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Evolution, Technological Empowerment and Ecological Optimisation of Blended Teaching in College English

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Abstract. This article reviews recent empirical and theoretical research, systematically examines the evolution of models, technological integration, and effect validation, and critically analyses their limitations from an ecological perspective. It sorts out three progressive developmental stages of college English blended teaching research, ranging from simple structural online-offline blending, specific disciplinary technical fusion to AI-driven educational ecological reconstruction, and combines theoretical frameworks adopted in relevant literature. After reviewing the studies and reviews, the paper found that the research field is moving towards interdisciplinary and technological integration. The paper uses constructivism, data-driven learning, and ecological models to frame the blended teaching mode. The blended teaching model integrates technology with traditional offline teaching, including corpus-based data-driven learning tools, intelligent learning platforms and adaptive AI teaching systems. Likewise, empirical data from controlled experiments consistently prove that such integrated teaching designs significantly lift learners' comprehensive linguistic performance, cross-cultural awareness and autonomous inquiry ability. This has positive effects on students' learning outcomes, learning initiatives and innovative competence, etc. Though the overall results are positive, technological determinism, cross-cultural disparities, and methodological limitations can still be discovered. To break through the existing theoretical problems and experimental evidence bottlenecks identified in the literature review, three targeted improvement paths are put forward: The development of teacher ecological support, more application of vertical validation in the research projects, and updates to disciplinary theories are the directions for future research and studies.

Keywords: Blended teaching, College English, AI in education, Teaching Effectiveness

1. Introduction

Against the background of the "Internet +" era, the 14th Five-Year Plan for Education Development advocates developing "Internet + Education" [1]. Pure offline college English teaching can no longer satisfy students' learning requirements. However, pure online learning also has some demerits. Blended teaching has evolved into a regular teaching mode, from structural blending to in-depth disciplinary integration. Although existing literature has carried out sufficient analysis, empirical tests, and practical exploration on college English blended teaching, there are still defects in theory,

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teacher practice, and empirical evidence. This paper mainly discusses four points: how teaching models develop from simple mixing to subject-oriented integration; how data-driven learning and AI change the relationship between technology and teaching as well as their defects; empirical evidence of teaching effects; and obstacles restricting assessment reform. First and foremost, most existing studies focus on platform functions and student learning outcomes, lacking consideration of teachers' self-cognitive transformations and adaptive pedagogical practices in the process of technology integration. This may lead to the fact that teachers will be viewed as a "black box" of technology application, merely evaluating the application of the tool, while teachers' role transformation and the underlying logic of curriculum reconstruction are overlooked. This gives rise to the risk of "technology addition" [2], where various digital tools are mechanically applied without meeting pedagogical demands. Besides, though data-driven learning and AI furnish a blended teaching model for more in-depth disciplinary integration, giving rise to students' learning outcomes and initiatives, there are limitations such as the high demands of digital literacy and the reduction of the activeness of the teachers' role. The literature search for this review covers publications issued from 2021 to 2026. The paper first outlines theoretical frameworks, including blended teaching, constructivism, data-driven learning, and the ecological model. Then, it thematically reviews recent literature with embedded gap analysis of Instructional model design, technology integration, and empirical effects and assessment innovation, and synthesises findings into systemic limitations, therefore eventually formulating conclusions.

2. Theoretical framework

2.1. Constructivism and active learning

Constructivism holds that knowledge comes from two-way interaction between learners and their learning environment. The active constructive view of learning consists of four core elements: meaning construction, context, collaboration, and dialogue. According to Liang, learners actively construct knowledge based on their prior knowledge and experiences in a certain social context related to their current learning, and collaborative dialogue is present throughout the learning [3]. This view provides a solid theoretical foundation for the "Online + Offline" Mixed English Teaching Strategy: In the pre-class online stage, the teacher selects online tasks relevant to the learning targets of the lesson, so that students are able to focus their attention on classroom learning with clear targets and learn independently, fulfilling individual meaning construction. In the classroom teaching stage, Offline classroom sessions adopt thematic scenarios and multiple activities through dialogue to put the context and collaboration into practice. After class, teachers provide personalised exercises and keep continuous communication with students [3]. Such a three-stage arrangement helps realise the core idea of constructivist learning.

2.2. Data-driven learning

Proposed by Tim Johns, data-driven Learning (DDL) is a foreign language learning and teaching method based on corpus data. In the past, corpora were used as a research tool for linguistic researchers, but this theory turns it into a daily learning medium. DDL serves as core theoretical support for blended teaching modes. With corpus resources, students observe and sum up language rules and become active researchers [4]. Guided by the Corpus-Based DDL Online and Offline Blended Teaching Model (CBM), students independently explore language knowledge via AntConc and Sketch Engine in the cycle of pre-class, in-class, and post-class, but not merely in a traditional

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online-offline blended teaching procedure. This provides a solid theoretical basis for deep integration between blended modes and college English reading pedagogy [4].

