

CASE STUDY

Cross-boundary recognition mediates global standards and local practices for children's physical activity and health accompanists

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Abstract

Against the backdrop of globalization, this study addresses the core tension between international standardization and local specificity in the recognition of vocational education learning outcomes. It adopts a qualitative case study design, empirically examining the development of the International Occupational Standard for children's physical activity and health accompanists. The research draws on analysis of policy documents, draft and revised occupational standards, and project process archives, which are complemented by data from expert workshops and related consultations. We conceptualize "cross-boundary recognition" as a core mediating construct that links globally standardized rules with locally situated practices through two interlocking mechanisms: "Contextual adaptation" involves translating and recalibrating international competence frameworks to fit local children's healthcare context—the Chinese context, in this study—while "rule validation" refers to the iterative testing of local practices against international standards to distill transferable and measurable indicators. Integrating these mechanisms into an essence-mechanism-value framework, the study offers a practical pathway for reconciling global legitimacy with local relevance in the international recognition of learning outcomes in vocational education. It thereby provides actionable guidance for cross-border certification and the localization of emerging health promotion occupations.

Keywords

vocational education learning outcomes, international recognition, cross-boundary recognition, organizational legitimacy, local specificity


INTRODUCTION

Research on boundary crossing and identity work in the field of vocation education has examined how actors negotiate who we are and what counts as valid when collaborations span cultures, jurisdictions, and organizations. Early discussions of transboundary identity emerged from studies of cross-border mobility and the diverse affiliations established while living and working across national boundaries. Later organizational research expanded the

meaning of "boundary" from territorial space to contested domains of norms, values, and institutional expectations, highlighting tensions between identities in cross-boundary collaboration (Amosha *et al.*, 2019; Li, 2018; Markuszewska *et al.*, 2016; Shen *et al.*, 2019; Tang *et al.*, 2017). Building on this scholarship, the present study advances cross-boundary recognition as an analytically tractable manifestation of transboundary identity in transnational vocational education and training (TVET). Cross-boundary recognition is the process through which the legitimacy,

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 Received: 8 November 2025; Revised: 13 January 2026; Accepted: 11 March 2026
<https://doi.org/10.54844/vte.2025.1095>

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comparability, and meaningfulness of learning outcomes and qualifications are evaluated across jurisdictions.

Against the backdrop of globalization and the internationalization of TVET, the mutual recognition of learning outcomes has become both a policy priority and a persistent theoretical challenge. From an organizational legitimacy perspective, outcome-based qualification frameworks are often treated as prerequisites for credible cross-border recognition because they provide shared levels and descriptors that enable comparability (*e.g.*, regional or supranational reference frameworks). At the same time, vocational learning remains deeply embedded in local contexts, where country-specific competency standards, occupational cultures, and pedagogical traditions shape what is considered valid learning. This generates a core tension: The more recognition schemes rely on universal outcome descriptors to ensure interoperability, the more they risk misrepresenting locally grounded meanings and valuable attributes in vocational learning. In practice, this tension is frequently reflected in the limited translation of formal recognition into actual mobility or utilization outcomes.

Three major debates structure existing discussions of cross-boundary recognition within the broader context of international mutual recognition of TVET learning outcomes. First, the standardization-legitimacy view emphasizes that universal outcome standards and comparable levels are central to dismantling national barriers to skill recognition and building institutional trust. Second, the local specificity view suggests that recognition cannot be reduced to technical equivalence because local occupational cultures, pedagogical rationales, and socio-cultural meanings constitute the bedrock of what recognition should preserve. Third, and most critically, the literature often remains divided between these perspectives, leaving a gap in the discourse regarding how legitimacy requirements and local meanings are negotiated through concrete recognition processes. As a result, there has been limited systematic explanation of how unified rules can be reconciled with differentiated identities and practices in international mutual recognition.

Grounded at the intersection of identity theory and organizational legitimacy theory, this study argues that cross-boundary recognition can serve as a mediating construct linking global standards and local practices. Theoretically, it clarifies the boundaries and interfaces between organizational legitimacy and local particularities, and it proposes a dialogical account in which the two can coevolve and colegitimate one another. Specifically, it conceptualizes two interrelated mechanisms through which cross-boundary

recognition becomes workable: Contextual adaptation (the translation of standardized descriptors) and rule validation (the distillation of locally meaningful competencies into internationally communicable and assessable indicators).

