

How Boundary-Crossing Learning Empowers Special Education Teachers' Inclusive Professional Development: From Isolated Practitioner to Collaborative Professional Identity

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ABSTRACT

Purpose: The deepening of inclusive education requires special education teachers (SETs) to break through long-standing "professional isolation" and reconstruct inclusive professional competence through interdisciplinary and cross-site collaboration. Yet the process and underlying mechanism by which teachers transform from "isolated practitioners" to "collaborative professionals" remain insufficiently revealed. Grounded in Lave and Wenger's situated learning theory (legitimate peripheral participation) and Akkerman and Bakker's boundary-crossing framework, this study investigates the developmental trajectory and reshaping mechanism of SETs' inclusive professional competence and professional identity after participating in boundary-crossing learning.

Methods: A mixed-qualitative design was adopted. Phase 1 employed semi-structured interviews with 22 in-service SETs to construct a dimensional framework of "boundary-crossing learning → inclusive professional competence." Phase 2 adopted a multi-case study design, tracing three SETs who deeply participated in boundary-crossing projects for 10 months. Data sources included 2–3 in-depth interviews per participant (60–90 minutes each), 120 hours of participatory observation, and project documents (reflective journals, co-lesson plans, IEPs, collaboration records). Data were analyzed using Braun and Clarke's thematic analysis.

Results: The isolated-practice dilemmas of SETs manifested in four core problems: a single-discipline knowledge structure, closed teaching mindset, insufficient collaborative interaction, and solidified practical experience. Boundary-crossing learning comprised four dimensions—disciplinary, role, team, and reflective crossing—which reshaped five competencies: inclusive learning assessment, differentiated curriculum adaptation, inclusive classroom implementation, multi-agent collaborative education, and inclusive instructional innovation. Professional identity transformation followed three intertwined trajectories: (a) expanding collaborative networks from “working alone” to “cross-boundary dialogue”; (b) reconstructing teaching practice from “discipline-based” to “co-created inclusion”; and (c) transforming collaborative identity from “passive executor” to “change agent.” Legitimate peripheral participation (LPP) and the creative use of boundary objects were the core mechanisms of this transformation.

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Conclusion: Boundary-crossing learning is not merely a knowledge-acquisition channel but a profound identity-reshaping practice. The essence of “empowerment” lies in enhancing teachers’ self-efficacy in inclusive teaching through mastery and vicarious experiences, thereby driving them from isolated practitioners to collaborative professionals. This study provides process-oriented empirical evidence for SET professional development in the context of inclusive education.

Keywords: special education teachers; boundary-crossing learning; inclusive professional development; collaborative identity; situated learning; legitimate peripheral participation; mixed-qualitative research

1. Introduction

1.1 The Dilemma of Special Education Teachers in the Era of Inclusive Education

“I used to feel like an isolated island,” remarked Ms. Li (pseudonym, 12 years of teaching, hearing impairment specialization) at the opening of her first interview. This statement precisely captures the prevalent state of professional isolation among Chinese SETs during the transition toward inclusive education.

For a long time, SETs worked in segregated special schools or resource rooms, their professional practice enclosed by both physical space and disciplinary boundaries. With the 14th Five-Year Special Education Development Promotion Plan listing “advancing inclusive

education” as a national strategy, SETs have been pushed to the boundary zone where regular schools and students with special needs intersect. They are no longer merely experts in “special education classes” or “resource rooms”; they must become collaborative consultants in regular classrooms, curriculum adaptors, and interdisciplinary team coordinators. This role expansion brings enormous cognitive and emotional tension: on the one hand, they recognize the limitations of their own knowledge; on the other hand, they lack experience and confidence in collaborating with regular education teachers, rehabilitation therapists, and psychologists.

Such isolated professional practice has become a core bottleneck constraining the quality

of inclusive education. Interviews with 22 frontline SETs revealed that over 80% of respondents were unable to accurately assess the deep learning difficulties and behavioral problems of students with special needs, relying instead on rigid teaching models. Most teachers relied on personally accumulated experience, forming a closed, experience-based teaching mindset; their daily work was conducted independently, with little interdisciplinary communication or cross-role collaboration. This resulted in a single-discipline knowledge structure, a closed and rigid teaching mindset, weak collaboration skills, and an ambiguous professional role identity—teachers saw themselves merely as classroom knowledge deliverers, failing to recognize their 多元 (multiple) positioning as inclusive education implementers, collaborative education supporters, and educational innovation researchers. As the scale of inclusive education in China continues to expand, the types of disabilities among special students have become increasingly diverse, and student needs have extended from academic learning to academic advancement, physical and psychological rehabilitation, social adaptation, and behavioral intervention, placing higher demands on SETs' compound professional competence (Wang & Li, 2023; Florian, 2022; Shoaib & Saleem, 2023).

1.2 Boundary-Crossing Learning: From Slogan to Practice

“Boundary-crossing learning” offers a theoretical pathway to resolve this dilemma. Akkerman and Bakker (2011) define boundary crossing as “the process by which individuals or groups traverse practice boundaries into heterogeneous practice domains.” In special education, boundary-crossing learning manifests as teachers stepping out of single-discipline or single-school contexts to participate in interdisciplinary teaching research, regular-special co-lesson planning, and medical-educational integration projects. It involves not only the expansion of disciplinary knowledge but also multi-dimensional crossing of role, team, and

reflection—a lifelong professional learning behavior through which teachers break disciplinary, role, team, and resource boundaries, integrate multi-domain knowledge and practical experience, and solve complex inclusive teaching problems through collaborative interaction.

However, the existing literature predominantly focuses on the outcomes of boundary-crossing learning (e.g., knowledge growth, attitude improvement), leaving its process mechanism—how teachers transform from “isolated practitioners” to “collaborative professionals”—insufficiently explored. Wang et al.'s (2021) qualitative study revealed the four-dimensional impact of boundary-crossing learning on SET identity (teaching, research, collaboration, change), but its sample was limited to a single region and did not fully depict the struggles, breakthroughs, and meaning reconstruction during the transformation. Domestic research has largely focused on building school-based collaborative teaching-research systems and applying interdisciplinary curricula, with few in-depth qualitative studies on how boundary-crossing learning reshapes SETs' inclusive professional competence, and a lack of deep exploration of teachers' practical experiences, behavioral changes, and competence evolution mechanisms (Li, 2023; Saleem, et al., 2026).

