An Exploration of Blended Learning: Integrating Small Private Online Courses with Project-Based Learning

Taking the "Virtual Studio Technology" Course as an Example

Kai Du

School of Education, Jianghan University, Wuhan, China

dukai@jhun.edu.cn

Abstract. This study investigates the integration of Small Private Online Courses (SPOC) with Project-Based Learning (PBL) within the "Virtual Studio Technology" course. A blended learning model was proposed and evaluated through a practical teaching experiment subsequently.

Keywords: SPOC; PBL; Blended Learning Model; Course.

1 Introduction

The fast development of film technology and the rise of virtual production introduce many new challenges to education.

For instance, the focus of film and television teaching activities is imbalanced currently, with an excessive emphasis on practical demonstrations by instructors. This conventional "teacher demonstrates student learns" approach is now inadequate in an educational environment that prioritizes innovation and active learning. It occupies a considerable portion of class time without significantly improving students' initiative and creative thinking. evolution of the industry necessitates that film and television students not only acquire traditional production skills but also develop a comprehensive understanding of 3D virtual model development. This, in turn, elevates the requirements for expertise and diversity within the teaching faculty. The high costs associated with professional equipment restrict the modernization and expansion of school facilities. This limitation results in a shortage of adequate practical experiences for students, directly impacting the quality of education and the development of their hands-on skills. The existing disconnect between theoretical knowledge and practical application in film and television production courses is an urgent issue. This gap not only leads to the inefficient use of educational resources but also dampens students' enthusiasm for learning, ultimately yielding teaching outcomes that do not align with the desired standards.[1] Accordingly, it is imperative to revamp traditional teaching methodologies to align with emerging industry trends and to nurture a new generation of film and television professionals who can satisfy the demands of the modern era.[2]

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To tackle these issues, we've implemented a blended learning approach in our virtual studio tech courses, leveraging online resources to encourage self-directed learning and reduce reliance on lengthy teacher demonstrations. Our interdisciplinary faculty includes experts from both film production and 3D tech, ensuring a well-rounded education. We've also introduced foundational courses to lay a solid base of knowledge. In practice, we use a project-based, collaborative model that allows all students to operate equipment and develop teamwork and individual skills.

2 Characteristics of the "Virtual Studio Technology" Course

The Virtual Studio Technology course encompasses a variety of signal processing principles, including camera parameter synchronization, management of multiple signal groups, and the integration of live-action with virtual scenes. Initially, these concepts can seem abstract and challenging to students.[3] As the course progresses, it introduces virtual game engines, such as Unity, and various tool plugins for creating virtual environments, including on-site VR and AR scanning. This integration seamlessly aligns with the gradual advancement in technological applications. In light of the rapid evolution of equipment and production methodologies, integrating cutting-edge technological trends into the educational curriculum is essential. [4]

In traditional teaching models, the lecture-style approach, where teachers predominantly instruct and students passively absorb information, is prevalent. This method restricts students' intellectual growth and their ability to gain a comprehensive understanding of interdisciplinary technologies. Consequently, it leads to a deficiency in the practical application of technology for future advancements.[5] To transform this scenario, the course team embraces a student-centered educational philosophy, prioritizing a teaching approach that encourages problem identification and solution exploration. They have developed a blended learning model, leveraging Special Private Online Courses (SPOC), and have adopted Project-Based Learning (PBL) as the core methodology.[6] In this model, students lead the classroom, with teachers offering guidance and support. For the virtual studio tech course, faculty upload multidisciplinary materials and tutorials to the online platform to build the course framework and direct students to review key points pre-class. The platform also facilitates Q&A and interaction with the teaching team. Afterward, teachers organize students into groups and assign project tasks to foster robust communication and discussion among and between groups. Before engaging in offline experimental teaching activities, students are encouraged to interact deeply with the teaching team. They use brainstorming sessions to ignite students' creative thinking, prompting them to generate and discuss innovative concepts and enhance their initiative and creativity.

Moreover, teachers elucidate the video production process with detailed demonstration lessons and design specialized exercises. This approach enables students to adeptly utilize various tools for practical tasks, tailored to their specific needs. To evaluate the efficacy of the micro-lesson model, teachers devise challenges that require student teams to autonomously tackle fundamental assignments, such as filming practice and

virtual environment development. They share and compare outcomes through group presentations to solidify and deepen their educational gains.

With this task-driven, output-oriented learning approach, the course can facilitate the reconstruction and assimilation of knowledge and develop students' comprehensive skill sets.

