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Toward High-Quality and Equitable Compulsory Education: Value Implications and Mechanism Development of Teachers' Boundary-Crossing Learning in School Groups

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Abstract: As China advances the high-quality development of basic education by expanding access to high-quality provision and enhancing educational quality, compulsory education is transitioning from basic equity to high-quality equity, with the quality and effectiveness of teacher workforce development emerging as a pivotal variable in this process. Focusing on the practical problem of the structural decoupling of teacher allocation under school-group development, this study draws on boundary-crossing theory to elucidate the value implications of boundary-crossing learning for teachers' professional development. The research identifies that boundary-crossing learning enables teachers to transcend institutional, disciplinary, and cultural boundaries within school groups, thereby fostering collaborative knowledge construction, enhancing pedagogical innovation, and promoting equitable distribution of educational resources. It further proposes four interrelated strategies for developing mechanisms of teachers' boundary-crossing learning: identifying the boundaries of cross-boundary learning, coordinating relationships for cross-boundary collaboration, activating multiple cross-boundary perspectives, and deepening system-wide cross-boundary action. These strategies collectively aim to establish sustainable professional development ecosystems that support both individual teacher growth and collective institutional improvement. The study concludes that effective boundary-crossing learning mechanisms are essential for achieving high-quality and equitable compulsory education, offering theoretical insights and practical guidance for educational policymakers, school administrators, and teacher educators seeking to optimize teacher development within school-group contexts.

Keywords: compulsory education; school groups; teacher development; boundary-crossing learning; educational equity

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1. Introduction: Practical Demands of Quality and Equity in Compulsory Education for Teacher Allocation

High-quality and equitable compulsory education reflects a comprehensive advancement beyond mere resource distribution toward multidimensional quality improvement, aiming to realize high-quality and equitable development across all elements, the entire educational process, and every dimension [1].

Against the backdrop of a marked decline in the school-age population, aggregate saturation and structural shortages in the primary and secondary teaching workforce have become increasingly evident [1]. By transcending the organizational boundaries of individual schools, the school-group model establishes institutional mechanisms for coordinated teacher allocation across member schools and educational stages, thereby helping to mitigate localized mismatches between teacher supply and demand. Teacher redeployment within a school group extends beyond simple personnel matching through cross-school or cross-stage transfers; fundamentally, it involves the strategic reallocation of high-quality educational resources. Its objective should not be limited to addressing temporary staffing gaps, but rather to optimize the group's overall staffing structure and

enhance educational quality through purposeful, evidence-informed teacher mobility. However, teachers are not interchangeable human resources whose deployment can be determined solely by headcount. Significant differences exist among them in disciplinary knowledge, experience across educational stages, pedagogical practices, and professional identities. Consequently, administratively mandated arrangements such as rotation and exchange may alleviate short-term numerical imbalances but seldom resolve the underlying misalignment between teachers' competencies and the specific requirements of assigned roles.

Teachers constitute the most fundamental yet highly heterogeneous human resource in educational organizations [2, 3]. Currently, cross-school and cross-stage staffing adjustments rely predominantly on administrative interventions—including rotation and exchange—rendering them largely temporary or transitional in nature. While such measures may ease immediate imbalances in teacher supply and demand, they often fail to reconcile deeper discrepancies among institutional staffing needs, individual teacher competencies, and long-term organizational development goals. These limitations engender a range of practical challenges requiring timely and systematic attention.

1.1. A Disconnect between Staffing Needs and Individual Competencies

Current teacher allocation continues to prioritize adherence to authorized staffing quotas and numerical post-filling, which frequently results in mismatches such as "no authorized posts available," "over quota and overstaffed," "formally over quota yet functionally understaffed," and "vacant posts left unfilled." While this quota- and headcount-oriented approach may temporarily alleviate vacancy issues, it fails to assess whether transferred teachers possess the requisite knowledge structures, cross-stage teaching experience, and adaptive capacities for specific positions. Teachers reassigned across schools, educational stages, or subject areas must undergo cognitive, psychological, and organizational adaptation [4]. In the absence of systematic competency diagnosis, targeted retraining, and sustained follow-up support, reassignment risks becoming a purely formal exercise—yielding the latent mismatch of "a filled position without an appropriate competency fit."