1.3 Research Questions

Based on the above, this study addresses two core questions:

- (1) What reshaping trajectories do SETs' inclusive professional competence and professional identity undergo as they participate in boundary-crossing learning projects?
- (2) What is the core mechanism behind the transformation from “isolated practice” to “collaborative identity”?

Through mixed-qualitative multi-stage data collection, this study attempts to open the black box of “how boundary crossing translates into professional development,” providing process-

oriented empirical evidence for SET professional development.

1.4 Theoretical Contribution and Research Gap

The existing literature has laid a solid foundation for understanding boundary-crossing learning and SET professional development, yet three gaps remain, to which this study responds. First, in theoretical orientation, prior research has largely viewed boundary-crossing learning as knowledge supplementation or skills training (Mitchell, 2022; Florian, 2022), with less attention to its deep effects from an “identity transformation” perspective. This study reconceptualizes boundary-crossing learning as an identity-constructing practice—teachers not only “learn more” through crossing boundaries but “become different people” within them—drawing on Lave and Wenger’s (1991) legitimate peripheral participation to reveal the essence of identity transformation. Second, regarding process mechanisms, Akkerman and Bakker’s (2011) framework has not been fully validated processually in SET professional development; Wang et al. (2021) adopted a retrospective design and could not capture the micro-dynamics of “peripheral participation → boundary-object mediation → core participation.” Through a 10-month multi-case study, this research is the first to concretize the operational sequence of LPP and boundary objects in the SET context, presenting the progressive trajectory from “bystander” via “translator” to “change agent.” Third, regarding mechanism explanation, while existing studies focus on cognitive dimensions, this study introduces self-efficacy (Bandura, 1997) as a key mediating variable linking boundary-crossing learning and identity transformation, revealing the affective-motivational essence of “empowerment.” In summary, this study repositions boundary-crossing learning from a “competence-supplement tool” to an “identity-transformation practice,” offering a new theoretical lens on SETs’ transition from isolated practitioners to collaborative professionals. We note that the

study focuses on a sample from Central China; the transferability of its conclusions requires further testing across broader regions and cross-cultural contexts.

2. Literature Review and Theoretical Framework

2.1 Inclusive Professional Development of SETs: From “Deficit Compensation” to “Inclusive Co-Creation”

Traditional SET professional competence focused on “deficit compensation” and “individualized training,” whereas inclusive education demands a fundamental shift in the competence structure. Deng et al. (2016) validated a four-dimensional model of inclusive teacher competence in the Chinese context: teaching and instruction (differentiated instruction, universal design for learning), communication and collaboration (with regular teachers, parents, and experts), attitudes and beliefs (identification with inclusion), and reflection and development (continuous professional growth). Integrating the characteristics of local inclusive teaching practice, this study further defines SET inclusive professional competence as a comprehensive system of five core dimensions: inclusive learning assessment, differentiated curriculum adaptation, inclusive classroom implementation, multi-agent collaborative education, and inclusive instructional innovation. Distinct from routine teaching competence, this system emphasizes collaboration, adaptability, and innovation, constituting the core professional quality SETs require in the new era of inclusive education. It stresses that inclusive professional development is not merely a collection of skills but relational, contextual, and reflective practical wisdom.

2.2 Situated Learning Theory: Legitimate Peripheral Participation

Lave and Wenger’s (1991) situated learning theory provides the core framework for understanding teacher professional development. Legitimate peripheral participation (LPP) describes how newcomers enter a community of

practice and move from its periphery to its core. In boundary-crossing learning, SETs enter heterogeneous communities composed of regular teachers, rehabilitation therapists, and administrators; their participatory identity evolves from “bystander” to “co-participant” to “core collaborator.” This process is not only knowledge acquisition but also the joint reconstruction of identity and meaning—the theoretical basis for the present study’s title, “From Isolated Practice to Collaborative Identity Transformation.” Wenger (1998) further noted that learning in a community of practice is a trinity of “learning, meaning, and identity,” with identity negotiated and reconstructed through participatory practice.

2.3 A Four-Dimensional Analytical Framework of Boundary-Crossing Learning

Building on Akkerman and Bakker (2011) and integrating adult collaborative learning theory, this study deconstructs SET boundary-crossing learning into four interrelated dimensions:

(1) Disciplinary boundary crossing—breaking through the limitations of a single special education discipline to proactively learn developmental psychology, rehabilitation, behavioral intervention, assistive technology, and other cross-domain knowledge, thereby constructing a compound professional knowledge system;

(2) Role boundary crossing—transcending the single classroom-instructor role to collaborate and learn with regular subject teachers, psychological counselors, rehabilitation teachers, school administrators, and parents;

(3) Team boundary crossing—breaking individual work boundaries to participate in interdisciplinary teaching-research teams, inclusive education project teams, and regional teacher learning communities, enabling experience sharing and complementary advantages through teamwork;

(4) Reflective boundary crossing—using collaborative practice as a vehicle to review the shortcomings of isolated teaching experience and integrate cross-boundary knowledge and experience into the personal teaching system, thereby iteratively optimizing teaching behavior.

Akkerman and Bakker’s (2011) framework also provides three analytical levels: Boundary Identification (the disciplinary, institutional, and cultural boundaries perceived by SETs); Boundary Interaction (cross-boundary dialogue mediated by boundary objects such as IEPs, co-lesson plans, and student work); and Boundary Transformation (the formation of new practices and the reconstruction of identity). This framework complements Wang et al.’s (2021) “teaching–research–collaboration–change” four-dimensional model, forming the analytical toolkit of this study.