3 Design of a Blended Learning Model Integrating SPOC and PBL on the Course

The "Virtual Studio Technology" course is crafted around a student-centered approach that prioritizes the simultaneous development of practical skills and innovative thinking. It is grounded in Kolb's experiential learning theory, which conceptualizes learning as a cyclical process that encompasses hands-on practice, introspective reflection, and the seamless integration of knowledge and action.[7] The "SPOC+PBL" blended learning model effectively utilizes online platforms to incorporate Project-Based Learning (PBL) methodologies within the Special Private Online Course (SPOC) framework. Goodyear emphasizes that genuine blended learning represents a fusion of instructional and tutorial strategies within a "student-centered" learning environment, rather than merely melding traditional face-to-face instruction with online teaching modalities. [8]

The course implementation unfolds in three phases—pre-class, in-class, and post-class—via online mentorship, offline presentations, and interactive summarization. In the pre-class phase, comprehensive course materials are accessible via the SPOC platform, including learning objectives, focal points, challenges, courseware, video lectures, and supplementary resources. Concurrently, project task books and discussion prompts related to the course material are introduced, along with minor assignments to gauge self-study effectiveness. Students are prompted to manage their time efficiently, independently acquire theoretical knowledge, and proactively organize teams and project plans as per the task book.

In the in-class phase, students can take the lead in learning, and internalizing knowledge by advancing projects. Groups are formed based on professional ratios, mixing film and television with computer students. Using problem-oriented learning (PBL), they absorb course material and design and execute projects.[9] During group work, in-depth discussions foster interdisciplinary collaboration. Projects are group-led, with presentations followed by peer evaluations. Teachers and students critique these presentations, addressing shared challenges and clarifying concepts to deepen comprehension. Class ends with quizzes on the SPOC platform, guiding personalized teacher feedback. Post-class, teachers showcase top projects on the SPOC platform for review and reflection. Set discussion topics to probe common themes, steering students toward inquiry-based learning and improving outcomes through interactive communication. Sometimes, blended learning takes more time than offline learning, but the cost is also worth it in order to achieve better learning outcomes.[10]

As shown in Figure 1, the implementation process of the SPOC and PBL model embraces a student-centered pedagogical approach and leverages online SPOC re-

sources offering interdisciplinary content. Students establish project teams in accordance with a professional ratio, comprising two members from the film and television program and two from the computer science program, forming a quartet. This structure is designed to facilitate interactive learning through collaboration, communication, discussion, presentation, and task delegation.

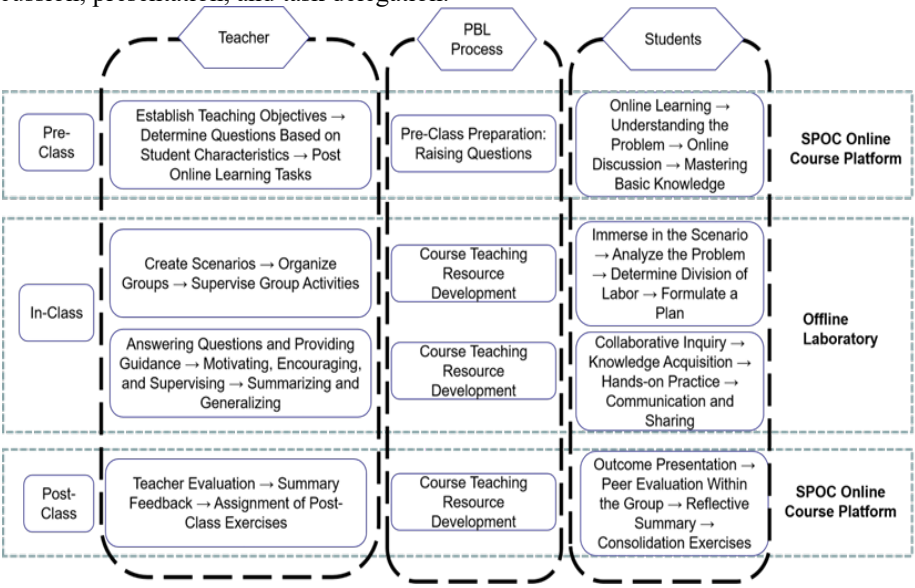

Fig. 1. Learning Process of the Blended Learning Model.

