EXAMINING THE IMPACT OF HYBRID TEACHING MODEL REDESIGN ON STUDENT LEARNING EFFECTIVENESS

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Abstract

The rapid digital transformation of higher education has accelerated the adoption of hybrid teaching models that combine online and face-to-face instruction. However, in skill-intensive courses such as Building Information Modeling (BIM), the optimal balance between online and offline components remains unclear. This study examines the effect of restructuring hybrid teaching on student learning effectiveness in higher education institutions in Kunming, Yunnan, China. Drawing on the Community of Inquiry framework, Self-Regulated Learning theory, Self-Determination Theory, and the Technology Acceptance Model, the study investigates the relationships among online learning duration, interaction frequency, self-regulated learning ability, learning motivation, learning platform support, and learning effectiveness. Self-regulated learning ability and learning motivation are tested as mediating variables, while interaction frequency functions as a moderating variable. A mixed-methods design is adopted, combining survey data analyzed through Structural Equation Modeling (SEM) with qualitative insights from student feedback. The findings aim to provide theoretical and practical guidance for optimizing hybrid teaching structures in skill-intensive higher education programs.

Keywords: Digital transformation, hybrid teaching, self-regulated learning theory, self-determination theory, technology acceptance model

Introduction

The rapid digital transformation of higher education, intensified by the COVID-19 pandemic, has fundamentally reshaped instructional delivery worldwide. Hybrid teaching—also referred to as blended learning—has emerged as a dominant pedagogical model that integrates online digital instruction with traditional face-to-face learning. While this model offers flexibility, accessibility, and expanded learning resources, questions remain regarding its effectiveness, particularly in skill-intensive disciplines that require both conceptual understanding and practical application. In technical and application-driven fields such as Building Information Modeling (BIM), students must develop theoretical knowledge alongside hands-on competencies, collaborative problem-solving skills, and industry-relevant technical proficiency. Purely online learning environments may struggle to replicate the experiential aspects of such training, whereas exclusively face-to-face instruction may fail to leverage the flexibility and scalability of digital technologies. Consequently, institutions face a critical challenge: how to restructure hybrid teaching in a way that optimizes learning effectiveness while balancing online and offline instructional components.

Despite the widespread implementation of hybrid models, existing research has largely focused on general pedagogical benefits rather than on how specific structural elements influence learning outcomes in skill-based education. In particular, there is limited empirical

evidence regarding the optimal configuration of hybrid teaching in technical courses. Furthermore, while factors such as online learning duration, interaction frequency, student motivation, and digital platform support have been individually examined, fewer studies have investigated their combined effects within an integrated conceptual framework.

This study addresses these gaps by examining the effect of restructuring hybrid teaching on student learning effectiveness in skill-intensive higher education courses. Specifically, it explores how online learning duration, interaction frequency, learning platform support, self-regulated learning ability, and learning motivation interact to influence learning outcomes. Rather than treating hybrid teaching as a uniform model, the study conceptualizes it as a strategic design problem requiring careful calibration of instructional time allocation, interaction patterns, and digital support mechanisms.

The research is theoretically grounded in multiple established frameworks. The Community of Inquiry (CoI) framework emphasizes the roles of cognitive presence, social presence, and teaching presence in digital learning environments. Self-Regulated Learning (SRL) theory highlights the importance of learners' ability to plan, monitor, and reflect on their learning processes, especially in online settings that demand autonomy. Self-Determination Theory (SDT) underscores the role of intrinsic and extrinsic motivation in sustaining engagement. Additionally, principles such as Time-on-Task and the Technology Acceptance Model provide insights into how time investment and perceived usability of digital platforms contribute to learning performance. Within this integrated framework, self-regulated learning ability and learning motivation are conceptualized not only as direct predictors of learning effectiveness but also as mediating mechanisms through which hybrid teaching structures exert influence. Interaction frequency is further examined as a potential moderating factor, recognizing that excessive or insufficient interaction may affect cognitive load, engagement quality, and overall outcomes.