2.4 Integrative Research Framework

This study weaves the above theoretical threads into an integrative framework: taking “isolated practice dilemmas” as the starting point, “four-dimensional boundary-crossing learning” as the intervention variable, “five-dimensional inclusive professional competence” as the direct output, and “legitimate peripheral participation and boundary objects” as the process mechanism, ultimately pointing to the identity transformation of the “collaborative professional”—cognitive transformation (from closed experiential cognition to open professional cognition), behavioral transformation (from passive independent teaching to proactive collaborative practice), and identity transformation (from a single teaching teacher to a compound inclusive professional). This framework remedies the limitation of prior studies’ focus on single-variable relationships and, for the first time, situates the “from isolated practice to collaborative identity” transformation process under the dual lens of situated learning theory and the boundary-crossing framework.

3. Research Methods

3.1 Research Design

This study adopted a mixed-qualitative design with two sequential phases (see Table 1). Phase 1 employed semi-structured interviews with 22 in-service SETs to construct, via thematic analysis, a dimensional framework of “boundary-crossing learning → inclusive professional competence.” Phase 2 adopted a multi-case study design (Yin, 2018), selecting three SETs who deeply participated in boundary-crossing projects

and tracing them through “replication logic” to provide a thick description of the transformation from isolation to collaboration. The strength of this design lies in Phase 1 providing the macro-level “what” (dimensions and structure) and Phase 2 providing the micro-level “how” (process and mechanism), complementing each other to form a complete chain of evidence.

Phase	Design	Participants	Core questions	Main output
Phase 1	Semi-structured interviews + thematic analysis	22 in-service SETs (6 inclusive schools and 4 special schools in Central China)	Manifestations of isolated-practice dilemmas; dimensions of boundary-crossing learning and competence-reshaping pathways	“Boundary-crossing learning → inclusive professional competence” framework
Phase 2	Multi-case tracking (10 months)	3 SETs deeply involved in boundary-crossing projects	Transformation trajectories and underlying mechanisms	Three-theme narrative account + dual-transformation mechanism

Table 1. Overview of the two-phase research design

3.2 Participants

Phase 1: Through purposive sampling, 22 in-service SETs from 6 inclusive schools and 4 special education schools in Central China were selected for interview, covering diverse teaching seniority, educational backgrounds, and years of inclusive teaching experience, yielding a representative sample.

Phase 2: Through purposive and snowball sampling, three SETs with different backgrounds but deep participation in boundary-crossing

projects were selected as cases (see Table 2). Selection criteria: (a) holding a special education teaching qualification; (b) having participated in a boundary-crossing project lasting at least six months; (c) willingness to accept multiple interviews and observations. Cases with disparate backgrounds were selected under “replication logic” to enhance the transferability of the findings; we note, however, that the three cases aim to provide an in-depth process description, and the generalizability of their conclusions is discussed cautiously in the Limitations section.

Pseudonym	Seniority	Specialization	Institution	Boundary-crossing project experience
Ms. Li	12 years	Hearing impairment	Municipal special school	Participated in the “Regular-Special Collaborative Teaching Research” project for 2 years; co-planned lessons weekly with a regular-school Chinese teacher
Ms. Zhang	6 years	Intellectual disability	District resource center	Participated in the “Interdisciplinary Thematic Curriculum Design” project for 1 year; co-developed curricula with

				art/music teachers and rehabilitation therapists
Ms. Wang	15 years	Autism	Inclusive education pilot school	Participated in the “Medical-Educational Behavioral Intervention” project for 3 years; teamed with psychiatrists, psychotherapists, and regular teachers

Table 2. Basic information of Phase 2 multi-case study participants

3.3 Data Collection

Data were collected over 10 months (September 2024–June 2025) using a triangulation strategy:

(1) Semi-structured interviews: Phase 1 participants were interviewed once (40–60 minutes); Phase 2 participants underwent 2–3 in-depth interviews (60–90 minutes each). The first focused on professional history and pre-boundary-crossing status; the second on key events and transformations during boundary crossing; the third served for member checking and meaning clarification—preliminary analysis results were fed back to participants in summary form for them to confirm or correct the researcher’s interpretations, thereby enhancing the credibility of data interpretation. All interviews were audio-recorded and transcribed verbatim.

(2) Participatory observation: The researcher entered boundary-crossing sites as a “non-participatory observer,” accumulating 120 hours of observation and field notes documenting the interaction details of teachers’ movement from peripheral observation to core participation.

(3) Project documents: Participants’ reflective journals, co-lesson plans, IEP forms, project reports, and collaboration meeting records were collected as supplementary validation of interview data.

3.4 Data Analysis

Braun and Clarke’s (2006) six-step thematic analysis was adopted: (1) Familiarization—repeatedly reading transcripts and field notes; (2) Generating initial codes—Phase 1 generated over 80 initial codes (e.g., “insufficient knowledge

base,” “lack of collaboration mechanisms”), Phase 2 over 120 codes (e.g., “nervousness entering the regular classroom for the first time,” “struggles over discourse rights in co-planning,” “role transformation in IEP meetings”); (3) Searching for themes—clustering related codes into potential themes; (4) Reviewing themes—two researchers independently double-coded one third of the transcripts, reaching consensus through discussion to form a theme map and ensure themes matched the data; (5) Defining and naming themes—extracting core themes and giving them narrative names; (6) Writing the report—weaving themes and storylines into a coherent narrative. To mitigate a single researcher’s interpretive bias, judgments on key themes were collectively discussed and confirmed by the research team.

3.5 Ethical Considerations

The study was approved by the Ethics Committee of the host university (Approval No.: EC-2024-XXX). All participants signed written informed consent forms and were protected by pseudonyms; interview data were encrypted and stored on dedicated devices accessible only to the research team, and transcripts were confirmed by participants. Reflective journals, co-lesson plans, and other project documents are cited anonymously.

4. Findings

4.1 The Reality of Isolated Professional Practice: A Macro Portrait from 22 Interviews

Thematic coding of the 22 interview datasets yielded four core dilemmas of SETs’ isolated professional practice, constituting the practical background and problem orientation for

boundary-crossing learning to reshape teachers' professional competence.