Throughout the course, student learning teams have developed a virtual studio system covering over 30 comprehensive projects spanning nine categories. These categories cover aspects such as camera motion trajectories, signal processing, CG animation, scene library management, virtual 3D objects, lighting, audio processing, special effects editing, and rendering plugins. Projects like "Camera Signal and Composited Signal Collection," "Virtual Camera Position Trajectory," "Operation Panel Parameters," "Virtual Scene Library Management," "Blue Box Chroma Keying Level Parameters," and "Rendering Virtual Models" are crafted to align with the chapter content. They are rolled out sequentially, escalating from simple to complex, and are revised each semester to reflect student progress. For instance, the "Virtual Camera Position Trajectory" project's task book meticulously outlines the learning objectives, procedural steps, and assessment benchmarks, steering students from theoretical study to practical application. The project task book is depicted in Table 1.

Table 1. "Virtual Camera Position Trajectory" Project Task Book.

Teaching Components	Learning Tasks
Pre-Class	1) In the SPOC class, students learn through video tutorials to understand and master the operational procedures and screen logic, and complete the online pre-class test. 2) Utilize the Vision Magic system to set keyframes for the virtual camera crane shots. 3) Comprehend and reflect on the operational procedures within the course database. 4) Each group determines the movement methods and entry order of the virtual camera positions, organizes thoughts according to the script, and assigns tasks.
In-Class	1) Students work in groups to implement the setting of virtual camera motion trajectories. Each member of the group designs a motion scheme for the camera movement, and through practice, a unified scheme is determined through discussion within the group. 2) Inter-group communication and presentation. Two groups are randomly selected to share their ideas and clarify their characteristics. Other groups conduct cross-evaluations, organizing and exchanging thoughts on the trajectory of motion in the virtual model, virtual camera positions, lens angles, scene lighting, and motion keyframes. 3) Based on the students' reports, targeted guidance is provided to help students achieve knowledge reconstruction and deepening.
Post-Class	1) Complete the online test for this chapter. 2) Organize the project report and complete the flowchart design for the virtual camera trajectory content experiment. 3) Upload the completed report and flowchart design to the SPOC platform. 4) Students first conduct peer reviews, followed by teacher comments and specific grading.

The "Virtual Camera Position Trajectory" project follows a rigorous structure that encompasses the three distinct stages of pre-class preparation, in-class engagement, and post-class review. Each stage is defined by specific task objectives and supported by targeted assessment and feedback systems. This organized approach enables students to tailor their learning pace to suit their personal needs while allowing teachers to offer prompt, personalized guidance and encouragement based on the observation of student performance in both online and offline settings.

4 A Questionnaire Survey on the Teaching Experiments

After a teaching experiment, to assess the students' reception of the SPOC+PBL blended learning model and its effect on learning outcomes, we administered a post-course questionnaire survey. The 5-point Likert scale questionnaire aimed to gauge students' personal views on the teaching model comprehensively, including both positive and negative aspects. We received 54 valid responses, and Cronbach's alpha analysis revealed a high internal consistency with an alpha coefficient of 0.920, validating the data's reliability. As shown in Table 2.

Table 2. Reliability analysis of the questionnaire.

Cronbach's alpha reliability analysis

	Item	CITC	Deleted Alpha	Cronbach αcoefficient
1)	The hybrid teaching model effectively supports and guides my learning.	0.487	0.921	
2)	This hybrid learning method aligns well with my study routine.	0.61	0.916	
3)	I consistently stay focused in hybrid learning scenarios.	0.721	0.912	
4)	Our team's collaborative abilities have been strengthened by the hybrid model.	0.689	0.913	
5)	We have received adequate technical support in hybrid learning environments.	0.574	0.917	
6)	I find the hybrid model to be more beneficial than conventional teaching.	0.804	0.909	
7)	I frequently get inspired and assisted by peers from different groups.	0.566	0.919	
8)	Motivated by other teams, our group actively meets challenges and completes tasks.	0.748	0.911	
9)	Hybrid teaching fosters interdisciplinary knowledge exploration within our team.	0.572	0.917	
10)	Engaging in cross-disciplinary problem-solving in hybrid courses has enhanced my subject comprehension.	0.651	0.915	
11)	Implementing hybrid teaching has boosted my study productivity.	0.775	0.911	0.92

12)	Hands-on activities in hybrid learning have significantly improved my educational experience.	0.627	0.915
13)	I am eager to engage in further hybrid teaching courses.	0.787	0.909
	Standardized Cronbach's α coefficient：0.923		

This questionnaire aims to assess the efficacy of the blended learning model in real-world applications by examining five key dimensions: interdisciplinary knowledge integration, promotion of project-based learning, enhancement of teamwork skills, learning satisfaction, and educational outcomes. It seeks to provide a holistic evaluation of student's learning experiences and achievements. Initially, fifteen questions were crafted on the Questionnaire Star platform. We then enlisted the feedback of three educators to assess the items' validity and engaged eight undergraduate students to test the questionnaire's readability. After a rigorous review and refinement process, 13 questions were retained, with five being selected for detailed analysis. Linear regression analysis was performed using SPSS software, yielding an F-value of 14.495 ($p<0.001$), which indicates that the model has strong explanatory power. Moreover, the D-W statistic of 2.140, being close to 2, implies no significant autocorrelation in the model's residuals. These analytical findings affirm the blended learning model's effectiveness and applicability within our curriculum as shown in Table 3.