Practically, this lens helps explain contradictions frequently observed in mutual recognition arrangements, such as formal recognition with limited utilization and technical interoperability without actual mobility. In other words, qualifications may be recognized on paper while remaining weakly convertible into real employability gains, mobility opportunities, or stable professional identities. By examining how recognition operates at the interface between standardized frameworks and context-specific practices, this study aims to inform the development and evaluation of more workable and context-sensitive mutual recognition schemes. We refer to it as the International Occupational Standard for children's physical activity and health accompanists. This new occupational standard provides a novel approach to talent development and practical implementation within the health industry.

Accordingly, this study addresses the following research questions (RQ). RQ1: How are globally circulated templates translated into locally operable standard items and assessment routines? RQ2: How are locally specific practices distilled into indicators that can be validated and recognized across contexts? RQ3: How can the translation for adaptation and distillation for validation mechanisms be integrated into a coherent framework that explains when and why mutual recognition becomes effective across contexts?

To address these questions, this study draws on an empirical case study of transnational mutual recognition in the TVET context. We used policy and standards documents, expert consultations, and pilot implementation records to trace how cross-boundary recognition is negotiated and stabilized across contexts.

METHODOLOGY

Research design

This study adopts a qualitative case study design. It examines the development, refinement, and pilot implementation of the International Occupational Standard for children's physical activity and health accompanists as a critical case of cross-boundary recognition in TVET. This case was selected because it lies at the intersection of an emerging child health promotion occupation, international standard-setting logics, and their local implementation in China. It thus provides a suitable empirical setting for examining how organizational legitimacy and local

specificity are negotiated in practice. The case boundary covers the standard-development cycle from initial drafting through expert consultation, Delphi-based indicator refinement, and small-scale pilot testing across practice sites from November 2023 to August 2025. The overview is presented in Table 1.

Participants

A purposive criterion-based sampling strategy was used to recruit stakeholders who directly participated in at least one stage of standard review, development, or implementation. In total, 42 adult participants contributed across the process, including (1) frontline practitioners and managers ($n = 20$) from schools, community organizations, and training institutions; (2) domain and internationalization experts ($n = 7$) in sports science, public health, vocational pedagogy, and international qualification frameworks; and (3) representatives from competent authorities and partner organizations ($n = 15$), including policy officers, professional association representatives, and project managers responsible for standard review and implementation coordination. A pilot implementation was conducted by a practitioner subgroup ($n = 15$) drawn from the frontline sample across eight selected schools and training institutions. In addition, 68 children participated in the pilot sessions. Only aggregated implementation indicators derived from routine monitoring and platform records were used in the analysis.

Data sources and materials

Data were collected to document both the formal development of the standard and its practical testing. The following types of sources were used.

Policy and standards documents

Domestic and international policy texts and standards related to vocational education, learning outcomes, and health promotion were employed, while international qualification and competency frameworks were used as reference points.

Draft and revised versions of the occupational standard

Initial drafts, consultation drafts, and the final approved version were consulted, including tracked changes and stakeholder annotations.

Workshop materials

Agendas, minutes, slide decks, working notes, and revision logs produced during expert workshops were reviewed.

Delphi materials

Data came from questionnaires, rating sheets, and round-by-round feedback summaries documenting expert judgments on indicator clarity, importance, and feasibility.

Pilot implementation records

Finally, we used platform logs and site archives (session records, participation and adherence logs), selected quantitative indicators (e.g., session frequency, heart rate and related records where applicable, movement quality ratings, and system-generated feedback reports), and qualitative materials (practitioner reflections, home-school communication records, and site implementation reports).

Data collection procedures

Document corpus construction

A document corpus was compiled from official portals, project archives, and partner institutions, including policy and standards texts, reference frameworks, and all available standard versions. The materials were dated, catalogued, and organized to maintain an audit trail.

Expert workshops

Three expert workshops were convened to map reference competence and qualification frameworks onto role- and task-specific competencies in the Chinese context. Competence units, performance criteria, and indicator wording were iteratively revised. Decisions and rationales were documented via minutes, working notes, and version-controlled revisions.

