



Blended Instructional Design of "Case + Digital Technology Fusion" under BOPPPS--Taking the Digital Content Creation Practice of the Course "Digital Synthesis and Special Effect Technology" as an Example

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Abstract. Aiming at the problems of disconnection between theory and practice of digital media practical courses, fragmentation of cases, insufficient technical empowerment, and weak creative ability of students, this paper deeply integrates the BOPPPS teaching model with case-based teaching and digital technology to build a "diagnosis on the front line of the class-in-class Closed-loop implementation-output of after-school results" integrated hybrid teaching. Taking the course "Digital Synthesis and Special Effects Technology" as the carrier, taking the production of the opening credits of the Mid-Autumn Festival as a case, the whole process design is carried out around the six links of BOPPPS, integrating core technologies such as 3D layers, mask animations, particle light effects, and atmosphere toning, and integrating Cultural and curriculum ideological and political elements. Taking 86 students as the object for demonstration, the results show that the core skills of students have been improved by an average of 22.4 points, the excellent rate of works has reached 37.2%, and the comprehensive satisfaction rate of courses has reached 94.09 points, which can significantly improve students' special effects synthesis, artistic aesthetics and cultural innovation capabilities. Provide a reproducible and scalable teaching paradigm for similar courses.

Keywords: BOPPPS; Case-based teaching; digital technology; Blended teaching; Digital synthesis and special effects technology; Digital content creation

1 Introduction

The digital economy and new media industry are at a high speed. Relying on the national cultural digitalization strategy, the demand for digital content creation talents in the fields of film and television post-production, animation creation, virtual vision, and integrated media production is rising. The industry urgently needs to integrate technical capabilities, artistic aesthetics, and cultural expression. compound innovative talents. "Digital Synthesis and Special Effects Technology" is a core practical course for digital media, visual communication and other majors. It has the character-

istics of strong practicality, fast tool iteration, and high integration of art and technology. It is a key course connecting professional foundations and industry positions. Students' ability to produce special effects, creative design and engineering implementation is very important.

There are obvious disadvantages in the current course teaching. Classrooms mostly adopt the teaching form of one-way demonstration by teachers and passive imitation by students. The knowledge points are scattered and fragmented, and there is a lack of systematic logical connection, which makes it impossible for students to establish a complete digital creation process thinking. At the same time, most of the teaching cases are single software function demonstrations, which are divorced from the real creation scene of the industry, lack visual style, narrative logic and cultural connotation, and it is difficult to cultivate students' creative output ability. In addition, the application of cutting-edge digital technology in the curriculum is insufficient, and the teaching content lags behind the industry workflow; The assessment is single, only relying on the evaluation results of the final works, lacking procedural and diversified evaluations, unable to accurately feedback students' problems, and there is a problem of disconnection between technical training, aesthetic cultivation, and cultural education.

The BOPPPS teaching model takes closed-loop structure, goal-oriented and participatory learning as the core, and is highly suitable for practical course teaching [1]. Integrating this model, case teaching and digital technology can build a highly blended teaching system and improve the adaptability of talent training to industry needs. The current academic research is relatively one-sided, and there is a lack of teaching research that combines complete creative processes, cultural themes and can be quantified and verified. Based on this, this paper takes the Mid-Autumn Festival title production as a case to build a new type of BOPPPS teaching program and carry out empirical research to provide reference for digital media curriculum reform [2].

2 Relevant Theoretical Basis

2.1 Connotation and Characteristics of BOPPPS Teaching Model

The BOPPPS teaching model originated from the Canadian teacher skills training system and is an effective classroom design widely used in universities around the world. The six links of Post-assesent and Summary constitute a complete teaching closed loop. The leading link is used to attract students' attention and establish learning motivation; The target link clarifies observable, measurable, and achievable learning expectations; The pretest is used to diagnose the foundation of students and realize precise teaching; Participatory learning emphasizes students' hands-on practice, group cooperation and inquiry learning; Post-test is used to test the learning effect in real time and feedback error correction; The summary link is used for knowledge review, ability transfer and task extension. The model highlights student-centered, goal-oriented, and process control as a means, and is highly suitable for practical, process-oriented, and achievement-oriented courses [3].