1.2. Insufficient Two-Way Adjustment Across Schools and Educational Stages

Demographic change has led to asynchronous fluctuations in teacher demand across schools and educational stages. Consequently, teacher allocation must evolve from simple numerical adjustment toward integrated optimization of post structures, educational stage configurations, and spatial distribution. In practice, however, teacher mobility remains largely governed by administrative gap-filling and one-way reassignment. Schools involved in teacher transfers often lack mechanisms for reciprocal knowledge exchange, capability feedback, and sustained collaboration. Institutional barriers—including fragmented interdepartmental coordination—further constrain redeployment. As a result, cross-school and cross-stage mobility frequently devolves into temporary personnel adjustments, lacking a two-way regulatory mechanism that integrates mutual staffing support, professional reciprocity, and knowledge return [4].

1.3. Teachers' Passive Compliance with Organizational Change

When teacher redeployment overlooks teachers' emotional experiences, professional values, and rights to participation, it may diminish their sense of agency and weaken procedural alignment. In centrally guided educational initiatives, educators sometimes respond through subtle, nonconfrontational behaviors that reflect limited acceptance of externally imposed expectations [5]. Surface-level compliance, therefore, does not necessarily indicate authentic commitment to organizational adjustments. When staffing reallocations within school groups lack transparency, meaningful opportunities for input, or structured mechanisms for mutual consultation, educators may exhibit reduced involvement, perfunctory implementation, or quiet disengagement—undermining the professional coherence and long-term effectiveness of collaborative improvement efforts.

1.4. A Deficit of Organizational Learning Mechanisms That Activate Professional Growth

Teacher development within school groups continues to depend primarily on centralized training and model teaching by experienced educators [6]. Concurrently, in-service training frequently features content that lacks specificity to local contexts and is constrained by uneven access to professional development opportunities, hindering the establishment of a learning-organization mechanism rooted in shared vision, systematic planning, and collaborative growth. Furthermore, without a stable collaborative culture, sustained organizational commitment, and robust professional support across schools and educational stages, teacher participation tends to become perfunctory task execution, failing to sustain professional motivation or instructional improvement. Research indicates that a collaborative school culture significantly enhances teachers' instructional strategies, with teacher efficacy and organizational commitment serving as key mediating factors. Thus, the core deficit lies in the absence of enduring organizational conditions that consistently foster teacher engagement, collaboration, and professional advancement.

2. Value Implications of Teachers' Boundary-Crossing Learning in School Groups

2.1. Insights from Boundary-Crossing Theory

Boundary-crossing theory explains discontinuities between communities associated with different organizations and professional domains, arising from differences in goals, knowledge systems, norms, language, identities, and interests, and examines how sustained interaction can reconfigure relations across domains. Boundary crossing does not aim to eliminate boundaries or standardize practices. Rather, it acknowledges diversity and maintains the distinctiveness of participating practices while supporting communication, mutual understanding, and collaboration through boundary spanners, boundary objects, knowledge exchange, meaning negotiation, and coordination. Boundary spanners may be institutions, groups, or individuals that bridge organizational divides and facilitate communication across them, including through the development and use of boundary objects. Boundary objects possess sufficient structural stability to support shared recognition while retaining interpretive flexibility required by different practices. They therefore enable collaboration even when participants have not reached full consensus. In teaching, examples include curriculum standards, student work samples, and instructional designs. Boundary objects serve both as tools and as products of boundary crossing, and effective boundary objects are accessible and usable by all participants. Boundary crossing is not a one-time, unidirectional transfer; it is a sustained and reciprocal interaction between actions and contexts and often involves multiple, overlapping crossings. The selection of strategies and deployment of relevant elements must therefore be responsive to specific practical conditions [7]. From a process perspective, boundary crossing is conceptualized through four interrelated mechanisms: identification, coordination, reflection, and transformation. Identification involves distinguishing the identities, boundaries, and interrelations of different practices while recognizing the legitimacy of difference. Coordination strengthens linkages and collaboration across practices through shared boundary objects even when differences persist. Reflection involves re-examining one's own and others' practices from alternative perspectives and deepening mutual understanding through comparison and dialogue. Transformation refers to the reconstruction of existing knowledge, relationships, and patterns of action. In concrete boundary-crossing processes, these mechanisms interact and recur, enabling boundaries to shift from barriers to collaboration into spaces for learning and innovation.

