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A Deep Analysis of Learning Environment Systems of Flipping Classroom from the Perspective of Second Language Acquisition

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Abstract: *Guided by the core theories of Second Language Acquisition (SLA), this study systematically analyzes the unique characteristics and internal mechanisms of the learning environment systems constructed by the flipped classroom model for second language learners. The research review reveals that flipped classrooms optimize the quality of input through pre-class knowledge internalization, enhance output opportunities by relying on in-class interactive spaces, and create contextually authentic environments via technical tools. These practices align with classic theories concerning second language learning. However, obstacles including vague construction of physical environments, insufficient technical support, lack of guidance for peer interaction, and delayed transformation of teachers' roles significantly hinder the full release of its potential for environmental optimization. Therefore, it is necessary to rely on dynamic systems theory to systematically design and integrate physical space, intelligent tools, and sociocultural elements, thereby constructing a multi-dimensional interactive integrated language learning environment. This study provides a path reference for optimizing technology-empowered language teaching.*

Keywords—second language acquisition; flipped classroom; learning environment; collaborative dialogue

1. INTRODUCTION

In the contemporary context where globalization and informatization are deeply intertwined, enhancing second language proficiency (particularly in English) has become a critical dimension of talent development. Over several decades of development, theories of Second Language Acquisition (SLA) have evolved from a singular structuralist model to a more complex, dynamic, and interactive understanding of cognitive and sociocultural systems. Core theories—such as Krashen's (1985) Input Hypothesis, Swain's (1995) Output Hypothesis and its extension of Collaborative Dialogue, Long's (1994) Interactive Hypothesis, and Vygotsky's (1978) Sociocultural Theory and the Zone of Proximal Development—collectively outline a central principle: effective second language acquisition occurs within a supportive learning environment where learners are actively engaged, interact fully, and have access to high-quality opportunities for language input and output. However, traditional foreign language classrooms, centered on teacher-led knowledge transmission, are often constrained by time and space limitations. The "teacher-dominated lecturing" approach compresses students' opportunities for active language application, practice, and negotiation, exacerbating the contradiction between overemphasis on form-focused instruction and insufficient attention to meaning-focused communication.

In recent years, the rapid development of information technology and innovations in educational philosophy have given rise to the "Flipped Classroom" (FC) teaching model. Its core idea lies in shifting knowledge transmission to out-of-class settings while focusing on knowledge internalization and practice during class time (Bergmann & Sams, 2012). Specifically, within the context of second language teaching, this typically involves students engaging in autonomous pre-class learning through teacher-designed video materials, digital resources, etc., to achieve initial exposure to linguistic knowledge (e.g., grammar, vocabulary) and partial cognitive skills. Class time is then primarily dedicated to teacher-guided interactive activities, such as situational dialogues, project-based inquiry, problem-solving, peer review, in-depth discussions, and personalized teacher guidance (Flores et al., 2016). The flipped model aims to transform valuable class time from one-way knowledge transmission to facilitating language output, application, and negotiation of meaning.

Existing studies have preliminarily confirmed the potential of flipped classrooms in enhancing students' language learning motivation, classroom participation, autonomous learning abilities, and specific language skills (Kong et al., 2024; Lee & Wallace, 2018). However, most research focuses on macro-level evaluations of the flipped model's teaching processes, activity design, or implementation effects. There remains a lack of systematic, in-depth analysis of the "learning environment", which serves as the core carrier underpinning the achievement of SLA goals in flipped classrooms. An effective flipped classroom environment for foreign language learning is not merely a physical combination of pre-class self-study with in-class activities but a complex ecosystem dynamically constructed through the interplay and synergy of multiple dimensions, including physical space, technical support, task design, social interaction, emotional atmosphere, and teacher guidance methods (Evseeva & Solozhenko, 2015). How to create and provide conditions aligned with the laws of second language acquisition within technology-based systems urgently requires analysis from a specialized SLA perspective.