Delphi study

A three-round Delphi study was conducted with seven experts. Panelists rated each indicator's clarity, importance, and feasibility on a 5-point scale and provided written comments. After each round, anonymized aggregated results and synthesized feedback were returned to the panelists to inform subsequent ratings. Consensus was assessed as the proportion of experts rating an indicator as "important or very important" (4-5). Indicators reaching the predetermined threshold ($\geq 75\%$) were retained; those below were revised and reevaluated, and indicators with persistently low agreement were removed. Round 3 confirmed stability and finalized the indicator set.

Pilot testing and process documentation

Small-scale pilots were implemented across eight selected schools and training institutions. A practitioner subgroup ($n = 15$) enacted the roles and tasks proposed in the draft standard. Sixty-eight children participated in pilot sessions, allowing aggregated implementation indicators to be derived from routine monitoring and platform logs. Process data (including session frequency, participation and adherence, heart rate records where applicable, and movement quality ratings) and qualitative feedback (including practitioner reflections, parent/guardian feedback, and implementation reports) were collected to test feasibility and inform the subsequent refinement of

Table 1: Overview of data sources, collection methods, and analytical purposes

Data type	Sources/participants	Collection method	Main analytical purposes
Policy and standards documents	Domestic and international agencies, qualification bodies	Retrieval from official portals and archives	Contextualizing global-local frameworks; identifying reference logics for alignment
Draft and revised occupational standards	Standard development taskforce and expert committees	Project archives; tracked-change files; annotated drafts	Tracing evolution of competence descriptors and indicators
Workshop materials	Stakeholders drawn from the three adult groups	Audio records, minutes, working notes, slides	Examining how competencies were negotiated and contextualized
Delphi questionnaires and feedback	Expert panel ($n = 7$)	Online/email questionnaires across three rounds; round summaries returned to panelists	Building consensus on indicator importance, clarity, and feasibility
Pilot implementation process data	Practitioners implementing the pilot ($n = 15$) across eight sites	Platform logs, attendance records, implementation reports	Assessing feasibility and robustness of descriptors and operational procedures
Quantitative pilot indicators	Child participants in pilot sessions ($n = 68$)	Aggregated heart rate records, movement assessments, adherence statistics	Describing implementation patterns; supporting feasibility judgments
Reflective reports and communication logs	Practitioners, parents/guardians, and project coordinators	Written reflections, home-school communication records	Understanding local perceptions, constraints, and acceptance

competence descriptors and operational thresholds.

Small-scale pilots were implemented across eight sites by the practitioner subgroup ($n = 15$). Children participated in routine sessions, enabling aggregated implementation indicators to be derived from monitoring and platform logs. Process indicators (including session frequency, adherence, and heart rate summaries where applicable) and qualitative feedback (practitioner reflections, parent/guardian feedback, and site reports) were collected to test feasibility and refine descriptors and operational thresholds.

Data analysis

Qualitative analysis

The study was primarily qualitative. Textual materials—including policy and standards documents, successive versions of the occupational standard, workshop minutes/notes, Delphi comments, reflective reports, and home-school communication records—were managed in NVivo and coded at the segment (meaning-unit) level. An iterative analysis was conducted in three steps.

First, open coding was used to label content related to competence definitions and wording changes, reasons for alignment with external frameworks, implementation constraints, and issues of cross-boundary recognition and comparability.

Second, these codes were consolidated into themes within a framework centered on cross-boundary recognition. At this stage, particular attention was paid to how two recurring considerations were balanced: Organizational legitimacy (alignment with internationally recognizable competency/qualification logics) and local specificity (feasibility within Chinese practice settings). Themes were refined around competence operationalization, indicator revision decisions, and the rationales recorded for those decisions.

Third, interpretations were strengthened through analytic demoing and targeted participant validation. Brief theme summaries and selected excerpts were shared with a small set of key informants (workshop organizers and lead experts) to check factual accuracy, clarify decision rationales, and flag potential misinterpretations. Their feedback informed the final refinements and supported the audit trail.

All textual materials (documents, standard versions, workshop records, Delphi comments, reflections, and communication records) were managed in NVivo and coded at the meaning-unit level. The analysis of these materials proceeded in three steps: (1) Open coding captured competence definitions, wording changes, alignment rationales, implementation constraints, and issues of cross-boundary comparability. (2) Codes were consolidated into themes using cross-boundary recognition as the organizing framework, with analytic attention to how organizational legitimacy (alignment with internationally recognizable logics) and local specificity (feasibility in Chinese settings) were balanced. (3) Credibility was strengthened through analytic demonstration, construction of an audit trail, and targeted participant validation. Brief theme summaries and selected excerpts were shared with key informants (workshop organizers and lead experts) to verify factual accuracy and clarify decision rationales; the feedback was incorporated into the final interpretation.