Teachers' boundary-crossing learning has been described as an informal mode of professional learning in which educators situated in different organizations and communities of practice move beyond the confines of their usual educational settings, engage with participants from other communities, and thereby restructure their knowledge and advance their professional growth. In the context of school groups, the term refers more specifically to teachers moving across schools or educational stages within the group, where prior knowledge and experience interact with new forms of

professional knowledge. Through this process, teachers adapt to integrated and vertically coherent educational provision, expand their professional capabilities, and ultimately contribute to quality improvement and equitable outcomes. In other words, teachers' boundary-crossing learning is not an automatic result of teacher mobility; it is a critical mediating process linking teacher movement to enhancements in school quality. Its deeper value lies in shifting professional development from experience accumulation within a single school toward collaborative knowledge construction across schools, enabling external support to be internalized as member schools' capacity for self-improvement and, through improvements in classroom teaching and student learning, creating practical conditions for quality improvement and equity within the group [8].

Within school groups, teachers' boundary-crossing learning takes place in practical environments where multiple boundaries overlap. Four types of boundary are particularly salient: disciplinary boundaries, school-level boundaries, organizational boundaries between schools, and boundaries related to professional identity and role. Disciplinary boundaries arise from differences in knowledge systems, professional discourse, and pedagogical approaches. School-level boundaries reflect variations in curricular goals, developmental expectations, and assessment frameworks. Organizational boundaries stem from differences in school culture, operational arrangements, and resource contexts. Identity and role boundaries involve adjustments in professional self-conception, authority-responsibility relationships, and role expectations [5]. These boundaries do not exist in isolation; they intersect in cross-school, cross-stage, and cross-disciplinary practice and are continually engaged through the mechanisms of identification, coordination, reflection, and transformation (As shown in Figure 1).

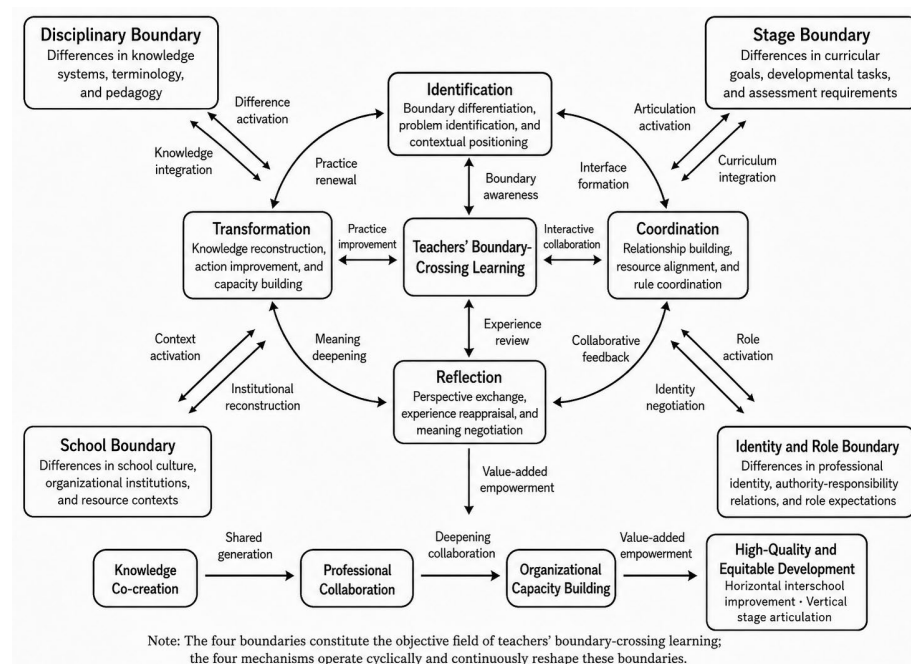


Figure 1. Boundary-Mechanism-Outcome Model of Teachers' Boundary-Crossing Learning

2.2. Value Implications of Teachers' Boundary-Crossing Learning

2.2.1. Responding to Policy Requirements for a High-Quality Professional Teaching Workforce

Recent national guidance emphasizes enhancing teachers' capacity to educate students and advancing innovation in professional development. As quality and equity in basic education evolve from equitable access to resources toward equitable outcomes in learning, teacher development must shift beyond numerical expansion and geographic reallocation to sustained professional growth and fair access to developmental opportunities. Complementary national initiatives further stress the need for balanced

advancement in the size, quality, and structural composition of the teaching workforce, with a strong focus on strengthening professional competence. These directions reflect a broader transition—from isolated, school-centered models of teacher cultivation—to coordinated regional efforts, collaborative engagement across institutions, and shared use of educational resources. Consequently, teachers' professional learning is increasingly situated within open, networked environments that transcend organizational boundaries.