2.2 Integration Logic of Case-based Teaching and Digital Technology

Case-based teaching transforms abstract theoretical knowledge into operable, reusable, and transferable practical processes through a real, typical, and complete task carrier, helping students quickly build system cognition and problem-solving capabilities. In digital content creation courses, case-based teaching can transform complex software operations, special effects principles, and visual laws into complete works that can be followed, debugged, and innovated, effectively learning thresholds. Digital technology includes tools and methods such as 3D synthesis, particle system, mask tracking, intelligent color correction, and dynamic text design, which can significantly improve the texture of works, optimize the creation process, and improve practical efficiency [4]. The organic integration of the two can realize the simultaneous advancement of technical learning and artistic creation.

2.3 Implementation Path and Advantages of Blended Teaching

Blended teaching integrates online independent learning and offline centralized practical training, breaks through the constraints of time and space, realizes the full-cycle learning path of pre-class preview diagnosis, closed-loop teaching in class, and iterative optimization after class, and is more suitable for the ability cultivation of digital content creation courses need [5]. The online platform is used for resource push, preview test, homework submission and mutual evaluation interaction; Offline classrooms are used for centralized practical operations, difficult breakthroughs, achievement display and real-time comments, and online and offline complement each other to form a closed loop of efficient teaching.

2.4 Teaching Characteristics of Digital Synthesis and Special Effects Technology Course

The course "Digital Synthesis and Special Effects Technology" involves software operation, visual principles, dynamic design, lens language, color aesthetics, cultural expression and other fields of knowledge, requiring students to have both technical realization ability and artistic aesthetic ability. The course has a long tool chain, outstanding practicality, fast iteration speed, and emphasizes the unity of creative expression and engineering realization, so it is suitable for case-driven, process-based training, and result-oriented teaching. The integration of BOPPPS model, case-based teaching and digital technology can form an efficient teaching link of "clear goals-case-driven-technology empowerment-process control-achievement output", enabling students to shift from passive imitation to active creation, and from skills Training shifts to the improvement of comprehensive capabilities, so as to better meet the digital content industry's demand for compound innovative talents [6].

3 Blended Instructional Design Framework Based on BOPPPS

3.1 Ideas and Principles of Instructional Design

This paper takes the cultivation of digital content creation ability as the core goal, takes the BOPPPS teaching process as the overall framework, takes the production of Mid-Autumn Festival titles as the typical task carrier, and takes digital technology tools as the efficiency support to build a "goal-led-case-driven-technology empowerment-process Evaluation-result output" integrated hybrid teaching system. The design idea follows the principles of student-centered, goal-oriented, integration of theory and practice, double training of skills, and fully integrates online learning resources, offline practical training, digital tool application, curriculum ideological and political elements, and multiple evaluation mechanisms to realize knowledge imparting, The synergy and unity of ability cultivation and value shaping.

3.2 Construction of Three-dimensional Teaching Goal System

Teaching objectives are divided into three dimensions: knowledge, skills and quality. Knowledge objectives require students to layer animation, three-dimensional space structure, masks and orbit masks, particle light effect systems, color atmosphere adjustment, visual synthesis specifications and other core principles and industry terms; Skill goals require students to be able to independently complete the complete production process of the Mid-Autumn Festival title, skillfully use After Effects and mainstream special effects plug-ins, and have the ability of lens design, dynamic rhythm control, picture synthesis and work output; The quality goal emphasizes the cultivation of students' artistic aesthetic expression, teamwork ability, innovative creation awareness, cultural self-confidence and cultural inheritance awareness.

3.3 Layered and Progressive Teaching Content Design

The teaching content is progressive according to the basic level, advanced level, core level and comprehensive level. The basic layer includes software interface operation, layer management, key frame animation, and dynamic design of basic characters; The advanced level includes three-dimensional layer enablement, camera control, lighting setting, mask drawing and track mask application; The core layer includes particle light effect generation, atmosphere color correction system, lens stabilization and motion matching, and comprehensive use of external plug-ins; The comprehensive layer takes the Mid-Autumn Festival title as the complete task to realize the integrated creation of narrative design, visual style, cultural elements, technical realization and work output.

