



Research on the Correlation between Formative and Summative Assessment in Blended Teaching Based on OBE: A Case Study of an E-commerce Course at LNNU

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Abstract

Current blended teaching evaluation faces persistent challenges, notably the overemphasis on summative results at the expense of process, a disconnect between instructional objectives and assessment, and superficial online interaction. To address these issues, this study adopts the theoretical framework of Outcome-Based Education (OBE) alongside the Community of Inquiry (CoI) model. Guided by the principle of “reverse design,” an integrated evaluation system was constructed, encompassing pre-class, in-class, and post-class formative assessments alongside summative evaluation. Drawing on a sample of 160 students enrolled in the “Introduction to E-commerce” course at LNNU, this research investigates the relationship between evaluation metrics and learning outcomes. A mixed-methods paradigm was applied, utilizing 16 weeks of multi-dimensional behavioral data and final grades. The findings indicate that: (1) both platform access frequency and offline collaboration participation are significantly and positively correlated with academic grades, revealing a high degree of isomorphism between online and offline engagement; (2) video viewing duration positively predicts academic performance, whereas the volume of forum posts exhibits only a weak correlation with grades, suggesting that online interactions largely remain at the social level and fail to translate into cognitive depth; (3) formative assessment correlates significantly with summative assessment, validating the supportive role of continuous process evaluation in achieving learning outcomes. Based on these findings, the study proposes strategies including strengthening OBE-driven reverse design, enhancing online cognitive presence, and deepening formative feedback, thereby offering empirical evidence and a practical paradigm for evaluating blended teaching quality.

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Keywords: Blended Teaching, OBE Concept, Teaching Evaluation, Process Evaluation, CoI Model

1. Introduction

Since the turn of the 21st century, information technology in education has transitioned from a peripheral content-display tool into a core driver of pedagogical transformation. Blended learning, which deeply integrates face-to-face instruction with online modalities, strikes a balance between the flexibility of digital platforms and the immersive experience of physical classrooms, making student-centered teaching models achievable. Yet, blended learning diverges fundamentally from traditional instruction in both philosophical underpinnings and organizational structures. As societal expectations for talent cultivation in higher education rise, conventional summative and rigid evaluation criteria fall short of meeting the demands of blended environments. Traditional assessments frequently fall into the trap of “valuing results over processes,” relying solely on final exams to measure knowledge retention while entirely neglecting students’ cognitive trajectories during online sessions and their problem-solving development in offline collaborations. Constructing a scientific, comprehensive, and dynamic evaluation index system for

blended learning has thus emerged as an urgent practical imperative. Outcome-Based Education (OBE), introduced by Spady and colleagues in 1981, prioritizes the learner and employs backward design focused on learning outcomes. The OBE philosophy mandates a clear visualization of expected learning outcomes before educational activities commence, organizing teaching and evaluation accordingly to highlight process assessment and continuous improvement. This approach offers a theoretical lens to resolve the aforementioned evaluation predicaments: it demands that the evaluation system remain tightly coupled with expected capability outputs, transforming each assessment node from a mere grading exercise into tangible evidence of skill attainment. Nevertheless, applying the OBE philosophy to blended teaching evaluation still encounters a “implementation gap.” Many systems, though branded as OBE-compliant, continue to design indicators that deviate from actual learning outcomes and fail to capture specific student behavioral data precisely within blended contexts. Consequently, this study adopts the OBE concept as its theoretical foundation, integrating the Community of Inquiry (CoI) model to construct a robust evaluation system for blended teaching. It empirically tests the correlation between individual evaluation indicators and learning outcomes. The research aims to address these core questions: Do the process evaluation indicators derived from OBE genuinely support the attainment of summative learning outcomes? To what extent do interactive online behaviors (such as forum posting and video consumption) substantially correlate with final academic performance? Answering these questions will provide a scientific basis for enhancing blended teaching quality.