Mechanism-focused analysis

"Contextual adaptation" and "rule validation" were operationalized as mechanism categories within the coding framework. Contextual adaptation captured instances in which reference-framework elements were reformulated, restructured, or reweighted to fit practices that promote Chinese children's health. Rule validation captured instances in which local practices and pilot evidence were translated

into mutually recognizable descriptors, assessable criteria, and supporting documentation aligned with mutual recognition requirements. Coding decisions followed explicit criteria and were iteratively refined during thematic development.

Supporting quantitative analysis

Selected pilot indicators (counts, percentages, and distribution summaries) were summarized descriptively in SPSS to characterize implementation patterns and corroborate qualitative interpretations in terms of feasibility and threshold robustness. Quantitative analyses remained supportive rather than explanatory.

Overall, triangulation across documents, stakeholder inputs, and pilot records provided an empirically grounded account of how cross-boundary recognition was constructed through iterative interaction between standardized frameworks and context-specific practices.

EXPLICATION OF CORE CONCEPTS AND CLARIFICATION OF IMPLICATIONS

The core tension: Organizational legitimacy vs. local specificity

In this study, cross-boundary recognition refers to the degree to which vocational learning outcomes are deemed (1) comparable and legitimate across jurisdictions and (2) usable and implementable within a specific local training and service context. It is conceptualized as a mediating construct that links two requirements that often pull in different directions: Organizational legitimacy, reflected in alignment with widely recognizable learning outcome logics and level descriptors (e.g., outcome-oriented qualification frameworks, such as the European Qualifications Framework), and local specificity, reflected in the feasibility of delivering, assessing, and credentialing those outcomes under domestic institutional arrangements, resource conditions, and service settings.

Functionally, cross-boundary recognition therefore has a dual orientation. It is designed to enhance the cross-jurisdictional readability and comparability of learning outcomes while ensuring that descriptors remain meaningful for local training design, assessment practice, and service delivery. In this study, recognition is not treated as a choice between "international standards first" and "local practice first". Rather, the case suggests that workable recognition is typically produced through iterative alignment between these two alternatives, which are operationalized through two interrelated mechanisms: Contextual adaptation, whereby internationally recognizable descriptors are translated, restructured, or reweighted to fit local role-task

realities; and rule validation, whereby locally grounded practices and pilot evidence are documented and translated into more mutually communicable descriptors, assessment criteria, and supporting documentation.

The development of the occupational standard for children's physical activity and health accompanists illustrates this tension. On the one hand, the standard needs to remain intelligible within internationally recognizable competency and learning outcome discourses (e.g., competencies related to health promotion, support for physical activity, and self-management). On the other hand, it must embed capabilities specific to Chinese practice settings, such as designing exercise-based interventions for childhood obesity and developing workable solutions under common school- and community-based constraints (e.g., limited time, space, and staffing for accompanying young children). In this sense, cross-boundary recognition refers to the acceptance of a composite competence profile that combines broadly communicable descriptors with locally necessary content, enabling the occupational standard to be simultaneously legible across contexts and effective within each context.

The evolution of the boundary concept and transboundary identity

The analytical lens of transboundary identity builds on boundary studies and identity scholarship, which conceptualize "boundaries" not only as geographic or ethnic demarcations but also as symbolic and institutional distinctions that organize membership, authority, and evaluative criteria. In this tradition, boundaries matter because they shape what counts as legitimate knowledge, valid practice, and recognized status across social worlds.

As research has expanded from spatial and group boundaries to rule- and institution-based boundaries, scholars have increasingly examined how coordination is achieved when actors must work across sectors, jurisdictions, or professional communities. A useful finding is that standards, metrics, and assessment tools can function as "boundary objects". They are expected to remain robust enough to sustain comparability across sites and adaptable enough to fit local work routines and constraints. This provides a concrete entry point for theorizing transboundary identity in vocational domains—namely, as the identity work through which practitioners learn to interpret, translate, and enact externally circulating rules in locally workable ways while sustaining the legitimacy required for cross-boundary recognition.