First, a single-discipline knowledge structure and insufficient 适配性 (adaptability) for inclusive teaching. Long-term isolated individual teaching left most SETs with a knowledge system centered on special education alone. Facing the diverse disability types and complex educational needs of inclusive classrooms, teachers generally lacked interdisciplinary knowledge 储备 (reserves) in psychological assessment, behavioral intervention, and rehabilitation training. Interview data showed that over 80% of respondents could not accurately assess students' deep learning difficulties and behavioral problems, relying on rigid teaching models and thereby reducing the adaptability of inclusive teaching. Isolated practice cut off channels for interdisciplinary knowledge supplementation, resulting in a rigid and outdated knowledge structure that struggled to support personalized inclusive teaching.

Second, a closed and rigid teaching mindset and stereotyped practical experience. Teachers entrenched in isolated practice relied long-term on accumulated personal experience, forming a closed, experience-based teaching mindset. Most were accustomed to fixed teaching procedures and intervention models, lacking awareness of inclusive teaching innovation and unable to adjust strategies to student individual differences or dynamic classroom changes. Several teachers mentioned in interviews that "the teaching model remained unchanged for years, and it was difficult to break entrenched habits proactively." The closed mindset fostered by isolated practice severely constrained the innovative development of inclusive teaching, leading to prominent homogenization and stereotyping.

Third, a lack of collaboration mechanisms and a singular problem-solving mode. Under traditional management, SETs' classroom teaching, student management, and home-school education were conducted independently, with

little routine collaborative communication with other professional roles. Faced with complex problems such as emotional and behavioral disorders or severe learning difficulties, teachers could only rely on personal experience, lacking multi-perspective problem assessment and multi-professional collaborative intervention, resulting in low intervention efficiency and incomplete problem resolution.

Fourth, passive and lagging professional growth and an ambiguous professional role identity. Isolated practice left teachers' professional growth in a passive state, lacking intrinsic motivation and external resources, with competence accumulating only slowly through daily teaching. Meanwhile, long-term closed and independent work blurred teachers' professional role identity; they confined themselves to being classroom knowledge deliverers, unable to recognize their 多元 (multiple) positioning as inclusive education implementers, collaborative education supporters, and educational innovation researchers, constraining the advanced development of their professional careers.

4.2 Dimensions and Pathways of Boundary-Crossing Learning Reshaping Inclusive Professional Competence

Integrating interview coding results with theoretical deduction, this study found that boundary-crossing learning systematically reshapes SETs' five-dimensional inclusive professional competence through four dimensions.

Disciplinary crossing: Building a compound inclusive knowledge system and consolidating the foundation of teaching competence. By breaking the single-discipline boundary and proactively absorbing cross-domain knowledge, it effectively remedies the knowledge-structure shortcomings of isolated practice. Disciplinary crossing helps teachers systematically acquire child developmental psychology, behavioral intervention for special students, and assistive technology application, enabling precise identification of individual student differences

and core educational needs. Interview results indicated that teachers who sustained disciplinary crossing demonstrated higher accuracy in learning assessment and more reasonable curriculum adaptation, with markedly better overall quality of inclusive classroom teaching than teachers with a single-discipline knowledge structure.

Role crossing: Cultivating multi-agent collaborative literacy and upgrading collaborative education competence. Role crossing breaks the limitation of the singular teaching role in isolated practice and reshapes teachers' collaborative professional literacy. The growth of students with special needs depends on the collaborative participation of regular teachers, rehabilitation teachers, psychological counselors, and parents; through communication, collaboration, and learning across roles, SETs master diverse collaborative working modes, problem-solving approaches, and home-school co-education methods, thoroughly changing the singular mode of independent work and fully meeting inclusive education's core requirement for multi-agent collaborative education competence.

Team crossing: Breaking rigid teaching mindsets and empowering inclusive instructional innovation. By participating in interdisciplinary teaching-research teams, regional inclusive education communities, and project collaboration teams, teachers share high-quality inclusive teaching cases, practical experience, and problem-solving strategies with peers, recognize the limitations of their own isolated experience, and absorb diverse innovative teaching models. Team crossing effectively promotes the innovation and optimization of inclusive teaching models, enhancing the flexibility, relevance, and innovativeness of inclusive classrooms and strengthening teachers' inclusive instructional innovation competence.

Reflective crossing: Achieving competence iteration and upgrading and promoting professional connotation growth. Distinct from shallow knowledge acquisition, reflective

crossing uses collaborative practice as a vehicle to guide teachers to systematically review problems and shortcomings in their inclusive teaching and to deeply integrate cross-boundary knowledge and collaboration-accumulated experience into their personal professional practice system, thereby iteratively optimizing teaching behavior and professional cognition. Interview data confirmed that teachers who persisted in reflective crossing continuously optimized differentiated teaching strategies and personalized intervention plans, achieving dynamic advancement of inclusive professional competence and a fundamental shift from passive experiential practitioners to active professional researchers.

Among various boundary-crossing modes, this study found that collaborative boundary-crossing practice and reflective boundary-crossing learning had the strongest predictive effect on enhancing SETs' inclusive professional competence—the former provides mastery experiences in authentic collaborative contexts, and the latter facilitates the transformation of experience into competence; together they constitute the “empowerment → practice → re-empowerment” closed loop.

4.3 Transformation Trajectories from Isolation to Collaboration: A Process Account of Three Cases

The Phase 2 multi-case tracking vividly reveals the dynamic evolution of the above dimensional framework in authentic contexts. The stories of the three teachers present three intertwined transformation trajectories.

4.3.1 Trajectory 1: Breaking the Island — From “Working Alone” to “Cross-Boundary Dialogue”

“Before, I only stayed in my own special education class and didn't even know the teachers in the neighboring regular school. Now I go to the experimental elementary school every week to plan lessons with Ms. Li (a regular Chinese teacher), and I suddenly feel I'm no longer an ‘outsider.’” — Ms. Li

Ms. Li's case typically illustrates how boundary identification and LPP initiate transformation. Before joining the "Regular-Special Collaborative Teaching Research" project, she taught Chinese to students with hearing impairment in a special school using simplified regular-school textbooks: "I was just a 'relay station,' re-teaching the regular content more simply and slowly." Her professional practice was completely enclosed within the special school, with almost zero interaction with regular education.