2. Literature Review and Research Hypotheses

2.1. Theoretical evolution and pain points of blended teaching evaluation

Contemporary research into blended teaching evaluation is increasingly incorporating diverse conceptual frameworks. Notably, the Community of Inquiry (CoI) model proposed by Garrison (2007)^[2] and colleagues stands out. This model elucidates the interactive mechanisms among social, teaching, and cognitive presences in blended learning. Their practical inquiry model categorizes cognitive presence into four phases—triggering, exploration, integration, and resolution—establishing a theoretical basis for evaluating online cognitive processes. However, in evaluation practice, existing studies frequently conflate online behavioral data with actual cognitive engagement, overlooking the variance in cognitive depth behind those actions.

Regarding evaluation model innovation, Fengqing Li (2017) developed a whole-process evaluation index system based on outcome-oriented principles across “pre-class, in-class, and post-class” stages, confirming that process evaluation fosters higher-order thinking. Xuefeng Lei (2022)^[5] adopted a competence-oriented approach, verifying the value of process assessment in stimulating self-directed learning and cultivating scientific literacy. Recently, integrating the OBE concept with evaluation models has become a prevailing trend. Wan Peng et al. (2025)^[8] and Zhang Yang (2025)^[9] combined OBE with the CIPP model and the “input-process-output” dimensions, respectively, to construct systematic evaluation frameworks. Kam Cheong Li et al. (2023)

highlighted that blended teaching suffers from challenges in monitoring the learning process, questioning whether online interaction authentically translates into learning outcomes. Broadly speaking, current research reveals two significant gaps. First, the reverse design logic of OBE is awkwardly implemented within evaluation systems, often merely repackaging traditional indicators without clearly mapping the relationship between “behavioral indicators” and “capability outputs.” Second, empirical studies tend to focus on the reliability and validity testing of overall scales, lacking sufficient analysis of the micro-mechanisms between specific behavioral data (particularly online interactions) and final academic outcomes. Consequently, critical questions—such as the actual efficacy of forum posting and the utility of video viewing—remain largely in a “black box” state.

2.2. Proposing research hypotheses

Guided by the OBE concept, the ultimate output of blended learning extends beyond knowledge memorization to encompass knowledge application and team collaboration skills. Platform access and offline collaboration serve as essential behavioral pathways to realize these outputs. Fengqing Li’s (2017) research confirmed that learning initiative positively correlates with academic performance. Thus, the following is proposed:

H1: Platform access scores and participation in offline team collaborative learning are positively correlated with course grades.

In the online phase of blended learning, video viewing acts as a core mechanism for knowledge internalization; the time invested should positively predict academic performance. Concurrently, posting replies—an external manifestation of social and cognitive presence within the CoI model—theoretically facilitates meaning construction through peer interaction. Therefore:

H2: Video viewing duration is positively correlated with course grades; similarly, the number of posts submitted is positively correlated with course grades.

The OBE philosophy emphasizes that process evaluation dynamically monitors the achievement of learning outcomes, implying that process input should support summative output. Accordingly:

H3: Formative evaluation is significantly correlated with summative evaluation.

3. Research Design

3.1. Research subjects and curriculum context

This study takes the blended course “Introduction to E-commerce” at LNNU in Guangdong Province as its empirical focus. As a core foundational course for e-commerce and business administration majors, it features strong theoretical and practical interactivity. A total of 160 students from two natural classes (78 males, 82 females) were selected as the sample. Relying on the Chaoxing Fanya platform, the course ran in a blended mode for 16 weeks, utilizing an “online independent exploration + offline flipped classroom” format, culminating in a unified offline final exam. This course was selected because its competency objectives (e-commerce model analysis, team collaboration, and planning skills) align perfectly with the OBE concept, and its rich online interactive components facilitate the collection of multi-dimensional behavioral data.

3.2. Design of evaluation system based on the integration of OBE and CoI

Departing from the inertia of traditional indicator enumeration, this study strictly adheres to the OBE “reverse design” principle and incorporates the CoI model’s definition of cognitive processes to construct the evaluation system.