2.3. From TPACK to ecological model

The Technological Pedagogical Content Knowledge (TPACK) framework consists of three fundamental components: technology, pedagogy, and subject content knowledge. But it fails to clearly reflect the mechanisms of connection between different areas, especially the impacts of curriculum restructuring on teachers' identity transformation and the impact of environmental factors on technology [2]. As a complement to TPACK, ecological systems theory (Bronfenbrenner, 1979, as cited in [2]) regards teacher development as located inside multi-layered nested environmental systems: microsystems (classrooms), mesosystems (professional communities), exosystems (institutional policies), and macrosystems (cultural values). TPACK originates from teachers' internal cognition, and delineates the individual knowledge constitution required to implement technology-integrated instruction. By contrast, the ecological systems theory transcends the scope of individual cognition. From the perspective of interactions within multi-layered nested environments, it interprets the generative process of teachers' instructional practices and professional development. TPACK addresses what knowledge competent teachers ought to possess, whereas the ecological systems theory answers under what environmental conditions teachers can develop and sustain technology-integrated teaching practices. However, this theory lacks the technological dimension of the ecology; technology cannot be viewed as a neutral external tool any longer. It is a structural component of the educational ecosystem. It actively governs what pedagogical approaches can be realised, remaps the boundaries of classrooms, and deeply influences the way that teachers develop their professional digital identities [5].

3. Instructional model, technology integration and empirical evidence of blended college-English teaching

3.1. Instructional model design: from structural blending to in-depth disciplinary integration

Early structural-oriented blended college English teaching arranges online and offline activities in a fixed order. Hu [1] put forward a teaching workflow of "online learning + offline class + online consolidation + assessment. It arranges pre-class online autonomous learning, in-class knowledge internalisation, after-class online consolidation, and a double evaluation system in an orderly manner, so as to address the temporal and spatial limitations in traditional offline teaching. Yu & Wang [6] further proposed a multi-dimensional teaching framework. It brings micro-lectures, MOOCs and live streaming into traditional teaching to enrich teaching forms and broaden learning space. In-depth disciplinary integration moves beyond structural blending, embedding discipline-specific tools directly into instructional workflows. For instance, the comprehensive English course at Beijing Foreign Studies University, demonstrates how U-campus and Blackboard platforms create an integrated pre-class, in-class, and post-class ecosystem, where learning analytics data can be fed back directly to classroom teaching, enabling teachers to diagnose students' performance and adjust teaching priorities in real time [7]. Likewise, by integrating corpus-based DDL learning tools (Ant Word Profiler, AntConc, Sketch Engine, etc.) into the three-stage college English reading course, students are transformed from passive recipients to active researchers, who are able to observe, analyse, and summarise linguistic patterns based on a corpus [4].

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Despite this progress, three obvious limitations restrict practice and theoretical development. First, most existing blended teaching models heavily depend on certain specific platforms. The blended teaching model constructed by Hu [1] leans on Xuexitong, WeChat, or QQ platforms, while the design in Song [7] rests on campus-specific learning platforms, U-campus and Blackboard. Besides, the Corpus-Based DDL Online and Offline Blended Teaching Model (CBM) advanced by Liang et al. [4] imposes high requirements on the digital literacy of teachers and students, for it demands command of complicated tools including AntWord Profiler, AntConc and Sketch Engine. Nevertheless, current studies have not offered alternatives to lower these technical barriers, nor have they put forward scalable teacher training programs. What's more, these blended teaching model designs largely adopt general educational models such as constructivism and TPACK for structural validation, without developing discipline-specific mechanisms. Such mechanisms explain how blended modes facilitate incidental second language vocabulary acquisition, pragmatic competence, and cross-cultural communicative awareness. The existing theoretical gap is in the absence of a blended teaching theory, which needs to illustrate the unique effects of online-offline integration on second language learning.

3.2. Technology integration: from platform application to AI empowerment

By applying web mining technology on platforms, blended teaching in college English is promoted in the direction of data-driven personalised education. There are four main mining methods: path analysis, interest Association, cluster analysis and sequential pattern analysis [8]. Through these mining methods, the access behaviours of learners are tracked systematically, which includes access content, stay time, and frequency. The platform also builds personalised learning resources, creating an adaptive ecosystem to respond to the ever-changing demands of individual learners. As for the combination of AI and the platform, students have a satisfaction score of 4.87, corresponding to the highest level of satisfaction [9]. Another study showed that in a 24-week comparative experiment, the interactivity of the group using AI-based blended teaching improved more than the group using traditional teaching methods. Their average English score and learning initiative also improved, and they thought there was more teaching personalisation [10].