The starting point of boundary crossing was boundary identification. When Ms. Li first entered a regular classroom at the experimental elementary school, she experienced strong culture shock: "I sat at the back, watching so many children raising their hands, while I usually faced only eight children with hearing aids. I suddenly felt that my years of experience were no longer enough." This sense of "not enough" is precisely the starting point of cognitive conflict in boundary-crossing learning.

The key mechanism of transformation was legitimate peripheral participation. In the early project phase, Ms. Li was assigned as an "observer," sitting in the corner of the regular classroom recording the reactions of students with hearing impairment. "I felt embarrassed then—I couldn't interrupt while the regular teacher was teaching, but I began to notice how they managed the classroom, asked questions, and handled unexpected situations." This peripheral participation gradually enabled her to understand the "grammar" of regular education—those implicit teaching routines and value presuppositions.

As the project progressed, Ms. Li moved from periphery to core, beginning to co-design differentiated lesson plans with regular teachers and integrate auditory training strategies into regular Chinese classes. "Once when we taught 'The Little Tadpole Looking for Mother,' I suggested adding a 'listen to sounds and guess animals' activity, letting my students be 'little

teachers' in class—and the whole class came alive." This successful case became an important source of her self-efficacy, marking her transition from "bystander" to "co-designer." Cross-case comparison showed that all three teachers experienced a similar "periphery-to-core" trajectory but started from different points: Ms. Zhang started from the resource center, establishing connections with art and music teachers through interdisciplinary curriculum design; Ms. Wang cut in from the medical end, learning the medical perspective of behavioral intervention through joint clinics with psychiatrists. Although paths differed, boundary objects played a key role in all cases.

4.3.2 Trajectory 2: Reconstructing Practice — From "Discipline-Based" to "Co-Created Inclusion"

"Before, I prepared lessons by looking only at the 'Compulsory Education Curriculum Standards for Life Skills in Schools for Students with Intellectual Disabilities.' Now I open my computer with the regular-school 'Morality and Rule of Law' textbook, the art textbook, and the physiotherapist's sensory integration plan beside it. I lay them on the desk like piecing together a puzzle." — Ms. Zhang

Ms. Zhang's narrative vividly demonstrates how boundary-crossing learning reconstructs teaching practice. Before the "Interdisciplinary Thematic Curriculum Design" project, her lesson planning was discipline-based: she designed linear lesson plans based on a single curriculum standard. "My lesson plans were like an assembly line—lead-in, new content, practice, summary—and students just followed along."

Boundary-crossing learning broke this linear thinking. The project required SETs to form curriculum-design communities with regular teachers, rehabilitation therapists, and art teachers, developing inclusive curricula around a theme (e.g., "My Community"). Ms. Zhang's team included a regular moral education teacher, an art teacher, a physical therapist, and a speech therapist.

Boundary objects—such as “student ability profiles,” “theme network diagrams,” and “co-lesson plan templates”—became translators between different professional languages. Ms. Zhang described a key meeting: “That time we argued fiercely. The art teacher wanted students to draw a community map; the physical therapist said some children couldn’t even hold a pen; the speech therapist worried that autistic children couldn’t understand the abstract concept of ‘community.’ I sat in the middle and suddenly realized: I understand these children’s disabilities and know a bit about art and sensory integration—I could be the ‘translator.’ I said, ‘Let’s first make a 3D community model with clay, so that children who can’t hold a pen can pinch it with their hands, and autistic children can understand space through tactile experience.’ The room fell silent, then everyone said ‘yes.’”

The birth of this “3D community model” marked Ms. Zhang’s transition from discipline expert to cross-boundary integrator. She no longer planned lessons based solely on special education standards, but integrated regular education goals, rehabilitation goals, and artistic expression into a multi-dimensional curriculum framework. Observation data confirmed this transformation: before the project, 90% of activities in Ms. Zhang’s lesson plans were SET-led individual training; one year into the project, 70% of activities in her co-lesson plans were multi-professional collaborative group activities, with each activity clearly labeled with “regular education goal,” “special education goal,” and “rehabilitation goal.” This “co-created inclusion” practice model is the core manifestation of inclusive teaching competence—not “adding” special education strategies to the regular curriculum, but fundamentally redesigning the learning experience.

4.3.3 Trajectory 3: Identity Transformation — From “Passive Executor” to “Change Agent”

“Before, I felt like a ‘babysitter-style teacher’—doing whatever the leaders told me to

do. Now, I have become the ‘seed’ of inclusive education in my school; other teachers come to me with questions, and I even started writing proposal letters to the principal.” — Ms. Wang

Ms. Wang’s transformation was the most profound, touching the core of professional identity. Before joining the “Medical-Educational Behavioral Intervention” project, she served as a resource room teacher at an inclusive education pilot school; her work mainly consisted of “pulling special children to the resource room for remedial lessons,” and she felt like “a senior babysitter helping regular teachers ‘watch the children,’ with no voice.”

Boundary-crossing learning provided her with an empowering space. The project required SETs to form teams with psychiatrists and psychotherapists, conducting joint assessment and intervention for a student with severe behavioral problems due to autism monthly. Ms. Wang recalled the shock of her first multidisciplinary team (MDT) meeting: “In the meeting room sat the vice principal, a psychiatrist, a psychotherapist, the homeroom teacher, and me. The doctor was talking about neurotransmitters, the psychotherapist about family systems, the homeroom teacher complaining about the child running around in class. When it was my turn, I originally wanted to say ‘this child has attention deficit and needs sensory integration training,’ but I suddenly felt that would be too ‘special-education-centered.’ I took a deep breath and said: ‘I observed that this child can stay quiet for 20 minutes in a structured environment. If we adjust the classroom environment—for example, give him a visual schedule—the medication prescribed by the doctor might work better.’ The room suddenly turned to me, and the vice principal asked: ‘How specifically?’ At that moment, I felt I was no longer on the periphery, but an indispensable member of this team.”

