.

The improved evaluation system more objectively reflects students' overall status during the learning process but also requires more investment. Establishing a big data-based evaluation system takes several years to build the platform, while process-oriented evaluation with diverse content demands greater attention from teachers to students[15]. Finding a balance between course instruction and the evaluation system is one of the key issues our project aims to solve.

3. Curriculum Design for the CAID Series in Industrial Design

3.1 Curriculum Design for Developing Students' Comprehensive Abilities

The Computer-aided Industry Design (CAID) series is a crucial set of specialized courses within the Industrial Design program. This series includes three independent courses: Computer-aided Industry Design I (Basis of 2 Dimensional Design), Computer-aided Industry Design II (3D Modeling and Rendering), and Computer-aided Industry Design III (Creo Engineering Design). These courses directly support the product series courses.

The courses in our university's Industrial Design program are broadly divided into four categories: Design Theory, Design Expression, Design Thinking, and Design Technology. The Design Technology category typically includes courses such as Computer-aided Design and Fundamentals of Engineering Design. The 2023 edition of the Industrial Design talent cultivation program presents these courses as a series, and the CAID series of courses cover plane, three-dimensional and engineering software respectively, as shown in Table 1.

Table 1: CAID curriculum corresponding software and bridging courses

Course Title	Corresponding Software	Connecting courses and content
Computer-aided Industry Design I (CAID I) (Basis of 2 dimensional design)	Photoshop, Adobe Illustrator, Coreldraw	Advertising design, visual communication design, packaging design, etc
Computer-aided Industry Design II (CAID II) (3D modeling and rendering)	Rhinoceros, Keyshot	Product Design I (Product Design Procedures and Methods), Product DesignII(Special Design for Intelligent Home Appliance Products), Portfolio making,Design competitions
Computer-aided Industry Design III(CAID III) (creo Engineering Design)	Croe	Assembly of parts Model making

The teaching is organized in course groups, emphasizing the connections between courses. This progressive approach gradually develops students' modeling skills for product design, ultimately achieving the goals of the talent cultivation program.

3.2 Software Course Instruction Aligned with Product Design Trends

Traditional teaching methods for the CAID series courses, which primarily relied on showcasing typical cases with supplementary group discussions, are no longer sufficient given the proliferation of artificial intelligence and the diversification of software used in the design process.

With the rise of minimalist trends and economic pressures, students find it easier to use computer-aided design software for creating simpler designs. Rather than focusing heavily on form, preliminary research content for products is now more commonly emphasized in project presentations. Given this scenario, incorporating all the synchronous design software available online, such as Figma and Photoshop, into the curriculum is impractical. Introducing project-based learning, integrating emerging software, and prioritizing project completion as the primary objective can enhance students' autonomy

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in learning.

4. Teaching Design for the CAID Series

4.1 Three-dimensional Multidimensional Teaching Design

Pre-class Preparation Stage: Industrial design students generally show high enthusiasm for learning software, but they often lack clarity about the overall course structure. By leveraging online resources and the "mentorship system" during the initial phase of the course, students can better understand the place of each course within the entire CAID series. This helps them identify key and challenging aspects of the course content, allowing for targeted learning.

(1) In-class Learning Stage: With thorough pre-class preparation, the in-class progression can move beyond basic knowledge introduction to addressing complex problems, effectively enhancing learning efficiency. Students also develop a more nuanced understanding of representative cases.

(2) Post-class Review Stage: Utilizing the established premium course library and online teaching resources, post-class knowledge reinforcement is structured around projects, with competitions as a secondary focus. The goal of computer-aided design is to support industrial product design. By working in design competition teams, students not only complete design projects but also reinforce all the content from the CAID series courses. The second classroom, aimed at design practice and featuring multiple instructors, offers a more practical extension of traditional classroom teaching.

(3) In a multi-level evaluation system, the focus extends beyond students' classroom performance to a comprehensive assessment of their overall learning status as required by the course. The evaluation methods span across pre-class, in-class, and post-class stages, and course assignments are no longer the sole criteria for grading.

4.2 Project-oriented Teaching Hierarchy

The focus of the software series courses is on student application. In today's era of popular AI software, the learning of software is characterized by both diversity and specialization. Effectively utilizing AI software to stimulate self-learning and complete projects is the goal, rather than the traditional follow-along learning model (Table 2).