Table 3. Linear Regression Analysis.

Linear Regression Analysis Results (n=54)							
	Unstandardized Coefficients		Standardized Coefficients	t	p	Collinearity Diagnosis	
	B	Standard Error	Beta			VIF	Tolerance
Constant	-0.14	0.203	-	-0.691	0.493	-	-
1. The hybrid teaching model effectively supports and guides my learning.	0.138	0.106	0.131	1.302	0.199	1.226	0.815
4. Our team's collaborative abilities have been strengthened by the hybrid model.	0.219	0.126	0.207	1.741	0.088	1.707	0.586
7. I frequently get inspired and assisted by peers from different groups.	0.033	0.097	0.038	0.34	0.735	1.503	0.665

9. Hybrid teaching fosters interdisciplinary knowledge exploration within our team.	0.062	0.131	0.054	0.476	0.636	1.578	0.634
11. Implementing hybrid teaching has boosted my study productivity.	0.671	0.149	0.535	4.508	0.000**	1.699	0.589
R 2	0.602						
Adjusted R 2	0.56						
F	F (5,48)=14.495, p=0.000						
D-W	2.14						
Dependent Variable: I am open to enrolling in similar blended learning courses should the opportunity arise.							
* p<0.05 ** p<0.01							

The application of the SPOC+PBL blended learning model in the course showed a marked improvement in academic performance compared to the 2018, 2019, and 2020 cohorts, which did not benefit from this approach. The 2021 class, after the introduction of blended learning, exhibited a notable normal distribution in their grades: the rate of excellent grades soared to 23.1%, good grades accounted for 66.3%, and the average and below scores constituted a mere 10.6%. This shift indicates that most students can effectively complete project tasks, engage in classroom interactions, and demonstrate a solid grasp of the course material, with an overall performance that surpasses those classes utilizing traditional teaching methods.

As the results showed, most respondents expressed a positive view towards the statement "blended learning can adapt to my study habits." Specifically, 60.78% strongly agreed, seeing the new teaching model as providing guidance and support for their academic endeavors. Additionally, 35.29% agreed, showing their endorsement of the blended learning model. When questioned about the impact of "blended learning experimental activities on my learning experience," most students praised the practical and experimental activities within the blended learning framework. Among them, 68.63% strongly agreed, and 27.45% agreed. A negligible number of students rated their learning experience with these activities as average, with a mere 3.92% selecting this option. Thus, we can conclude that practical and experimental activities within the blended learning model positively influence students' learning experiences.

Regarding the question "I am willing to participate in similar blended learning courses," participants demonstrated a strong interest and high willingness to engage. The data reveals that 66.67% strongly agreed and 27.78% agreed to participate, totaling an impressive 94.45%. This indicates that most participants hold a positive or very positive attitude towards blended learning courses.

In summary, the participants' keen interest and willingness to engage in blended learning courses represent a significant advantage for the promotion of such programs.

5 Conclusion

This study on the SPOC+PBL blended learning model yields several key findings: First, it effectively refocuses teaching activities on students, boosting their self-directed learning. The SPOC's online component allows for personalized, flexible knowledge acquisition. Second, the PBL model encourages students to apply theoretical knowledge to practical challenges, enhancing their understanding, practical skills, and teamwork. This interdisciplinary approach, particularly in film and television courses, significantly improves students' abilities in virtual 3D scene development, preparing them for industry advancements.

Despite these efforts, some areas require refinement. The teaching styles and technology use among the faculty are inconsistent, and course design and student mentorship are time-intensive, increasing the workload. Additionally, student engagement varies, with some students actively participating and others less so, potentially affecting overall teaching effectiveness. To address this, we must refine the teaching model, standardize teaching practices, enhance technology utilization, and motivate all students to engage. By doing so, we can enhance teaching outcomes.

In conclusion, the SPOC+PBL model offers substantial benefits for enhancing educational quality and student development, serving as a valuable reference for film and television education. We are committed to further refining this model to extend its benefits across more disciplines.

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