Therefore, this study is grounded in contemporary mainstream SLA theories and focuses on in-depth analysis of the learning environment constructed by the flipped classroom model. It aims to reveal the core components of the flipped classroom learning environment and their internal connections, as well as to elaborate how this environment meets and serves the core needs and key processes of second language acquisition through its unique operational mechanisms. By deconstructing and reconstructing the environment, this research seeks to provide a deeper theoretical basis for understanding the effectiveness of flipped classrooms in second language teaching, and to offer theoretical guidance and practical references for optimizing foreign language flipped classroom practices and constructing more effective "learner-centered" ecosystems for second language acquisition.

2. THEORETICAL FOUNDATIONS

2.1 Core Theoretical Perspective on SLA

Research in Second Language Acquisition (SLA) has undergone paradigm shifts, gradually forming a multi-dimensional theoretical framework that collectively explains how language competence develops in non-native environments. Early cognitive theories emphasize the central role of individual mental processing mechanisms. Krashen's (1985) Monitor Model proposes that "Comprehensible Input" is the primary driver of language acquisition, arguing that language development stems from learners' exposure to input slightly beyond their current proficiency level. Swain's (1995) Output Hypothesis critically supplements the one-way limitations of input, noting that language production can trigger "Noticing the Gap", prompting learners to engage in cognitive processing, reflection, and revision of linguistic forms. Long (1994) integrated these two perspectives to propose the Interaction Hypothesis, highlighting the core value of bidirectional negotiation of meaning. Specifically, communication-induced behaviors such as repetition, requests for clarification, and corrective adjustments due to comprehension difficulties can provide contextualized and targeted language feedback, thereby optimizing input quality and deepening cognitive processing (Long, 1994; Loewen & Sato, 2018). This cluster of cognitive theories collectively indicates that language acquisition efficiency depends not only on the "quantity" of input but, more importantly, on the quality of dynamic interaction between input and output in specific environments—a condition that traditional classrooms, with their limited interactive time, struggle to guarantee, yet which flipped classrooms can integrate through structured pre-class input and focused in-class interactive practice.

Complementing this is the sociocultural perspective, which, rooted in Vygotsky (1978)'s "social constructivism", views language learning as a socially mediated process of cognitive development. Its core concepts include "the mediating role of tools or signs in cognitive development" and the "Zone of Proximal Development (ZPD)"—referring to the potential ability level an individual can achieve through collaboration with teachers or peers (Lantolf & Thorne, 2006; Vygotsky, 1978). This theory posits that language competence is constructed through social dialogue and collaborative activities. Teachers or competent peers act as "mediators", providing temporary, learner-adapted support through scaffolding strategies to promote learners' awareness and autonomous internalization of linguistic functions and forms (Lantolf & Poehner, 2014). The sociocultural perspective emphasizes the ecological value of "interactive contexts" and "collaborative learning", whose principles align closely with the restructured "collaborative tasks", "group inquiry", and "teacher role transformation" in flipped classrooms. Essentially, the class time freed up by pre-class knowledge transfer in flipped classrooms expands, both physically and temporally, the "collaborative learning field" advocated by SLA theories, providing a crucial operational window for Vygotskian socially collaborative construction of language competence.

2.2 Dimensions of Learning Environment Systems from the SLA Perspective

As a key field influencing students' cognition, behavior, and emotional experience, the structural analysis of Learning Environment (LE) requires a constructive examination under specific disciplinary goals (Dai & Hu, 2025). From the perspective of Second Language Acquisition (SLA), an effective LE not only needs to provide physical space and technical support to ensure the continuous accessibility of language input but also needs to drive in-depth language processing through cognitive task design and social interaction frameworks (Lai et al, 2017). The physical-technical dimension serves as the fundamental carrier of contemporary learning environments, especially flipped classrooms: media such as online learning platforms and digital textbooks, whose design quality directly affects the accessibility and comprehensibility of pre-class language input—this is the premise for initiating "noticing" of linguistic forms (Szcześniak, 2024) and also reserves cognitive space for interactive practices in class (Abeysekera & Dawson, 2015). However, physical resources themselves are not the key to environmental effectiveness; their value in the environmental action chain always depends on the synergistic activation of task design and interaction dimensions (Elen et al., 2007)—that is, how technology serves the needs of input effectiveness and the connection of in-class output-oriented activities.