The school-group model serves as a suitable organizational framework to support these objectives. Conventional approaches to teacher development often foster insular professional cultures and fragmented resource utilization. In contrast, group-wide professional development fosters reciprocal interaction among educators and enables collaborative problem-solving around authentic instructional challenges. In this way, school groups facilitate boundary-crossing learning by reshaping professional relationships—guiding teachers away from reliance on routine practice and toward comparative analysis, joint sense-making, and reflective engagement across diverse teaching contexts [9].

2.2.2. Enhancing the Professional Adaptability of Teacher Mobility Amid Demographic Change

As the birth population declines and school-age cohorts shift sequentially across educational stages, school layouts, student-place supply, and teacher demand exhibit marked stage-specific differences. Several provinces have introduced policy measures to address these shifts. For instance, one province has established a dynamic adjustment mechanism for teacher staffing quotas and personnel allocation, and standardized cross-stage and cross-subject teacher deployment. Another province's implementation plan for building a high-quality and equitable system of basic public education services emphasizes dynamic teacher management across urban and rural areas, educational stages, schools, and school groups, while also strengthening training in curriculum implementation and educational research. However, spatial relocation of a teaching post does not automatically entail the transfer of professional competence. Although primary and junior secondary education belong to the same basic education system, they differ significantly in instructional organization and teachers' professional identities. Whether mobility occurs within a school group or not, a primary school teacher transitioning to a junior secondary school is not merely rotating between posts; the teacher must navigate multiple boundaries related to stage-specific curricula, instructional cultures, and professional identities.

Thus, seemingly active teacher mobility may amount to little more than mechanical personnel replacement if not accompanied by sustained professional learning. From the perspective of boundary-crossing theory, the central issue lies not in whether teachers can move, but whether they can reinterpret the rules of practice and reconstruct their professional identities upon entering a new school or educational stage. Teacher mobility therefore cannot be treated solely as a matter of resource allocation within personnel administration; it must constitute boundary crossing in the professional learning sense. As an important organizational vehicle, the school group should ensure that the mobility of personnel coincides with the circulation of knowledge, and that job reassignment aligns with the reconstruction of professional competence.

2.2.3. Advancing Teacher Development and Member Schools' Endogenous Capacity in Tandem

Evidence from exemplary school groups suggests that teachers' boundary-crossing learning first promotes individual professional development. Through cross-school and cross-stage engagement, teachers encounter diverse student profiles, varied curricular interpretations, and differing pedagogical approaches, enabling them to re-examine their own practice through alternative perspectives. However, individual knowledge acquisition does not automatically translate into sustainable improvement capacity for member schools. Policy guidance emphasizes that high-quality leadership, complementary strengths, and resource sharing aim not to concentrate expertise among a

limited number of experienced educators, but to elevate educational quality across all schools in the group. School groups therefore rely on teacher development centers, cross-school professional learning communities, expert-led teaching studios, and collaborative project teams to institutionalize insights gained through joint practice. Only then can resource allocation generate quality-enhancing outcomes and ensure equitable, enduring improvements.

2.3. Teachers' Boundary-Crossing Learning as a Normative Pathway for School-Group Development

By bringing formerly separate schools into an integrated organizational system, school groups create institutional space for teachers to work across schools and educational stages. Within such groups, however, teacher learning is not a routine exchange among homogeneous actors. It is a process in which teachers move through multiple practice settings and rebuild professional linkages under conditions of persistent difference.

First, differences among multiple practices constitute the boundary contexts of teacher learning. Member schools within a school group differ in student composition, curricular traditions, and organizational culture, while primary, junior secondary, and senior secondary teachers operate within distinct frameworks of student development. When such interschool and cross-stage differences impede understanding, collaboration, or joint decision-making during organizational integration, they function as "boundaries" in the context of boundary-crossing learning. Teachers' boundary-crossing learning within school groups requires them to re-examine the value and limitations of their own experience by engaging with perspectives from other settings [1].