First, the expected course learning outcomes (CLOs) were defined: CLO1 (mastering core e-commerce theories and analyzing real-world business models), CLO2 (demonstrating team collaboration and project planning

skills), and CLO3 (exhibiting critical thinking and online inquiry skills).

Second, these CLOs were reverse-deconstructed into observable process and terminal evaluation indicators. For CLO3, online posting serves not merely as a participation metric but as a measurement window for the “exploration and integration” stages of cognitive presence within the community. For CLO2, offline team collaboration and peer evaluation become the core considerations. The resulting integrated system is shown in Table 1.

Table 1: An OBE and CoI Integrated Blended Teaching Quality Evaluation System

Evaluation Method	Evaluation Node	Course Learning Outcome	Evaluation Metric	Evaluation Content	Evaluation Subject
Process Evaluation	Pre-class Learning	CLO1, CLO3	Student Engagement	Number of Platform Logins	Teacher
			Video Duration	Course Video Total Duration	
			Number of posts	Number of Posts and Replies	
	Online learning test	Proficiency Level			
	In-class	CLO1, CLO3	In-class Performance	Answer Quality	
			Collaborative Output	Course Report Content	
After-class Learning	CLO2	Presentation Impact	Group Summary and Report on the Effectiveness	Student	
		Team Contribution	Course Report Participation		
Summative Evaluation	Final Evaluation	CLO1, CLO2	Final Course Report	Group and Self-Reflection	Teacher/ Student
			Course Examination	Offline Exam Scores	Teacher

3.3. Quantitative calculation method of grades

The learner’s final score comprises the course exam score (summative) and the regular performance score (formative). The specific formula is as follows:

Final overall score = Course exam score × 60% + Regular performance score × 40%

Regular performance = Online learning score × 30% + Offline learning score × 10%

Where: Online learning score = Platform access score (10%) + Video viewing duration score (10%) + Post reply score (10%)

Offline learning score = Team learning outcome evaluation score × Peer review coefficient

3.4. Data collection and analysis methods

A mixed-methods approach combining quantitative and qualitative techniques was employed. Quantitative data—including 16 weeks of process behavior logs and final exam scores—were automatically captured from the Chaoxing

Fanya platform backend and processed using SPSS 26.0. Cronbach’s α coefficient tested reliability, while KMO and Bartlett tests assessed construct validity. The Pearson correlation coefficient examined the relationships between evaluation indicators and learning outcomes.

To deeply explicate anomalous phenomena in the quantitative analysis (such as the lack of correlation between post volume and performance), the study concurrently extracted text data from the platform’s discussion forums. Coupled with Garrison’s cognitive presence coding scheme, a qualitative analysis of post content was conducted to uncover the underlying reasons for ineffective interaction.

4. Data Analysis and Results

4.1. Reliability and Validity Test

Five core variables—platform access score (I), video viewing duration (II), post-reply score (III), usual performance score (IV), and course examination score (V), were extracted for reliability and validity testing. Results are presented in Table 2.

Table 2: Reliability and Validity Test Results of the Evaluation System

Dimension	Measurement Metrics	Factor Loading	Cronbach’s α	KMO	Bartlett (Sig.)	Cumulative Variance Explained
Online Behavioral Engagement	I	0.855	0.861	0.834	0.000	17.354
	II	0.713				27.996
	III	0.698				38.178
Offline Collaboration Investment	IV	0.787	0.799	0.794	0.000	58.670
	V	0.802				65.477
Overall	-	-	0.873	-	-	-

Note. Sample size: N=160

The overall Cronbach’s α coefficient is 0.872, indicating high internal consistency reliability within the evaluation system. The KMO measure is 0.834, and Bartlett’s test of sphericity is significant at $p < 0.001$, confirming significant correlations among the variables and suitability for correlation and factor analysis. Further exploratory factor analysis reveals that the factor extraction results (with characteristic roots > 1) align largely with the two preset main dimensions of “online behavioral engagement” and “offline collaborative engagement,” with a cumulative variance explained rate of 68.4%. The system demonstrates robust construct validity.