The in-depth demands of the SLA context on LE actually focus on the "Integrated Cognitive-Socio-Affective Dimensions" (Dörnyei, 2009). The cognitive-task dimension includes task complexity, cognitive demand, and metacognitive scaffolding, aiming to drive focus on form, output pushing, and meaning negotiation through design, such as problem-based tasks (PBL) and contextualized projects (Ellis, 2003). The social-interactional dimension encompasses teacher-student interaction, peer collaboration, and community presence (Garrison et al., 2000), which in flipped classrooms are manifested as structured group discussions,

role-plays, reflective peer reviews, and other activities, providing structural support for Vygotskian "collaborative construction" and Long's "interaction for meaning negotiation". The Affective Dimension, reflected in environmental safety, sense of belonging, and motivation incentives, directly affects Krashen (1985)'s "Affective Filter" and determines the absorbability of input (Dörnyei, 2009). Therefore, from the SLA perspective, the environmental effectiveness of flipped classrooms ultimately depends on whether these dimensions form a synergy through systematic design: the physical-technical platform enables controllable input, cognitive tasks guide the improvement of language awareness and output driving, the social interaction framework promotes the collaborative internalization of communicative competence, and the emotional atmosphere runs through the whole process to reduce learning obstacles and anxiety—multi-dimensional collaboration collectively points to a "learner-centered" efficient ecosystem for second language acquisition.

3. Support and Dilemmas of the Flipped Classroom Environment for Core Mechanisms of SLA

3.1 Input Optimization Mechanisms of Learning Environment Systems

The flipped classroom significantly enhances the diversity and controllability of the input environment, forming an important link in supporting basic language acquisition. The advantages of the flipped classroom learning environment are manifested in the following aspects: 1) Technology-empowered input personalization. Studies (e.g., Hwang et al., 2019) have shown that learners can repeatedly engage with language structures through pre-class materials such as short videos, corpora, or texts with interactive annotations, and autonomously adjust the pace of input according to their current proficiency level. This not only effectively reduces cognitive load and emotional anxiety but also achieves precise matching of input, laying a solid foundation for subsequent interactive output. 2) Repetitive processing enhancing implicit learning. Experimental verification based on multimedia theory (Castro-Alonso et al., 2021) indicates that functions such as pause, replay, and subtitle switching provided by flipped classrooms prompt learners to repeatedly expose themselves to target language features (e.g., specific grammatical points). This repeated exposure deepens the processing of input, strengthens noticing and the development of implicit knowledge, a process referred to as frequency-driven input processing. 3) Advantages of multimodal contextualized input. The extensive use of videos, animations, and infographics in the flipped environment provides multi-dimensional contextual cues beyond text for language learning.

However, structural dilemmas are a reality that cannot be ignored. Pre-class input is often regarded as a "self-study burden", especially when students generally lack metacognitive skills and time management abilities. The gap in their preview effects further exacerbates the polarization of classroom participation, rendering the input environment structurally fragile. In addition, numerous studies have warned of the problem of information fragmentation (Hu, 2023). Isolated short videos, although easy to absorb, separates the integrity of language, affecting the induction and generalization of language rules, and fragmented input leads to the fragmentation of knowledge.

3.2 The Manifested Value of In-Class Interactive Space

Under the premise of careful design, the social interaction field constructed by the flipped classroom demonstrates great potential in stimulating second language output.

Firstly, it realizes high-density meaning negotiation and closed-loop feedback. Multiple observational studies (e.g., Zheng & Warschauer, 2015) have shown that classroom activities such as role-plays, information gap tasks, or debates force learners to compensate for comprehension gaps (communication dilemmas) through language negotiation. In this process, high-frequency interactions stimulate a large amount of corrective feedback (including peer feedback and teacher feedback) to occur naturally, greatly promoting the verification of learners' language hypotheses (Swain, 1995). This "real dilemmas triggering language growth" is the core driving force of the environment. Studies from a sociocultural perspective (Grossen et al., 2022) have revealed how group cooperation evolves into a process of creating collective competence. Through peer scaffolding, novices achieve leapfrog growth within the "Zone of Proximal Development (ZPD)" with the guidance of more capable partners or teachers. Collaboration not only produces language products but also cultivates pragmatic strategies and communicative competence.