Second, boundary-crossing actors and shared objects serve as key mediators of professional linkage. Because teachers' knowledge is tacit and context-dependent, boundary-crossing learning cannot be reduced to the simple transfer of experience across settings; it relies on stable organizational platforms, clearly defined professional roles, and collaboratively pursued tasks. To support integrated teacher development, some education groups have established dedicated teacher development centers that provide structured platforms and pathways for professional growth. These centers focus on authentic classroom challenges and individual teaching difficulties, assist teachers in formulating professional and career development plans, and clarify growth trajectories. Other groups have implemented matrix-based management models organized around core functions, functional clusters, horizontal grade-level coordination, and vertical subject-area alignment—facilitating teacher interaction across schools and grade levels. Organizational linkage, however, remains only a precondition for boundary-crossing learning. Institutional interfaces yield meaningful professional understanding and practical improvement only when teachers engage in sustained interpretation, negotiation, and empirical validation centered on real-world educational problems.

Third, teacher learning within school groups entails multilevel transformation [10]. Boundary-crossing interaction initially reshapes teachers' curricular understanding, instructional judgment, and professional identity. Through sustained peer collaboration, individual insights can evolve into widely recognized knowledge and standards, and become embedded in curriculum design, educational research, and teacher development systems—ultimately contributing to organizational capacity. Some education groups describe campus-level teacher communities as "motivation clusters" and identify experienced teachers alongside their research partners as key contributors to advancement; simultaneously, distributed and participatory governance structures have emerged at the group level. Such transformation does not occur automatically and must be validated through measurable improvements in classroom practice, school-level capacity, and student development outcomes.

2.4. Mechanisms for Teachers' Boundary-Crossing Learning in School Groups

Although school-group arrangements create institutional space for cross-school mobility and cross-stage collaboration, integrated organizational membership does not

automatically ensure coherence in professional practice. Teachers entering different schools, educational stages, or subject domains still encounter discontinuities in knowledge systems, professional language, organizational norms, and identity expectations. Teachers' boundary-crossing learning must therefore navigate the structural complexities arising from overlapping boundaries of practice. Anchored in students' continuous development and the group's shared educational mission, this learning process identifies barriers across schools and stages. Boundary-crossing theory underpins pathway development through four core mechanisms—identification, coordination, reflection, and transformation. Accordingly, teachers' boundary-crossing learning can be operationalized as identifying boundaries of practice, coordinating cross-boundary relationships, deepening perspective-based reflection, and advancing the transformation of practice.

2.4.1. Identifying the Boundaries of Boundary-Crossing Learning

Teacher learning within school groups should not begin with the transmission of pre-established experience. Instead, it should focus on identifying authentic discontinuities in cross-school and cross-stage practice that affect students' continuous development. Interschool differences are primarily reflected in student composition, curricular traditions, and approaches to educational research, whereas cross-stage differences involve transitions in educational goals, knowledge progression, learning modes, and assessment requirements. Such differences do not in themselves constitute boundaries. They become boundaries only when they impede teachers' understanding, collaboration, or joint decision-making. School groups should therefore establish an interconnected issue system comprising group-wide common issues, stage-articulation issues, and school-context issues. Group-wide issues should focus on key competencies, student development, and quality improvement; stage-articulation issues should address discontinuities in curricular goals, knowledge progression, and modes of learning; and school-context issues should respond to specific difficulties arising from varying student foundations and instructional practices. Issue generation should be grounded in classroom observation, student work, learning data, and teacher narratives, rather than allowing school hierarchies, teacher status, or standardized training content to substitute for professional diagnosis.

2.4.2. Coordinating Cross-Boundary Collaborative Relationships

First, the overlap of multiple boundaries within school groups means that teacher learning cannot be confined to unidirectional transmission from a lead school to member schools or across educational stages. Instead, school groups should establish professional networks that connect schools horizontally and educational stages vertically. Teacher development centers, integrated cross-stage research groups, and project teams can support interschool collaboration and joint inquiry into stage articulation. Cross-school communities should examine how pedagogical practices function in diverse school contexts, while cross-stage research groups should clarify vertical progression around core concepts, key competencies, and student development trajectories. Second, the effective functioning of professional networks relies on boundary spanners who operate across multiple contexts. Teachers fulfilling linkage roles must grasp both the practical realities of different schools and the curricular logic and professional terminology of adjacent stages. Their responsibility is not to deliver standardized solutions but to interpret contextual differences, coordinate collaborative relationships, and enable mutual knowledge exchange. School groups should therefore develop teacher leaders capable of contextual understanding, professional communication, and knowledge adaptation through cross-stage placements, joint teaching, project leadership, and rotating research duties—while minimizing overreliance on a limited number of expert teachers from lead schools. Finally, cross-boundary coordination requires shared artifacts—such as curriculum standards, conceptual progression maps, student growth portfolios, classroom videos, and assessment rubrics—that serve as common reference

points. These artifacts support collective engagement while permitting schools and stages to interpret and adapt them according to local needs.