Health promotion offers an illustrative case of how the relevant "boundaries" have shifted from physical demarcations to normative and governance borders. The Ottawa

Charter defines health promotion as activities that enable people to increase control over, and improve, their health (Chen & Chiu, 2018). Subsequent global statements, including the Bangkok Charter and the Shanghai Declaration, further emphasize acting on broader determinants of health and embedding health promotion within development agendas (Heard *et al.*, 2020), thereby reinforcing the need to translate shared global norms into context-sensitive implementation arrangements (Li & Song, 2025; Potvin & Jourdan, 2022; Wang, 2019; Wu & Fu, 2019).

For the present study, this evolution has a direct analytical implication: Cross-boundary recognition can be treated as an intermediary that links globally circulated normative templates with locally operable standards and assessment routines in multisector fields, such as children's physical activity and health promotion. For example, World Health Organization (WHO) guidelines provide evidence-based recommendations on physical activity and sedentary behavior for children and adolescents, which are globally comparable in intent but require local operationalization in measurement and service delivery. A practical illustration of such localization is China's health industry standard WS/T 10008-2023 (implemented in 2024), which specifies evaluation tools and methods for assessing physical activity levels among children and adolescents aged 7-18 years, including operational definitions and indicators related to sedentary behavior and screen time, as well as an intensity classification and recommended amounts. Together, these examples demonstrate how international reference logics can be retained while measurement instruments and thresholds are calibrated to domestic lifestyles and institutional realities, thereby creating a feasible basis for cross-boundary recognition.

Existing research on international recognition of vocational education learning outcomes

Building on the boundary-based account above, this section maps three strands of research on the international recognition of TVET learning outcomes and shows why the mechanism through which "recognition" is practically produced remains underspecified. In this paper, "trans-boundary identity" refers to actor-level identity work, whereas "cross-boundary recognition" denotes the intermediary outcome produced through standards and assessment routines.

Institutional frameworks and standards logic

The first strand of research examines the institutional frameworks and standards logic underpinning international mutual recognition, which is commonly framed as a dual safeguard of institutions and standards. Comparative studies

of Africa, Germany, the European Union, and the Association of Southeast Asian Nations have discussed how the integration of qualification frameworks can reduce discrepancies in descriptors and support comparability and credit transfer (Caruso *et al.*, 2020; Hamanaka & Jusoh, 2016; Roth, 2017; Salleh & Sulaiman, 2020; Shabani & Okebukola, 2017; Sun & Zhang, 2024). These developments are often interpreted through the lens of institutional isomorphism (DiMaggio & Powell, 1983), which describes how national systems converge under the influence of international norms and policy borrowing. A closely related line of work focuses on standard calibration in quality assurance, which seeks micro-level comparability of learning outcomes through competency-based education, industry agreements, and professional accreditation (Wang, 2018; Wang *et al.*, 2020; Zhu, 2015). Drawing on quality control theory (Deming, 1986), this literature prioritizes alignment and output comparability, but it often presupposes—rather than problematizes—how standardized descriptors are translated into diverse local learning processes and occupational practices.

While this first strand clarifies the institutional infrastructure that makes recognition technically possible, a second strand shifts attention to what recognition means in terms of identity, values, and cultural legitimacy.

Structural frameworks of cross-boundary recognition: From instrumental to constructive approaches

A second body of literature analyzes recognition frameworks at the level of meaning-making, tracing a shift from largely instrumental approaches toward more constructive and value-sensitive perspectives. Instrumental approaches treat standard alignment and identity recognition primarily as means of facilitating occupational and geographic mobility (Li, 2018; Song & Wang, 2019; Tang, 2023; Xu & Guo, 2022). Read through the lens of instrumental rationality (Weber, 1978), this work emphasizes the efficient removal of formal barriers to cross-border credential use while warning against formalism and "certification for certification's sake" (Wang *et al.*, 2020). By contrast, constructive approaches foreground cultural adaptation and value consensus as conditions for sustainable recognition (Tan *et al.*, 2023; Zhang & Mo, 2023). Grounded in social constructivism (Berger & Luckmann, 1966), this literature cautions against unilateral cultural hegemony and calls for recognition arrangements that respect local epistemologies, pedagogies, and professional cultures.

However, even value-sensitive frameworks face an implementation issue: Recognition is enacted through cross-border networks, negotiations, and localized work routines,

where rule coordination and contextual differentiation often collide.