Table 2: Comparison Chart of Two Teaching Models

NO.	contents	Traditional Teaching Design	Project-based Teaching Design
1	Homework	Instructor-assigned Topics	Open-ended Topics within or outside the Course
2	Panel Discussion	Utilization-focused Discussion on Tools of software	Exploring How to Achieve Product Effects, not Limited to Single Software Tool Discussions
3	Self-learning	Passive learning	active learning
4	Classroom Presentation	Single-Software Case Demonstration Led by the Instructor	Application-Oriented Comprehensive Case Demonstration
5	Design practice	none	1-2

5. Construction of a Hybrid Evaluation System

5.1 Strategies for Student Evaluation System

5.1.1 Scoring Weight Standards

The evaluation of the CAID series courses involves a combined assessment by the course instructor, the laboratory teaching instructor, and the project-based corporate mentor. Scores are assigned based on the course content by the corresponding instructors[16](Figure 1).

To effectively avoid potential conflicts in grading among different mentors, the primary score for a project is determined by the main responsible instructor, with additional input from other instructors[17]. The online learning component (such as watching videos, online questioning, and group discussions) is

ISSN 2522-6398 Vol. 7, Issue 7: 94-100, DOI: 10.25236/FER.2024.070714

primarily overseen by the laboratory instructor[18]. The offline component (including attendance, assignments, and quizzes) is managed by the course instructor. The corporate mentor is responsible for evaluating the design practice[19].

Using design practice as an example, scores are given by the corporate mentor, the laboratory instructor, and the course instructor[17]. Since the corporate mentor is the main person responsible for this project, their score accounts for 70%, while the scores from the other two instructors make up the remaining 30%[20-21].

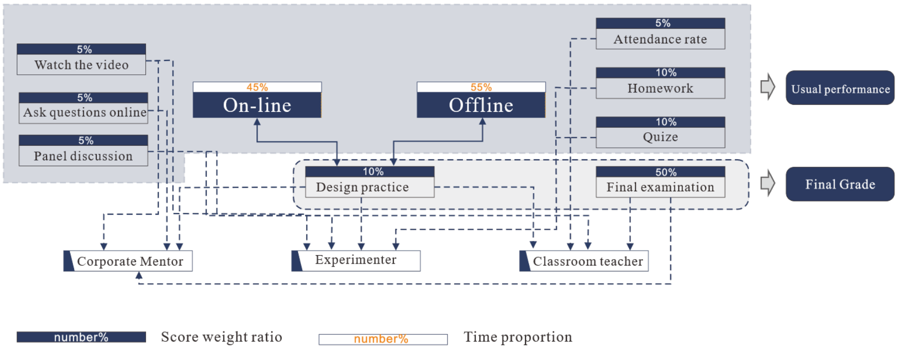

Figure 1: Weighting Ratio of Online and Offline Course Content Scores

5.1.2 Quantitative Scoring Standards

Building upon the previous general evaluation model, this approach employs accurate data as the foundation for grading, making educational assessments more equitable, intuitive, transparent, and scientific[22]. In alignment with course evaluation methodologies, the principles of course evaluation are divided into three parts: pre-class preparation, in-class learning, and post-class review[23](Figure 2). This approach emphasizes process-based assessment, transforming the traditional single evaluation method into a multidimensional evaluation system[24].

The accompanying chart exemplifies this by showing the distribution of the final grade components for the CAID III (Creo Engineering Design) course[25]. It illustrates the use of a more scientific weighting system, which encourages students to focus on product design as a guiding element in their course learning[26].

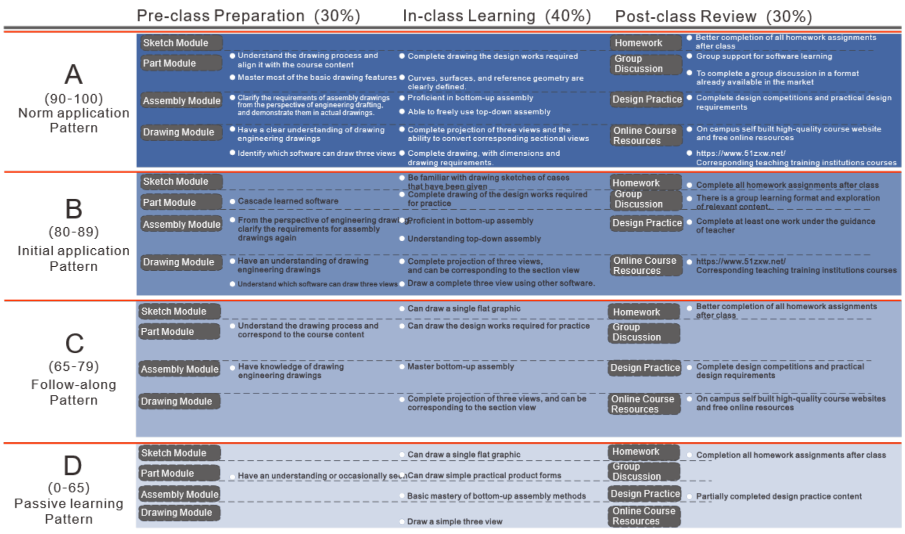

Figure 2: Weight Distribution Diagram of Final Grades for CAID III Course

5.2 Strategies for the Course Evaluation System

(1)Increased Student Satisfaction with Project-Based Criteria

In contrast to traditional teaching methods, which focus on tool mastery in software, CAID courses