2.4.3. Activating Multiple Cross-Boundary Perspectives

In practice, professional learning within school groups often takes the form of model lessons, experience sharing, and standardized lesson planning. Teachers may observe teaching practices without fully grasping the underlying student backgrounds, curriculum requirements, and school-specific contexts that inform pedagogical decisions. Cross-stage exchange limited to isolated content within a single stage can similarly reduce vertical coherence to mere sequencing of discrete knowledge points [11, 12]. Teachers' boundary-crossing learning must therefore reconnect with curriculum implementation and instructional practice, using collaborative work to reinterpret subject matter and drive meaningful improvements in professional practice. School groups should establish integrated professional-learning settings centered on "the same problem across different schools" and "the same problem across different stages." The former employs a shared instructional challenge to compare how teachers in different schools diagnose learning needs, handle content, and organize classroom instruction. The latter focuses on a common core concept, key competency, or learning objective, examining its cognitive demands and developmental manifestations across educational stages.

Integrated professional learning must be grounded in observable evidence from practice. Teachers' professional knowledge is deeply situated in classroom contexts, and abstract description alone cannot adequately reveal the reasoning behind pedagogical decisions or the outcomes of instructional actions. Classroom videos, lesson excerpts, student assignments, learning progressions, assessment results, and project outputs make implicit practical knowledge accessible for joint observation and analysis. On this foundation, school groups can implement a cyclical process comprising collaborative problem analysis, co-designed instruction, context-adapted implementation, evidence-informed evaluation, and iterative refinement.

2.4.4. Deepening System-Wide Boundary-Crossing Practices

Individual teachers' acquisition of new ideas and methods through boundary-crossing activities does not automatically translate into enhanced institutional capacity for improvement. The key to realizing quality and equity outcomes lies in systematically aligning transformation across individual, team, school, educational stage, and inter-institutional levels [6, 9]. At the individual level, attention should focus on whether teachers apply insights gained from boundary-crossing learning to diagnose students' learning needs, design instruction, implement classroom practices, and conduct assessment—thereby converting cognitive shifts into observable improvements in teaching practice. At the team level, collaborative reflection should convert personal experience into shared professional language and agreed-upon norms, while effective strategies should be codified into adaptable, evidence-informed resources. At the school and educational-stage levels, boundary-crossing learning must evolve from isolated initiatives into sustained, embedded practice. Schools should tailor available resources to their specific student profiles and operational contexts; adjacent stages should jointly develop aligned curriculum frameworks, instructional sequences, and longitudinal student development records to minimize gaps and inconsistencies in learning progression. At the inter-institutional level, a dedicated teacher development center should coordinate cross-school and cross-stage efforts, supporting continuity through workload accommodations, performance recognition mechanisms, and integrated digital infrastructure. Evaluation should assess not only changes in teachers' professional judgment and instructional behavior, but also reductions in systemic discontinuities, growth in schools' capacity for self-directed improvement, and measurable gains in students' access to high-quality learning experiences. Only through such integrated alignment can boundary-crossing learning extend beyond isolated gains to strengthen professional capability across the broader education ecosystem, reinforcing both horizontal collaboration among schools and vertical coherence across educational stages.

3. Conclusion

As quality and equity in basic education shift from resource allocation toward sustained quality improvement, the cross-school and cross-stage mobility of teachers must evolve beyond personnel reassignment into a continuous process of professional learning. Drawing on boundary-crossing theory, school groups can orient learning around challenges emerging across institutional, developmental, and organizational boundaries; leverage boundary-spanning roles and shared artifacts to strengthen professional connections; advance knowledge translation and collaborative practice development through integrated professional learning; and consolidate individual learning outcomes into durable institutional capacity. As school-group development and vertically coherent education systems mature, teachers' boundary-crossing learning holds potential to enhance interschool collaboration and cross-stage alignment—thereby reinforcing the practical foundations for equitable, high-quality basic education.

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