However, these studies have several research gaps. The study of Bian [8] depended on the current access data of learners. Therefore, low-motivation learners with minimal access behaviours could not be effectively monitored and are consequently overlooked. Moreover, the validation of this study focused on grammar patterns, oral English and other highly interactive skills were not covered in it. Xinli & Thepnuan [9] adopted a one-group pre-post test without control groups. Such a design cannot rule out interference such as the Hawthorne effect and maturation effect. Though research in Li [10] set up a control group, their study mainly focused on lower-level skills such as pronunciation accuracy, neglecting advanced objectives like pragmatic competence and critical thinking. Eventually, the three studies above all implicitly regard teachers as neutral operators or hidden implementers of the platforms, but not as active curriculum reconstructors. The connection between technological affordances and student learning outcomes may be mediated by teachers' behaviours, including reconstructing courses, negotiating professional identities and judging tools rationally, but this connection is not examined in the studies. Subjectivity of teachers is absent, teachers are not positioned as the critical curators of technological tools.

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3.3. Empirical effects and assessment innovation

Lots of empirical evidence shows blended teaching brings positive effects for college-English learning. An experiment found that the experimental group outperformed the control group in English test scores. Before the experiment, the average English score of the experimental class was 17.94, versus 16.15 for the control class. An independent samples t-test on post-test scores yielded $t = -3.027$, $p = .002 < .05$, revealing a significant gap [3]. In the corpus-based DDL blended experiment, students under CBM attained higher scores in the Torrance Test of Creative Thinking, which demonstrated the improvement of innovative thinking skills. In addition, the learning initiative of participants was also enhanced [4]. Innovation in assessment design transformed toward blended teaching models. In the double evaluation system, formative evaluation accounts for 40% of the overall grade, consisting of 20% for online learning records of students such as forum participation and online test scores, and another 20% for students' performance in offline teaching including group performance and presentation. The summative evaluation accounts for 60% through the final written examination [1]. A three-weight evaluation scheme at Beijing Foreign Studies University allocates 50% to daily performances, 20% to periodic quizzes, and 30% to the final exam [7]. The two assessments reflect a clear movement from one-off examinations to continuous multi-source evaluation, combining procedural digital behavioural traces with outcome-oriented academic indicators.

Although the findings are encouraging, both studies have methodological limitations, which constrain the reliability of the conclusions. First of all, neither Liang [3] nor Liang et al. [4] employed random assignment. Instead, intact classes were conveniently assigned to experimental or control groups, failing to eliminate selection bias. These studies are confined to short-term research designs. Liang [3] carried out a study lasting only one semester. Despite the fact that the research conducted by Liang et al. [4] lasted three semesters, it did not report its participant attrition rates. Additionally, affective and cognitive gains are measured predominantly by self-evaluations and questionnaires, without access to triangulation with objective behavioural traces, such as platform clickstreams, corpus search logs, and interactive timestamps. Hence, it remains unclear whether the observations stem from real learning or the result of the Hawthorne effect. These research gaps indicate that future studies should integrate learning analytics into blended teaching design in English education. The shift enables researchers to move beyond subjective results and turn to process-oriented evidence, so as to distinguish superficial engagement from substantial academic achievements.

4. Discussion & synthesis

4.1. The three-stage model of research evolution

Research on blended teaching for college English has undergone three evolutionary phases. The first stage centred on structural blending. Represented by Hu [1] and Yu & Wang [6], researchers established the fundamental "online-offline" framework. They rearranged pre-class, in-class, and after-class sessions in order to break the constraints of time and space. In the second stage, research advanced toward the integration of disciplinary and technological aspects. Liang et al. [4], Bian [8], and Song [7] constructed corpus-based DDL analysis, personalised web data mining, and platform-based formative assessment into discipline-specific teaching designs, earning routes can be optimized, and learner autonomy will be fostered. As for the ecological reconstruction stage, Sun & Zhang [2], Xinli & Thepnuan [9], and Li [10] reconceptualised blended teaching as an AI-

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empowered dynamic ecosystem. Their studies highlighted comprehensive capacity development of teachers, intelligent adaptation and human-computer collaboration, moving beyond superficial technology adoption and fragmented tool application.