Secondly, it reduces emotional anxiety and enhances learning participation. The flipped classroom creates a more supportive and secure language "comfort zone" by reducing the fear of impromptu expression (Lee & Wallace, 2018), significantly stimulating motivation for classroom participation.

However, the weakness in classroom task design has been repeatedly criticized. Some tasks are limited to superficial technology application or mechanical practice (e.g., "PPT presentations"), failing to trigger the negotiation of meaning with sufficient thinking complexity and depth. In reality, task discourse is often dominated by mother tongue or simple broken/interlanguage, lacking the pressure for improving language accuracy (pushed output) and motivation for revision, resulting in an abundance of interaction quantity but insufficient language growth (Sultana & Fang, 2024). In addition, if peer interaction sessions lack clear role allocation, language goals, and effective teacher monitoring, they will seriously hinder the occurrence of in-depth language collaboration.

3.3 Transformation of Teachers' Roles

Teachers are crucial mediators in the learning environment, but the role transformation in the flipped context is extremely challenging.

Teachers need to become mediators in the design of teaching environments. Theoretically, the pre-positioning of "knowledge transmission" forces teachers to bid farewell to the role of "sage on stage" and become designers and coordinators of classroom activities, as well as acute "diagnosers" of language development. Teachers need to accurately identify language difficulties (micro-zones) during students' activities and provide timely, personalized scaffolding support or language demonstrations (Lantolf & Poehner, 2014). This precise intervention constitutes a key driving force for language development.

Studies have shown (Abeysekera & Dawson, 2015) that many teachers have doubts about "delegating power" and lack specialized training in designing high-level cognitive tasks. Meanwhile, their insufficient understanding of second language acquisition theories directly affects their ability to observe classroom language data and intervene effectively. These constitute a gap between professional capabilities and practical needs. The transition from lecturers to environment constructors involves professional barriers far beyond the simple technical operation level. Therefore, teachers' roles need to be transformed to adapt to second language teaching in the technological environment.

4. Optimizing Flipped Classroom Learning Environment Systems for SLA

Current practices of flipped classrooms in Second Language Acquisition (SLA) still face the profound contradictions of "structural fragmentation" and "static design". These are mainly manifested as follows: 1) Physical-technical carriers, cognitive task design, and social interaction frameworks are often mechanically separated, with the affective dimension being marginalized; 2) Teaching implementation also lacks adaptive responses to dynamic learning processes, making it difficult to match the non-linear and emergent characteristics of language ability development (Larsen-Freeman, 2019). Based on Integrated Design and Dynamic Systems Theory (DST), this study proposes that the optimization path lies in constructing an adaptive ecosystem "centered on learners' language ability development"—its essence is to deeply nest technical tools, cognitive tasks, interaction forms, and emotional drivers in the spatio-temporal structure, and adjust environmental elements in real-time through dynamic feedback loops. The following will systematically elaborate from three aspects: tripartite integration, dynamic mechanisms, and the reconstruction of teachers' ecological niches.

4.1 Constructing the Task-Technology-Interaction Tripartite Integration Framework

The basic validity of the flipped environment first depends on whether the technical carrier, cognitive tasks, and social interaction form deep integration in the two stages of Input Intake and Output Pushing. The input stage is by no means merely deploying online videos, but requires capturing students' current Interlanguage level through an intelligent diagnostic system, dynamically generating a repository of comprehensible input resources (Krashen, 1985), and embedding a cognitive processing engine in the technical interface to trigger noticing of linguistic forms (Schmidt, 1995). The output stage needs to take technology-empowered collaborative tasks as the framework. For example, during group activities, it is necessary to frequently use the target language for negotiation of meaning (Long, 1994), and the intelligent collaborative platform will real-time capture deviations in linguistic forms in the dialogue and trigger "Focused Feedback" (Ellis, 2003).