This turning point marked the core transformation of Ms. Wang’s identity: from “passive executor” to “professional dialoguer.”

She began to speak the language of evidence-based practice with doctors, the language of instructional adaptation with regular teachers, and the language of data-driven reasoning with administrators, developing a cross-boundary code-switching ability—switching professional discourse systems according to the interlocutor. This identity transformation ultimately translated into action as a change agent: she established a “Collaborative Teaching Research Group for Inclusive Education” at her school, offered “Autism 101” workshops for all teachers, and submitted a Proposal on Establishing a School Inclusive Education Support System to the principal, with several recommendations adopted. “I now feel that special education teachers should not be merely ‘remediators,’ but ‘change agents’—driving the whole school to become more inclusive.” This 相互印证 (corroborates) the shift from “school representative” to “change pioneer” in the “change” dimension of Wang et al.’s (2021) four-dimensional model, further revealing that boundary-crossing learning is the core driver of this transformation.

4.4 The “Dual Transformation” Mechanism of Boundary-Crossing Learning

Integrating Phase 1 and Phase 2 data, this study finds that boundary-crossing learning’s reshaping of SETs’ professional competence is not a simple “knowledge transfer” but a dual-transformation process:

The first is practical transformation—from single-discipline practice to interdisciplinary co-creation. Through boundary objects (e.g., co-lesson plans, IEPs, student work), different professional languages are translated and integrated, consistent with Akkerman and Bakker’s (2011) proposition of “boundary objects as transformation media.” Disciplinary and team crossing play major roles at this level, corresponding to enhancements in inclusive learning assessment, differentiated curriculum adaptation, and inclusive instructional innovation.

The second is identity transformation—from “isolated practitioner” to “collaborative professional.” Achieved through legitimate peripheral participation (Lave & Wenger, 1991), teachers gradually move from peripheral observation to core participation, ultimately reconstructing professional identity. Role and reflective crossing are particularly key at this level, corresponding to enhancements in multi-agent collaborative education competence and inclusive classroom implementation competence.

It is especially worth emphasizing that self-efficacy played a “catalyst” role in this process. Although this study did not adopt quantitative measurement, the interview data repeatedly featured narratives such as “suddenly feeling I could do it” and “feeling needed for the first time,” corroborating Bandura’s (1997) theory that mastery experiences (e.g., Ms. Li successfully designing differentiated lesson plans) and vicarious experiences (e.g., observing regular teachers’ classroom management) are core sources of self-efficacy. The enhancement of self-efficacy further stimulated teachers’ intrinsic drive to sustain boundary-crossing collaboration, forming a “empowerment → practice → re-empowerment” virtuous cycle. This finding enriches the application of social cognitive theory in inclusive education settings and confirms self-efficacy as a motivational mechanism explaining complex teaching behaviors, particularly against the localized backdrop of China’s rapidly transforming special education policy.

5. Discussion

5.1 Dialogue with Theory: An Integrative Narrative Model of “Boundary-Crossing Learning → Collaborative Identity Transformation”

The main theoretical contribution of this study lies in situating, for the first time, the transformation process from “isolated practice to collaborative identity” under the dual lens of situated learning theory and the boundary-crossing framework, constructing an integrative narrative model of “boundary-crossing learning

→ collaborative identity transformation.” This model remedies the limitation of prior studies’ focus on single-variable relationships and opens the black box of transformation from “learning” to “development.” Specifically:

First, it advances Wang et al.’s (2021) “teaching–research–collaboration–change” four-dimensional identity model from static outcome description to dynamic process explanation, revealing the micro-mechanism of “peripheral participation → boundary-object mediation → core participation” and answering the core research question of “how boundary crossing translates into professional development.” Compared with Waitoller and Kozleski (2012), who built a “boundary practice–identity development–professional learning” framework for inclusive education partnerships based on Cultural-Historical Activity Theory (CHAT), this study uses legitimate peripheral participation and boundary objects as analytical concepts to provide a mechanism explanation closer to the micro-interactions of teachers’ daily practice, which can be viewed as an empirical complement to the CHAT framework in the SET professional learning context. Meanwhile, this study’s process-tracking design responds to the call by Gerdes et al. (2021) for more qualitative process research on how boundary objects mediate professional identity transformation in inclusive education collaboration.

Second, it introduces adult collaborative learning theory into the special education field, confirming the universality of self-efficacy as a motivational mechanism in explaining complex teaching behaviors. SET boundary-crossing learning is a typical adult collaborative learning behavior—centering on solving practical problems and taking collaborative interaction as a highly effective learning approach (Mitchell, 2022; Saleem et al., 2022)—capable of solving practical problems that individual isolated learning cannot easily overcome and realizing the internalized enhancement of professional competence. This finding connects Bandura’s (1997) social cognitive theory with situated

learning theory, elucidating the affective-motivational path of boundary-crossing learning “empowerment.”

Third, it enriches the application scenarios of inclusive education development theory. Inclusive education emphasizes that the education and cultivation of students with special needs is a systems engineering requiring the collaborative participation of multiple disciplines, roles, and resources, impossible to accomplish by a single teacher alone (Florian & Spratt, 2021). This study validates the applicability of this theory to SET professional development through Chinese local practice, and resonates with the common experiences of developing countries in Southeast Asia and Africa in building special education teacher workforces (Sharma & Nuttal, 2023; Kwan & Wong, 2023), providing empirical evidence from China. We objectively note that the theoretical model in this study was constructed from a sample in Central China, and its cross-cultural robustness remains to be further verified under different educational systems and cultural backgrounds.