4.2. Positive effect

Empirical studies consistently show that the blended teaching model has positive outcomes and effects in college English education. Constructivism-based blended teaching significantly improves students' English learning motivation and academic performance, as experimental groups outperform control groups in empirical tests [3]. Similarly, the corpus-driven blended teaching mode yielded higher overall evaluation scores than traditional instruction, and 98% of students thought their language competence was enhanced [4]. It further corroborates that blended teaching with AI empowerment promoted students' learning initiatives and academic scores more than traditional teaching [10]. The data from the post-test were higher than the data from the pre-test, and the high satisfaction of students, also demonstrated the effectiveness of the blended teaching designs [9].

4.3. Research gaps

In terms of theoretical construction, most existing research adopts general educational frameworks, including constructivism-based blended modes and ecological teaching models. Therefore, it fails to explain how language skills are acquired in blended contexts, ignoring the unique attributes, principles, learning goals, and content characteristics of an academic discipline. Regarding the integrating aspect, the role of the teacher is often treated as a backdrop in blended teaching, lacking subjectivity. Although existing ecological models focus on teacher development, they fail to build a mediation mechanism linking teacher behaviour and student learning outcomes. Furthermore, from the perspective of methodology, the current research outcomes draw on one-group pre-test and post-test designs [9]. A multi-center vertical randomised controlled trial (RCT) is needed, and objective learning analytic behavioural logs should be integrated [3, 4], so that triangulated subjective measures can be conducted.

4.4. Directions

To address the research gaps identified in existing blended teaching literature, future studies can be advanced through three interrelated and complementary research directions. Theoretically, it is essential to construct discipline-specific sub-theories of second language acquisition that adapt to blended learning scenarios, thereby elaborating how online and offline instructional contexts differently mediate the development of multiple linguistic sub-skills, including vocabulary knowledge, grammatical competence, and pragmatic awareness. Flexible curriculum management policies, tiered long-term TPACK-oriented training programmes, and regular offline and online teacher research communities can be established in this system. In addition, revised teaching evaluation criteria and sustainable operation mechanisms for digital learning platforms are also significant for creating a tangible and institutional ecosystem. These measures help break isolated, one-off technical skill training, realising the coordinated development of curriculum reconstruction, teacher professional identity transformation, classroom learning ecology and educational technology application. Practically, institutional support frameworks should transform fragmented technical training modes into integrated educational ecosystems to promote the coordinated evolution of curriculum design, teacher professional roles, learning environments, and educational technology.

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Researchers may take fine-grained learning behavioural analytics into consideration. For example, platform participation frequency, interactive discourse quality, and resource access trails can be combined in the research. Multidimensional linguistic proficiency measurements and teachers' continuous reflective data are essential to enhancing second language learning courses, as well as learners' affective indicators such as learning motivation, anxiety, and self-regulation. Such longitudinal designs can verify the long-term retention of students' language ability, tracking dynamic shifts in teachers' TPACK and professional identity, therefore comparing implementation effects across different institutional and student groups. Methodologically, sustained longitudinal investigations are required to combine fine-grained learning analytics data with academic achievement indicators, validate long-term learning retention, and establish cross-cultural and cross-institutional research databases.

5. Conclusion

By sorting out relevant literature from 2021 to 2026, this review clarifies the evolution of college English blended teaching, which has developed from simple online-offline structural combination to discipline-integrated and AI-empowered ecological teaching systems. Early models merely rearranged pre-class, in-class, and post-class activities across modalities, whereas contemporary approaches embed corpus-driven data analysis and intelligent adaptive tools directly into pedagogical workflows, transforming students from passive recipients into active researchers and enabling dynamic, personalised learning ecosystems. Technological integration has similarly progressed from basic web-based data tracking to sophisticated AI-powered adaptation. However, the reviewed studies consistently indicate that effectiveness depends on pedagogical design quality rather than technological sophistication alone. Exemplary teachers demonstrate selective adaptation and even deliberate abandonment of certain tools when they distract from learning goals, suggesting that mature blended instruction requires "subtractive competence", the discernment to resist technological fetishisation, rather than relentless addition of new platforms. Empirical evidence from controlled Chinese educational contexts largely supports positive outcomes in motivation, academic achievement, and creative thinking. Nevertheless, cross-cultural variations in digital infrastructure, pedagogical traditions, and institutional support systems imply that these findings cannot be unconditionally generalised across contexts. In short, the success of blended teaching does not depend on technological equipment, but on teachers' ability to integrate curriculum goals, professional development and educational resources into a complete ecological teaching system. Future research can move beyond isolated student outcome validation toward longitudinal investigations of the synergistic evolution among teachers, technologies, and curricula.

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