ISSN 2522-6398 Vol. 7, Issue 7: 94-100, DOI: 10.25236/FER.2024.070714

emphasize solving product design modeling problems[27]. Integrating project objectives into the curriculum helps students understand the market-driven purposes of their studies, facilitating structured post-course learning[28].

(2)Positive Feedback on the Multi-Mentor Teaching Model

The multi-mentor system addresses the limitations of single-mentor evaluations by providing multiple perspectives on student performance[29]. This approach allows students to demonstrate their skills through various platforms, resulting in a more objective and comprehensive assessment[30]. Furthermore, the CAID courses aim to develop students' modeling strategies using computer-aided design software, benefiting from diverse problem-solving insights offered by different mentors[31].

(3) Comprehensive Abilities have been widely recognized

Training that aligns with industry needs ensures that students' skills match job requirements[32]. Project-based learning advances product design beyond the conceptual stage to meet production standards[33]. The primary goal of CAID courses is to cultivate problem-solving abilities using computer software, rather than just tool proficiency[34]. Consequently, software updates do not hinder course objectives, and students' skills are acknowledged by the industry[35].

From multiple evaluation perspectives, including student feedback, qualitative analysis, quantitative analysis, and expert opinions, the effectiveness of classroom practices was validated. The survey results are illustrated in the accompanying diagram(Figure 3).

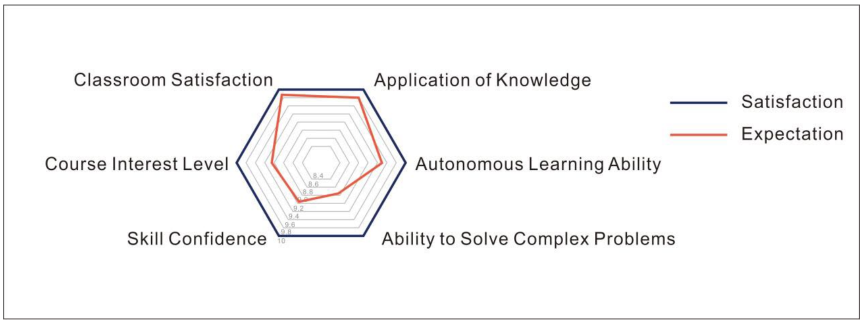

Figure 3: Course Evaluation Satisfaction

6. Conclusion

The hybrid evaluation system implemented in the CAID series courses represents a vital part of the overall hybrid evaluation system for industrial design programs. The unique nature of these courses, supported by a blended online and offline teaching approach, offers a robust foundation for a comprehensive evaluation framework. Through this project, we are establishing a computer-aided design course evaluation system that diversifies evaluators and evaluation methods, continuously enhancing course development and providing an excellent teaching environment. In the future, we will leverage this foundation to extend the evaluation system to encompass all courses within the industrial design program.

Acknowledgements

1) 2023 Lingnan Normal University Higher Education Teaching Research and Reform Project, Research on Teaching Reform of Industrial Design CAID Series Courses Based on Hybrid Teaching Evaluation System;

2) 2024 Ministry of Education Collaborative Ed-ucation Project of China (230907606271305), Computer aided Design teacher training based on CAID series courses;

3) 2023 Ministry of Education Collaborative Ed-ucation Project of China (230703711174142);

4) 2023 Zhanjiang Non-funded Science and Technology Tackling Plan Project (2023B01064);

5) 2023 Zhanjiang Philosophy and Social Science Planning Project (ZJ23YB45);

6) 2023 Lingnan Normal University Teaching Reform Project, Exploration on Teaching Mode of Interactive Design Course _ Innovative Practice Research on Integrating UCD and VR

ISSN 2522-6398 Vol. 7, Issue 7: 94-100, DOI: 10.25236/FER.2024.070714

7) 2023 Lingnan Normal University Education and Teaching Achievement Award (Higher Education) Cultivation Project, Creating a Series of Product Design Courses and Establishing a "Four-in-One" Core Curriculum Teaching Path;

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