4.2. Hypothesis testing results

Table 3: Correlation Among Platform Access Scores, Offline Grades, and Exam Scores

Variable	Platform Access Score	Offline Grades	Exam Scores
Platform Access Score	1	0.736**	0.452**
Offline Grades	0.736**	1	0.382**
Exam Scores	0.452**	0.382**	1

Note: Correlation is significant at the 0.01 level.**

(2) Correlation between video input, online interaction, and course grades

Table 4 reveals a moderate positive correlation between video viewing duration and course exam scores ($r = 0.516$,

(1) Correlation between learning engagement and course grades

As shown in Table 3, a moderate positive correlation exists between platform access scores and course exam scores ($r = 0.452$, $p < 0.01$), alongside a low positive correlation between offline learning performance and exam scores ($r = 0.382$, $p < 0.01$). Notably, the correlation between online access and offline collaboration performance is high ($r = 0.736$, $p < 0.01$). This elevated correlation suggests a substantial similarity in learning engagement across online and offline modalities. H1 is confirmed.

$p < 0.01$). Surprisingly, however, the correlation coefficient between the number of posts sent and exam scores is merely 0.182, failing to reach statistical significance ($p > 0.05$). Thus, H2 is only partially supported.

Table 4: Correlation Among Video Watch Time, Forum Activity, and Exam Scores

Variable	Video Watch Time	Forum Activity	Exam Scores
Video Watch Time	1	0.355**	0.516**
Forum Activity	0.355**	1	0.182
Exam Scores	0.516**	0.182	1

Note: Correlation is significant at the 0.01 level.**

(3) Correlation between formative and summative evaluation
As detailed in Table 5, a significant correlation ($r = 0.473$) emerges between regular performance (formative) and the

final overall score (including summative assessment) at the 0.01 level, highlighting a close logical link between process investment and terminal academic output. H3 is confirmed.

Table 5: Correlation Between Regular Performance Score and Final Course Grade

Variable	Regular Performance Score	Final Course Grade
Regular Performance Score	1	0.473**
Final Course Grade	0.473**	1

Note: Correlation is significant at the 0.01 level.**

5. Discussion

5.1. Holistic investment: Synchronous resonance between online and offline

This study confirms that both platform access frequency and offline team collaboration exert a significant positive predictive effect on academic performance. A more profound insight comes from the striking correlation coefficient of 0.736 between online access and offline collaboration, which shatters the previous assumption that online and offline function as separate silos. This evidence indicates that learning engagement in blended environments operates as a highly holistic construct. Students who frequently access online resources and actively prepare cognitively are more inclined to assume core roles in offline flipped classroom teams; conversely, those who are “invisible” online often emerge as “free-riders” during offline collaboration. Empirically, this echoes the OBE philosophy’s aspiration for “whole-group success”—it mandates simultaneous attention to engagement thresholds in both domains, as a deficit in either precipitates a collapse in overall learning efficacy.

5.2. The illusion of interaction: A qualitative examination of superficial social engagement and cognitive deficiency

The most theoretically and practically salient finding of this study is the decoupling between post volume and course grades ($r = 0.182$, non-significant). While this negates part of H2, it accurately exposes a critical flaw in current blended teaching evaluation: behavioral quantity does not equate to cognitive quality, and shallow interaction rarely transforms into deep cognitive output.

Why is “posting ineffective”? Drawing on community of inquiry theory and qualitative text analysis, this study identifies a prevailing “illusory prosperity” within online discussion forums. The overwhelming majority of posts are confined to “triggering events” and low-level “exploration” in Garrison’s model (e.g., “Professor, is the answer to this question A or B?” or “Can someone share the slides for Chapter 3?”). Peer replies are predominantly ritualistic or devoid of substance (e.g., “me too,” “bump”), severely lacking the higher-order cognitive presence required for “meaning integration” and “problem resolution.” In essence,

students achieve social presence online, but it seldom transitions into cognitive presence. This type of shallow interaction—triggering without integrating—may animate the forum’s data dashboard, yet it fails to promote knowledge internalization and transfer. This elucidates why prolific posters do not necessarily excel academically: their cognitive energy is dissipated on low-efficiency information seeking rather than deep critical thinking and conceptual reconstruction.