3.4 Digital Technology Support and Teaching

The digital support system comprises an online platform, professional creation tools, digital plugins, asset libraries, AI tools, and offline training facilities, forming a

full-process technical support system. As shown in Table 1, the online platform enables resource delivery, pre-class diagnostics, testing, and interactive feedback; professional tools centered on AE and PR establish a complete post-production workflow; digital plugins such as Particular, Saber, and DeepGlow enhance visual effects; AI tools assist with rotoscoping, color grading, restoration, motion graphics, scoring, and analysis, improving efficiency and precision; offline facilities include smart classrooms, green screen studios, and graphics workstations for practice and creation. Overall, the system provides stable and efficient support for BOPPPS blended learning and the Mid-Autumn Festival intro case study.

Table 1. Digital Technology Support System for BOPPPS Blended Teaching

Category	Components	Core Functions
Online Teaching Platform	Resource push, pre-class diagnosis, online testing, homework submission, peer evaluation, interactive feedback	Resource delivery, pre-class assessment, data tracking, interactive teaching
Professional Creation Tools	Adobe After Effects, Adobe Premiere	Full post-production workflow, synthesis, editing, rendering, output
Digital Plug-ins	Particular, Saber, DeepGlow	Professional visual effects, high-quality picture rendering
AI Intelligent Tools	AI keying, AI color correction, AI restoration, AI text animation, AI scoring, academic analysis	Lower difficulty, improve creation efficiency, personalized diagnosis, precision teaching
Offline Training Venues	Smart classrooms, green-screen studios, professional graphics workstations	Live shooting, hands-on practice, project creation, real-time guidance
Integrated System	Online platform + software + plug-ins + AI + offline facilities	Stable, efficient, cutting-edge support for BOPPPS teaching and the Mid-Autumn title case

3.5 Diversified Process Evaluation System

The evaluation system adopts procedural evaluation and summative evaluation, each accounting for 50%. The process evaluation covers pre-class preview, classroom participation, group collaboration, phased results, and experimental reports. The final evaluation focuses on the technical specifications, artistic effects, and culture of the Mid-Autumn Festival opening works. Expression and completion are the core, and the whole process, degree, and data-based teaching evaluation are realized.

4 Blended Teaching Implementation Based on BOPPPS and the Case of Mid-Autumn Festival Opening Production

The introduction link stimulates students' interest in learning by displaying excellent Mid-Autumn Festival theme titles, national style visual animation and festival fusion media packaging, combined with Mid-Autumn Festival cultural images and visual narrative characteristics, so that they can clarify the visual characteristics, cultural connotations and industry production logic of festival titles, and quickly establish A sense of learning goals and creative expectations, and highlight the important value of streamlined creation, stylized expression and cultural presentation through comparison; The target link clarifies the three-dimensional goals of knowledge, skills and quality in an observable, measurable and achievable form, standardizes the output format, duration requirements, technical points, visual style and evaluation scale of the Mid-Autumn Festival title, closely connects with industry job capabilities, and highlights Practical, fruitful and innovative, and integrated into cultural inheritance, aesthetic improvement and teamwork quality; In the pre-test link, the online teaching platform is used to carry out skill diagnosis, and accurately locate students' weaknesses in key frames, layers, masks, three-dimensional space, and color foundations. Based on this teaching focus, teachers focus on common difficulties. Participatory learning takes the Mid-Autumn Festival title as a complete case for modular dismantling, teachers demonstrate core technologies, students work together in a 4-person team to complete various production tasks, and teachers guide and encourage personalized creative expression in real time; The post-test link requires the first draft to be submitted on the spot, and if the combination of teacher comments, group mutual evaluation and random blind evaluation is used, real-time scoring will be carried out from six dimensions, so as to promote learning and reform through evaluation; The summary link systematically sorts out the production process, technical points and common problems, emphasizes the narrative rhythm, visual level, cultural artistic conception and industry norms of the festival title, displays excellent works and assigns iterative tasks, and finally realizes knowledge review and ability transfer.

Taking the Mid-Autumn Festival culture as the creative theme, this study designed the core practice case of the course "Digital Synthesis and Special Effects Technology", requiring students to complete a 15-25-second complete festival opening work, which must include Mid-Autumn Festival theme text animation, three-dimensional space layer construction, mask transition and screen fusion effects, particle light effects such as moon and star, Chinese warm atmosphere color adjustment, and finally output video files that meet the release standards of financial media platforms. The case takes the full moon in the Mid-Autumn Festival, family and country reunion, and poetic artistic conception as the cultural core, combines imagery with modern digital vision technology, and naturally integrates ideological and political elements of courses such as cultural self-confidence, aesthetic accomplishment, and cultural inheritance, so as to realize technical training, artistic improvement and Cultural synchronization. Before class, teachers push analysis videos, key technology micro-classes, national style material packages and reference project documents through the online learning platform. Students complete independent preview, material