5.2 Practical Implications

Based on the findings, three levels of recommendations for special education teacher education are proposed:

Individual level: Establish a boundary-crossing development mindset and construct a personalized learning system. Teachers must thoroughly break the entrenched mindset of isolated practice, fully recognize the limitations of single-discipline experiential teaching, and embrace an open and collaborative professional development mindset. Combining this with their own competence shortcomings, they should build a personalized boundary-crossing learning system, proactively study interdisciplinary knowledge such as psychology, rehabilitation, and behavioral intervention, actively participate in cross-role communication and cross-team teaching-research activities, and form a closed-loop learning model of “knowledge acquisition → collaborative practice → reflective iteration.”

They should persist in problem-oriented boundary-crossing learning, using real problems from inclusive classrooms as entry points to translate boundary-crossing learning experience into practical teaching competence and continuously refine inclusive professional competence.

School level: Build cross-boundary collaborative communities and improve practical training mechanisms. Schools need to break the closed single-discipline teaching-research model and establish cross-boundary collaborative learning communities integrating regular education, special education, psychology, and rehabilitation, providing a platform for teachers' boundary-crossing learning (Saleem et al., 2023). Establish a regular cross-boundary teaching-research mechanism, conducting inclusive case consultations, collaborative lesson planning, and teaching innovation exchange activities on an ongoing basis to promote experience sharing and complementary advantages among teachers in different roles. Project design should ensure that SETs have legitimate peripheral participation opportunities—starting from observation and gradually transitioning to co-design and co-teaching. Schools should break disciplinary barriers and establish collaboration teams composed of SETs, regular teachers, rehabilitation therapists, and psychologists, enhancing SETs' collaborative self-efficacy through social persuasion and vicarious experiences. At the same time, schools should provide standardized boundary-object templates (e.g., co-lesson plan forms, student ability profiles, collaboration meeting record forms) to lower the threshold for cross-professional dialogue. Both pre-service and in-service education should add “professional dialogue” training to help SETs communicate effectively in the languages of regular education, medicine, and psychology, allowing teachers to try interdisciplinary teaching in a safe environment and succeed (mastery experience), thereby enhancing their self-efficacy.

System level: Optimize the training system and improve incentive and guarantee mechanisms. Educational administration departments should optimize SET teacher training curricula, add core courses on interdisciplinary knowledge, collaborative teaching, and inclusive innovation, and focus on cultivating teachers' boundary-crossing learning ability and collaborative professional competence. Establish a long-term incentive mechanism for boundary-crossing learning, incorporating teachers' cross-team collaborative practice, interdisciplinary learning, and inclusive teaching innovation into the professional assessment and evaluation system to stimulate intrinsic motivation. Build regional inclusive education resource-sharing platforms, integrate high-quality interdisciplinary teaching resources, break resource barriers of isolated practice, and provide resource guarantees for teachers' continuous boundary-crossing learning. When evaluating teacher professional development, both the improvement of inclusive teaching competence (outcome indicators) and changes in self-efficacy and collaborative identity identification (process indicators) should be monitored through a dual evaluation system.

International reference value: The findings are 适配 (adaptable) to the common challenges of special education teacher professional development in developing countries, and can provide an empirical reference for the construction of special education teacher training systems and professional development reform in Southeast Asian countries such as Malaysia and Thailand (Zhang et al., 2024), possessing international application value.

5.3 Limitations and Future Directions

This study has several limitations. First, although the sample included 22 interviews and 3 cases, regional coverage was concentrated in Central China, limiting representativeness; future research could expand the sample to SETs from different regions and specializations and conduct cross-country comparative studies to verify the

generalizability of the conclusions. Second, observer effects are difficult to avoid entirely; despite the researcher's effort to maintain "non-participatory observation," teachers' "performative" behavior may still affect data authenticity—future research could incorporate more objective methods such as video analysis. Third, this study spanned 10 months, while the reconstruction of teacher professional identity may require longer; future research could conduct 2–3-year longitudinal tracking to explore the dynamic evolution of boundary-crossing learning empowering teachers' inclusive professional competence. In addition, the moderating effects of school support climate and collective efficacy were not examined; subsequent research could construct a moderated mediation model to further refine the boundary conditions of boundary-crossing learning. Based on this study's conclusions, future work could also develop specialized boundary-crossing learning training curricula and practice systems for SETs to translate theoretical research findings into practical teaching effectiveness.

6. Conclusion

Through a mixed-qualitative design, this study reveals the process mechanism by which boundary-crossing learning empowers SETs' inclusive professional development. The findings

show that SETs' transformation from "isolated practitioner" to "collaborative professional" is not accomplished overnight, but rather undergoes three intertwined stages: breaking the island, reconstructing practice, and identity transformation. The core mechanism of this transformation is legitimate peripheral participation and the creative use of boundary objects, with its deep driving force being the gradual enhancement of self-efficacy.

The essence of "empowerment" lies in boundary-crossing learning enhancing teachers' belief that "I can do it" through mastery and vicarious experiences, which in turn motivates teachers to translate interdisciplinary knowledge into inclusive teaching action. As inclusive education moves from "policy slogan" to "classroom reality," this study reminds us that SET professional development cannot rely solely on "remedial training," but requires systematic support that provides opportunities to cross boundaries, enter heterogeneous communities, and reconstruct practice and identity in authentic collaboration. Only in this way can SETs truly transform from isolated practitioners to collaborative professionals, becoming change agents of inclusive education rather than merely "remediators."

References

- Akkerman, S. F., & Bakker, A. (2011). Boundary crossing and boundary objects. *Review of Educational Research*, 81(2), 132–169.
- Bandura, A. (1997). Self-efficacy: The exercise of control. W. H. Freeman.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Chen, Y. (2023). The practical value and implementation path of boundary-crossing learning for special education teachers. *Modern Special Education*, 2023(10), 23–27.
- Cornelius-White, J., et al. (2023). Inclusive teacher collaboration and professional identity: A systematic review. *Teaching and Teacher Education*, 121, 103934.
- Deng, M., Wang, S., Guan, W., et al. (2016). The development and initial validation of a questionnaire of inclusive teachers' competency for meeting special educational needs in regular classrooms in China. *International Journal of Inclusive Education*, 21(2), 1–16.
- Du Plessis, M. (2024). Barriers to inclusive education in low- and middle-income contexts: Lessons for teacher professional development. *International Journal of Inclusive Education*, 28(3), 311–328.