4.2 Establishing Task Design Oriented to In-Depth Interaction

In the flipped classroom model, the core of task design needs to shift from one-way knowledge transmission to a language practice framework driven by in-depth interaction, which is a key path to realize second language cognitive reconstruction. Sociocultural theory emphasizes that language acquisition is essentially a socially mediated process, and the structure of extra-curricular knowledge internalization and in-class in-depth practice in flipped classrooms creates a manipulable "Zone of Proximal Development" for learners (Lantolf & Poehner, 2014). When designing such tasks, three principles should be followed: First, the efficiency of input preprocessing must contain comprehensible input to provide cognitive anchors for classroom interaction; Second, from the hierarchical nature of task complexity, the task chain progresses from "resource-dispersive to concept-intensive", driving learners to break through language thresholds through meaning negotiation; Third, in the dynamics of interactive roles, teachers transform from lecturers to cognitive scaffolding builders, forcing learners to actively apply metalinguistic strategies through designing mechanisms such as information gaps, decision-making power transfer, and negative feedback loops. For example, in vocabulary acquisition tasks, pre-class video learning focuses on semantic network construction, while in-class sessions design "vocabulary crisis negotiation" scenarios where groups need to use target words to negotiate resource allocation plans. The decision-making process triggers a cycle of meaning reconstruction (Swain, 1995), enabling linguistic forms to complete internalization transformation under communicative pressure.

Task design should directly drive the negotiation and development of linguistic meaning. It needs to design task sequences based on authenticity and cognitive challenges, adopting the Task-Based Language Teaching (TBLT)

framework (Ellis, 2003) to create complex chained tasks centered on real language needs. Pre-class input must accurately target the linguistic support points of classroom tasks. An output-oriented feedback system should be constructed: pre-class exercises focus on automatic feedback; the classroom environment should emphasize the integration of multi-source feedback—skillfully combining structured peer assessment, targeted teacher guidance, and subsequent personalized language profile reports based on learning analytics. Language attention guidance mechanisms should be designed: tasks can guide conscious noticing of key linguistic features through methods such as highlighting and structured gap-fill.

4.3 Reconstructing Teachers' Roles

The core mission of teachers in optimizing the environment shifts from static presupposition to dynamic ecological niche regulation, requiring them to possess system diagnostic capabilities, process intervention capabilities, and collaborative evolution guidance capabilities (Markauskaite et al., 2023). First, teachers' primary role is a sensitive contextual Diagnostician of learner-technology-task interactions. They need to analyze learner differences and implement differentiated scaffolding strategies when grouping students in class; for those with weaker foundations, step-by-step scripted scaffolding should be provided. Second, teachers' second function is an adaptive Intervener in case of environmental imbalance. When there is a disconnection between technology and tasks, teachers need to immediately activate "Redundancy Design", monitor the entire learning process of learners, and rebuild their sense of control by guiding learning strategies. Third, teachers' ultimate role is a Catalyst for ecological collaboration. By delegating students' rights to construct the environment, they activate self-organizing forces within the environment, enabling the system to have continuous evolutionary capabilities (Cai et al., 2022). Teachers no longer control the system but maintain the healthy evolutionary tension of the ecosystem through interventions at key nodes—which is precisely the core element for the sustainable development of the flipped environment from the DST perspective.

5. Conclusion

The significance of the flipped classroom lies in its potential to reshape the learning environment. From the perspective of second language acquisition theory, this paper examines the characteristics of the flipped environment, revealing its positive empowerment in optimizing input, enhancing interaction, and expanding technological applications. Meanwhile, it objectively points out the challenges it faces, such as weak physical support, superficial task design, inadequate teacher transformation, and insufficient sociocultural atmosphere.

The core value of the flipped classroom in second language application is that it creates a new mechanism that focuses the precious classroom time on social language practice and technology-empowered meaning expansion. Its essence is a dynamic language acquisition support system jointly constructed by physical tools, cognitive tasks, and social relationships. The future development path must go beyond isolated repairs and adopt Integrative Design Thinking to promote the collaborative construction of physical space layout, integrated support of intelligent platforms, innovative design of in-depth language tasks, and a trust-based language community co-built by teachers, students, and peers.

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