screening and basic operation exercises, and participate in online pre-tests to help teachers clarify teaching Focus and achieve precise teaching [7]-[10]. In the class, the closed-loop teaching is implemented in strict accordance with the BOPPPS process, and the situation introduction, clear goals, pre-test feedback, participatory learning, on-site evaluation and summary sublimation are completed in turn. Students practice the whole process, the teaching goals are clear, the process is complete, and the effect is measurable. After class, students optimize animation rhythm, light effect details, color atmosphere and picture texture based on classroom comments, submit works and participate in mutual evaluation, teachers combine process performance, group mutual evaluation and works to give comprehensive results, excellent works are used for campus Mid-Autumn Festival publicity, new media release and course results display, effectively enhance students' sense of learning achievement and creative motivation. In order to ensure the stable development of teaching, the course is equipped with a complete online resource library, professional software plug-ins, training equipment and standardized evaluation scales. Online resources, creative tools, training and multiple evaluation mechanisms work together to form a repeatable, repeatable and iterative teaching support system to ensure a smooth teaching process, measurable learning results, and demonstrable and popularizable practical results. As shown in Figure 1, the results of this Mid-Autumn Festival Opening Credits Production assignment showed that 93.2% of the students scored between 80-89 points, 2.3% scored 90 points or more, 4.5% scored less than 80 points, and no one scored less than 70 points, so the effectiveness of teaching and learning has been significantly improved.

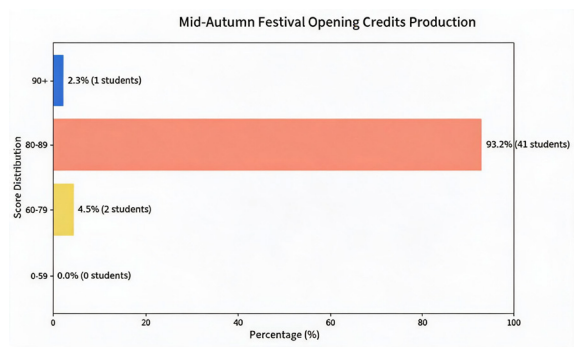


Fig. 1. "Mid-Autumn Festival Opening Credits Production" Homework Effectiveness

5 Verification and Analysis of Teaching Effect

5.1 Evaluation Indicators and Data Sources

In order to scientifically verify the effectiveness of teaching, this study constructed an evaluation system from four dimensions: knowledge level, practical creation ability, learning participation, and curriculum satisfaction. A total of 86 students in two clas-

ses of digital media majors at Level 23 of Guangzhou Institute of Technology were selected as the research object. The data were obtained through the comparison of pre-and post-test scores, double-blind review of works, online learning behavior data analysis, curriculum satisfaction questionnaire survey and semi-structured interviews. The data source is objective, the sample size is sufficient, and the evaluation method is standardized, which can truly reflect the teaching effect [11].

5.2 Analysis of Quantitative Results of Learning Effectiveness

The quantitative analysis results of learning effectiveness show that the average score of students in the pre-test is 62.3 points, and the average score in the post-test is 84.7 points, an average increase of 22.4 points, an increase of 35.96%, and the core skill level has improved significantly, As shown in Figure 2. The blind evaluation of works was jointly completed by two course teachers and an industry designer. The results showed that excellent works (≥ 85 points) accounted for 37.2%, good works accounted for 47.7%, qualified works accounted for 15.1%, and there were no unqualified works. The pass rate is 100%. Student works have significantly improved animation fluency, mask fusion, light effect atmosphere, color unity, cultural artistic conception expression, etc., and problems such as synthetic flaws, blunt edges, chaotic rhythm, and abrupt colors have dropped by more than 60% compared with teaching, As shown in Figure 3. Learning process data shows that the completion rate of online preview tasks is 95.3%, the participation rate of classroom practice is 98.8%, the efficiency rate of group collaboration and mutual evaluation is 94.2%, and the iterative optimization rate of after-school works is 97.6%. significantly improved, As shown in Figure 4.