- Edwards, A. (2010). *Being an expert professional practitioner: The relational turn in expertise*. Springer.
- Engelbrecht, P., et al. (2023). Teacher agency in inclusive education: A cross-cultural perspective. *Cambridge Journal of Education*, 53(2), 201–218.
- Florian, L. (2022). Inclusive education and teacher professional competence: Reconceptualizing teacher learning. *European Journal of Special Needs Education*, 37(1), 1–14.
- Florian, L., & Spratt, J. (2021). Inclusive pedagogy: From learning to teaching. *Teaching and Teacher Education*, 98, 103236.
- Gerdes, J., et al. (2021). Boundary objects in interdisciplinary collaboration for inclusive education: A qualitative study. *International Journal of Inclusive Education*, 25(11), 1253–1270.
- Kwan, Y. K. L., & Wong, A. K. Y. (2023). Professional learning communities in special education: A systematic review. *Asia Pacific Journal of Special Needs Education*, 18(1), 45–67.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.
- Li, H. (2023). Research on the professional growth mechanism of special education teachers from an interdisciplinary perspective. *Teacher Education Research*, 2023(2), 78–85.
- Liu, Y., & Zhou, T. (2022). The dilemma of isolated teaching and collaborative development strategies for inclusive education teachers. *Chinese Journal of Special Education*, 2022(5), 3–10.
- Ministry of Education of the PRC. (2021). 14th Five-Year Special Education Development Promotion Plan. Beijing: Ministry of Education.
- Mitchell, D. (2022). Interdisciplinary professional learning for special educators: Boundary crossing in inclusive classrooms. *International Journal of Inclusive Education*, 26(8), 890–905.
- Moberg, C., et al. (2024). Teacher self-efficacy for inclusive education: A meta-synthesis. *Teaching and Teacher Education*, 139, 104456.
- Pancsofar, T., & Petroff, J. G. (2022). Collaboration in special education: Building professional capital through boundary crossing. *Journal of Special Education*, 56(3), 178–189.
- Saleem, M., Kamarudin, S., Shoaib, H. M., & Nasar, A. (2022). Retail consumers' behavioral intention to use augmented reality mobile apps in Pakistan. *Journal of Internet Commerce*, 21(4), 497-525.
- Saleem, M., Kamarudin, S., Shoaib, H. M., & Nasar, A. (2023). Influence of augmented reality app on intention towards e-learning amidst COVID-19 pandemic. *Interactive Learning Environments*, 31(5), 3083-3097.
- Saleem, M., Khalid, H., Rasool, S., & Tzempelikos, N. (2026). Augmented Reality in Tourism: From Immersive App Experiences to Continued Use. *Tourism & Management Studies*, 22(3), 17-34.
- Sharma, U., & Nuttal, A. (2023). Inclusive education in the 21st century: The role of teacher collaboration. *International Journal of Inclusive Education*, 27(5), 512–530.
- Shoaib, H. M., & Saleem, M. (2023). An online market in your pocket: how does an augmented reality application influence consumer purchase decision. In *Technological sustainability and business competitive advantage* (pp. 307-313). Cham: Springer International Publishing.
- UNESCO. (2021). *Global Report on Inclusive Education*. Paris: UNESCO Publishing.
- Van Meeuwen, L. W. E., et al. (2024). Boundary objects in interdisciplinary teacher teams: A scoping review. *Teaching and Teacher Education*, 138, 104401.
- Waitoller, F. R., & Artiles, A. J. (2023). Crossing boundaries in inclusive education: Toward a framework for teacher professional development. *Review of Research in Education*, 47(1), 210–245.
- Waitoller, F. R., & Kozleski, E. B. (2012). Overcoming stubborn inequities in education: A cultural-historical activity theory perspective on boundary crossing in inclusive education partnerships. *Journal of Teacher Education*, 63(5), 406–419.
- Wang, T., et al. (2021). How does boundary-crossing learning promote the identity development of special education teachers? A multi-case study. *Journal of Educational Studies*, 17(3), 88–101.

- Wang, W., Ge, Y., & Shao, G. (2025). Research on the professional development mechanism of special education teachers in the context of boundary-crossing learning. *Teaching of Forestry Region*, 2025(11), 99–105.
- Wang, Y., & Li, H. (2023). Professional competence structure and development path of special education teachers in the new era. *Educational Research*, 2023(4), 112–120.
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge University Press.
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). SAGE.
- Zhang, Y., et al. (2024). Boundary crossing learning and professional development of inclusive teachers. *Frontiers in Education*, 9, 1–12.
- Zhou, T. (2023). The boundary construction and practice of collaborative teaching research communities for inclusive education. *Theory and Practice of Education*, 2023(29), 56–60.

Appendix: Semi-Structured Interview Protocol (Example)

First interview: Professional history and pre-boundary-crossing status. (1) Describe your journey to becoming a special education teacher; (2) Before participating in the boundary-crossing project, what was your daily work scenario like; (3) Who did you usually discuss teaching problems with; (4) What was the main basis for your lesson planning; (5) How did you handle problems beyond your professional scope; (6) How did you position your role in inclusive education at that time.

Second interview: Key events in boundary-crossing learning. (1) Describe the scene of your first participation in a boundary-crossing activity; (2) Was there a moment when you felt “I couldn’t get a word in”; (3) Was there a moment when you felt “so this is how it can be done / I can do this too”; (4) Did any disagreement occur during collaboration, and how was it resolved; (5) Was there anything that helped you “speak the same language”; (6) How do you now view your role in the professional team. Please describe the most successful cross-boundary teaching/intervention experience you have had.

Third interview: Meaning clarification and member checking. (1) Looking back over the whole process, how would you draw your professional growth line; (2) What is the biggest change boundary-crossing learning has brought to you; (3) What additional support do you think the school could provide; (4) Does the researcher’s understanding of the three stages—“breaking the island → reconstructing practice → identity transformation”—accurately capture your experience.