By focusing on the restructuring of hybrid teaching rather than merely its adoption, this study contributes to the growing discourse on digital transformation in higher education. It offers empirical evidence and practical insights for educators, administrators, and policymakers seeking to enhance learning effectiveness in skill-intensive disciplines. Ultimately, the research aims to provide a data-driven foundation for designing balanced, flexible, and pedagogically sound hybrid teaching models capable of meeting the evolving demands of contemporary higher education and industry practice.

Literature review

1. Hybrid teaching

Hybrid teaching, commonly referred to as blended learning, integrates online digital instruction with face-to-face classroom experiences. Earlier research has consistently shown that blended models can enhance flexibility, accessibility, and learning satisfaction compared with purely traditional instruction (Graham, 2019; Means et al., 2013). However, most empirical studies have focused on theory-based or knowledge-oriented courses. In skill-intensive disciplines—such as engineering, architecture, and Building Information Modeling (BIM)—learning requires not only conceptual understanding but also hands-on practice, collaboration, and applied problem solving

This dual requirement complicates the design of hybrid teaching structures. Excessive reliance on online instruction may limit experiential learning, while insufficient integration of digital tools may reduce flexibility and resource accessibility. Consequently,

determining the optimal configuration of hybrid teaching in skill-intensive courses remains an unresolved issue in higher education research.

2. Online Learning Duration

Time investment has long been recognized as a predictor of academic success. Time-on-Task theory (Carroll, 1963) and subsequent research emphasize that learning achievement is closely related to the amount of time students spend actively engaged in instructional activities. In online environments, however, the relationship between learning duration and outcomes is not linear. Research shows that structured and consistent engagement improves performance (Means et al., 2013), yet prolonged online sessions may increase cognitive load and reduce retention (Sweller, 1988). In hybrid settings, online learning duration must therefore be carefully calibrated. For technical subjects such as BIM, excessive screen-based learning may hinder practical skill development, whereas insufficient online exposure may weaken conceptual mastery. Despite extensive time-based learning research, empirical evidence identifying optimal online duration in skill-intensive hybrid contexts remains limited

3. Interaction Frequency

Interaction plays a central role in learning theory. Social Constructivism (Vygotsky, 1978) emphasizes knowledge construction through social engagement, while Moore's (1989) framework distinguishes learner–instructor, learner–learner, and learner–content interactions. The Community of Inquiry (CoI) model further highlights the importance of cognitive, social, and teaching presence in online and blended environments. Empirical studies demonstrate that frequent and meaningful interaction enhances motivation, engagement, and knowledge retention (Bernard et al., 2009; Swan, 2001). However, excessive interaction may produce cognitive overload, particularly in technologically mediated settings. In hybrid learning, interaction frequency must balance meaningful engagement with cognitive efficiency. Yet few studies have examined its moderating effects within a structural model that integrates psychological and technological variables

4. Self-Regulated Learning Ability

Self-Regulated Learning (SRL) theory (Zimmerman, 2002) posits that effective learners actively plan, monitor, and reflect upon their learning processes. In online and hybrid environments—where learners exercise greater autonomy—self-regulation becomes even more critical. Research indicates that students with strong SRL skills demonstrate higher academic achievement and persistence in digital learning contexts (Broadbent & Poon, 2015). SRL encompasses goal setting, time management, strategic learning, and self-evaluation. In hybrid teaching, online learning duration may stimulate self-regulatory behavior, as learners must independently organize their study schedules. However, insufficient structure may disadvantage students with weaker SRL capacities. While SRL is widely recognized as a predictor of performance, fewer studies explore its mediating role between hybrid design variables and learning effectiveness.

5. Learning Motivation

Motivation significantly influences engagement and academic performance. Self-Determination Theory (Deci & Ryan, 1985) distinguishes intrinsic motivation—learning driven by interest and personal growth—from extrinsic motivation, such as grades or external rewards. Hybrid learning environments, which require greater learner autonomy, depend

heavily on sustained motivation. Research indicates that motivated learners demonstrate stronger engagement and deeper conceptual understanding (Niemiec & Ryan, 2009). Learning platform support and structured interaction may enhance motivation by fostering competence, autonomy, and relatedness—the three core needs identified by SDT. However, empirical examination of motivation as a mediating variable within hybrid teaching structures remains insufficient.