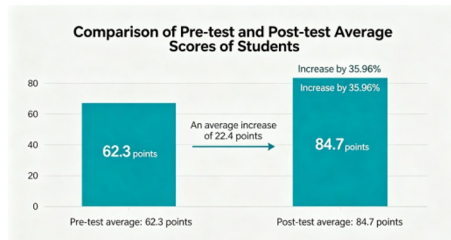


Fig. 2. Comparison of Problem Improvement before and after Teaching

Metrics	Values	Status
Online Pre-study Task Completion Rate	95.3%	Extremely High
Classroom Practical Operation Participation Rate	98.8%	Extremely High
Group Collaboration Peer Review Efficiency	94.2%	High
Post-class Work Iteration Optimization Rate	97.6%	Extremely High

Fig. 3. Learning Participation Data Statistics

Skill Dimension	Traditional Teaching	This Mode	Increase
 Animation Smoothness	55	88	+33
 Mask Blending	50	85	+35
 Lighting Atmosphere	48	82	+34
 Color Uniformity	52	86	+34
 Cultural Conception Conception Expression	40	79	+39

Fig. 4. Skill Dimension Score Improvement Comparison

5.3 Course Satisfaction and Student Feedback

The course satisfaction survey adopts a 5-point system. As shown in Table 2, the results show that the overall satisfaction is 4.67 (the rationality of teaching is 4.68 points, the practicality and fun of cases are 4.75 points, the effect of digital technology integration is 4.62 points, the adequacy of practical guidance is 4.59 points, and the overall harvest and recommendation are 4.71 points). Statistics show that 92.1% of students believe that this is significantly better than lecture-based teaching, 94.6% of students believe that digital technology tools significantly improve creative efficiency, and 89.5% of students believe that the combination of complete work output and cultural themes enhances their sense of learning achievement. Student interviews show that the Mid-Autumn Festival theme case has clear goals, complete experience, and a strong sense of atmosphere. The BOPPPS process makes the learning path clear and difficult breakthroughs efficient. Group collaboration is closer to the real work of the industry, and the teaching of technology, art, and culture is more in line with digital content. Creative learning rules.

Table 2. Course Satisfaction Evaluation Results

Evaluation Dimension	Core Data	Evaluation Level
Overall Satisfaction	4.67 / 5.00	★★★★★ Extremely High
Superior to Traditional Teaching	92.1% Student Recognition	★★★★★ Overwhelming
Technical Efficiency Improvement	94.6% Student Recognition	★★★★★ Highest
Cultural Enhancement of Achievement	89.5% Student Recognition	★★★★ Extremely High
BOPPPS Path Clarity	High-Frequency Interview Keywords	☒ Clear
Industry Fit of Group Collaboration	High-Frequency Interview Keywords	☒ High
Integration of Technology, Art and Culture	High-Frequency Interview Keywords	☒ Compliant with Rules

5.4 Existing Problems and Optimization Strategies

The study also found problems in teaching, including large differences in students' software foundations, uneven division of labor in some groups, insufficient refinement of works due to limited classroom time, and the depth of cultural and creative expression needs to be improved. In response to the above problems, optimization strategies such as hierarchical task design, group role fixation and contribution evaluation, 24-hour opening of cloud laboratories, introduction of industry reviews, and cultural and creative inspiration links are proposed to further improve teaching effects and personnel training.

6 Conclusion

Studies have shown that deeply integrating the BOPPPS teaching model with case-based teaching and digital technology, and using the production of Mid-Autumn Festival titles as a practical carrier, can effectively improve the teaching of the course "Digital Synthesis and Special Effects Technology", and significantly enhance students' special effects synthesis skills, artistic aesthetics, Awareness of creative creation and cultural inheritance. The structure is clear, highly operable, and the results are measurable. It realizes the unity of knowledge imparting, ability training, and value shaping. It is suitable for similar courses such as film and television post-production, short video packaging, and integrated media design, and has outstanding promotion value. In the future, it can further integrate cutting-edge technologies such as AI generation and real-time rendering, expand creative themes such as national style culture, deepen the integration of production and education, improve the adaptability of talent training to the needs of the digital content industry, and provide support for the cultural digitalization strategy.

Acknowledgment

The first batch of school-level teaching and teaching reform projects in 2025: BOPPPS-based "case-based, dual-integration" hybrid teaching research--Taking the course "Digital Synthesis and Special Effects Technology" as an example. 2025XJG015

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