5.3. Process scaffolding: Shifting from “assessment of learning” to “assessment for learning”

The significant correlation ($r=0.382$) between formative and summative evaluation dismantles the traditional bias that “process scores are merely sentiment scores,” validating the feasibility of “assessment for learning” under the OBE framework. Process data no longer serves as a mere appendage to summative scores; rather, it acts as a dynamic scaffold for achieving learning outcomes. In blended teaching, continuous evaluation and feedback on video viewing and classroom collaboration fundamentally shape students’ cognitive trajectories, ensuring continuous alignment with expected outcomes. This substantiates that well-designed, whole-process evaluation can objectively and comprehensively reflect learning effectiveness.

6. Conclusion and Suggestions

6.1. Conclusion

Grounded in the integrated OBE and CoI framework, this study constructed and empirically tested a blended teaching quality evaluation system, yielding the following conclusions. First, learning engagement displays holistic characteristics across domains; both online platform access and offline team collaboration act as crucial cornerstones for academic success. Second, video viewing duration effectively predicts academic outcomes, whereas shallow online interactions—represented by reply counts—lack substantive driving force for performance, reflecting a severe deficit in cognitive presence within current online learning. Third, formative evaluation is closely linked to summative evaluation, indicating that scientific process assessment can function as an effective scaffold supporting the realization of final learning outcomes.

6.2. Suggestions

Based on these findings, the following strategies are proposed to elevate blended teaching quality:

(1) Strengthen OBE reverse design to achieve precise mapping between outcomes and evaluations

Blended teaching evaluation must transcend the simplistic amalgamation of online and offline forms or behaviors. Instead, evaluation tasks should be reverse-engineered based on expected capability outputs. To rectify the current flaw of “valuing traces over abilities,” instructors must embed cognitive challenges into evaluation indicators. For instance, team collaboration assessments should evaluate not only participation frequency but also the innovativeness and logical rigor of student viewpoints, ensuring every evaluation node authentically targets the attainment of higher-order core competencies.

(2) Enhance online cognitive presence to overcome the pitfalls of superficial interaction

In light of the “posting ineffectiveness” phenomenon identified here, educators must undergo a role

transformation—from forum “bystanders” to “guides of meaning construction.” Specifically: first, reshape topic design by discarding factual questions in favor of structured, controversial prompts lacking standard answers; second, elevate the threshold and quality of interaction by mandating that replies be substantiated by literature or data, strictly prohibiting meaningless spam; third, intensify teaching presence by regularly distilling and providing in-depth commentary on forum discussions, thereby pushing the discourse from an “information-sharing zone” into a “meaning-integration and problem-solving space” and amplifying the cognitive depth of interactions.

(3) Deepen formative evaluation feedback to leverage its continuous improvement function

The vitality of process evaluation lies in feedback and enhancement, not mere screening and grading. Blended teaching should fully exploit the platform’s data profiling capabilities to establish dynamic early warning mechanisms. When the system detects insufficient video engagement or superficial forum interaction, prompt feedback should be dispatched to both instructors and students. The fundamental purpose of process evaluation is to help students identify the gap between their current status and OBE goals, enabling strategy adjustment and actualizing the paradigm shift from “assessment of learning” to “assessment for learning.”

6.3. Research limitations and future prospects

This study possesses certain limitations. First, the sample was confined to e-commerce courses; the applicability of these conclusions to disciplines requiring rigorous logical deduction (e.g., STEM fields) warrants further testing. Second, although Pearson correlation analysis confirmed variable relationships, it cannot establish rigorous causal inferences. Finally, the qualitative analysis of post quality remains somewhat coarse. Future research should expand the sample scope, employ Structural Equation Modeling (SEM) to probe causal pathways among indicators, and introduce Natural Language Processing (NLP) technologies to conduct large-scale, deep mining of sentiment and cognition within online interactive texts, thereby illuminating the black-box mechanisms of blended learning with greater precision.

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