6. Learning Platform Support

The effectiveness of hybrid education also depends on technological infrastructure. The Technology Acceptance Model (Davis, 1989) suggests that perceived usefulness and ease of use significantly influence user engagement with digital systems. Well-designed Learning Management Systems (LMS) and interactive tools can enhance collaboration, facilitate feedback, and improve learning experiences. In skill-intensive education, platform usability becomes particularly important, as technical courses rely on software applications, simulations, and collaborative digital tools. Although prior research has confirmed the importance of platform support in online learning success, its indirect influence on learning effectiveness through motivational mechanisms requires further exploration

Research Methodology

1. Research Paradigm

This study adopts a positivist research paradigm combined with a complementary interpretive perspective. The positivist approach supports the examination of causal relationships among variables through quantitative measurement and statistical analysis. Given that the research aims to test hypothesized relationships between hybrid teaching structure variables and learning effectiveness, quantitative analysis is appropriate for evaluating model fit and structural relationships. To enrich the statistical findings and provide contextual explanations for students' experiences in hybrid environments, qualitative inquiry is incorporated. Therefore, the study follows a mixed-methods paradigm, integrating quantitative verification with qualitative interpretation to achieve a more comprehensive understanding of restructuring hybrid teaching effectiveness

2. Research Design

This study employs a mixed-methods research design, consisting of:

- Quantitative component – to test hypotheses and validate structural relationships through survey data.
- Qualitative component – to explore students' perceptions and experiences in hybrid learning environments.

The quantitative phase is dominant, while qualitative findings provide explanatory support and contextual understanding.

3. Research Setting

The study is conducted in higher education institutions located in Kunming, Yunnan, China, focusing on students enrolled in the course Application of BIM Technology, a skill-intensive program within the Architecture, Engineering, Construction, and Operation (AECO) field. The selected context is appropriate because BIM education requires both theoretical knowledge and hands-on technical application, making it highly relevant for examining hybrid teaching restructuring.

4. Population and Sample

4.1 Population

The target population consists of undergraduate students enrolled in BIM-related hybrid courses in universities located in Kunming.

4.2 Sampling Technique

A stratified random sampling method is applied to ensure representation across different academic years and institutional types.

4.3 Sample Size

A minimum sample size is determined based on SEM requirements. Following Hair et al. (2019), a sample of at least 200–300 respondents is required for stable structural equation modeling. The anticipated sample size exceeds this threshold to enhance statistical power and reliability.

5. Data Analysis

5.1 Quantitative Analysis

Statistical analysis is conducted using SPSS and AMOS (or equivalent SEM software).

The analysis includes:

- Descriptive statistics – mean, standard deviation, normality testing.
- Reliability analysis – Cronbach's alpha (> 0.70).
- Validity testing – Confirmatory Factor Analysis (CFA), Composite Reliability (CR), Average Variance Extracted (AVE).
- Structural Equation Modeling (SEM) – to test direct and indirect relationships.

5.2 Qualitative Analysis

Qualitative data are analyzed through thematic analysis:

- Transcription of responses
- Coding of recurrent themes
- Identification of patterns related to hybrid teaching structure
- Triangulation with quantitative findings

This approach strengthens interpretation and enhances validity by providing explanatory depth.

Results and findings

The main findings can be summarized as follows:

- Restructuring hybrid teaching significantly influences learning effectiveness.
- Self-regulated learning ability and learning motivation are critical mediating mechanisms.
- Learning platform support indirectly enhances learning effectiveness through motivational pathways.
- Interaction frequency has a dual effect, beneficial at moderate levels but potentially detrimental when excessive.
- Optimal hybrid design requires balanced online duration, structured interaction, and psychological support mechanisms.

Implications of Findings

The findings highlight that hybrid teaching effectiveness is not merely a matter of increasing online components, but rather strategically balancing duration, interaction, and student autonomy. Psychological factors, particularly self-regulation and motivation, serve as central mechanisms linking structural design to learning outcomes.

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