Practical pathways and challenges: Network governance vs. local adaptation

A third research strand interrogates implementation pathways and challenges—especially the tension between regional network governance and locally adapted differentiation. On one hand, studies of transnational and transregional cooperation networks argue that network governance integrates rules and resources to coordinate recognition across borders (Hamanaka & Jusoh, 2016; Puscus, 2024; Wei, 2016), often drawing on multiactor governance (Rhodes, 1997). On the other hand, scholars emphasize the necessity of respecting local context in standard development and talent-training models (Li & Hui, 2022; Wang & Wei, 2021; Wei & Shi, 2008; Zhang & Mo, 2023). This approach resonates with culture-sensitive interpretive perspectives (Geertz, 1983). Across this strand, a recurring difficulty stems from balancing commonality and particularity—particularly in emerging service professions, where competencies are relational, context dependent, and not easily captured by conventional occupational descriptors.

Synthesizing the gap

Taken together, these three strands of scholarship explain the "why" and "what" of mutual recognition, but they do not adequately explain the "how"—the stepwise translation and validation work through which standards become locally workable yet internationally comparable.

First, few frameworks integrate standards, identities, and cultures into a single analytical model capable of capturing how organizational legitimacy, professional identity work, and local cultural meanings interact during recognition processes. Second, limited attention has been paid to composite learning outcomes in emerging service professions—such as children's physical activity and health promotion—where competencies span care, health, education, and community engagement. In this field, some initiatives tend to import international guidelines and competence templates without sufficient adjustment to local baseline data and institutional constraints, whereas others prioritize domestic requirements while underspecifying competencies emphasized in international sports and health communities. Both tendencies underestimate the intermediary role of cross-boundary recognition in linking global scientific norms with locally workable practice. Third, existing studies rely heavily on policy texts and system-level comparisons, with fewer mechanism-oriented case analyses of how concrete occupational standards are developed, negotiated, and iteratively revised in context. As a result, the processes through which global templates are

translated, contested, and re-embedded in local routines remain underexplored.

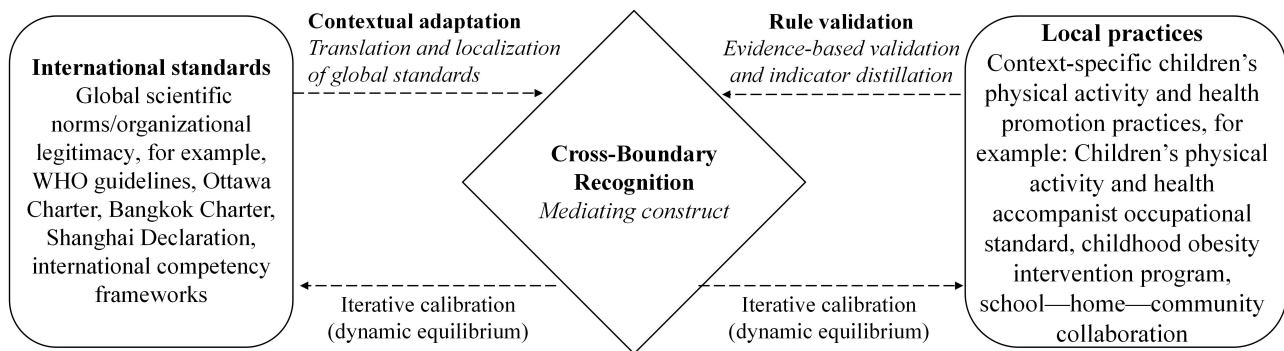
To answer the question of "how", we examine the development of the occupational standard for children's physical activity and health accompanists as a qualitative case of iterative standard-making, focusing on the two linked processes of contextual adaptation and rule validation.

Before developing the propositions, we outline the overall theoretical model that guided the analysis (Figure 1). The model conceptualizes cross-boundary recognition as a mediating construct between international standards and local practices in the international mutual recognition of vocational education learning outcomes. Here, cross-boundary recognition is treated as an intermediary outcome embodied in competence descriptors, indicators, and assessment routines that are simultaneously defensible under internationally referenced criteria and workable in local implementation.

As shown in Figure 1, international standards represent globally endorsed scientific norms and organizational legitimacy benchmarks (e.g., WHO-aligned guidance, major health promotion charters or declarations, and international competency frameworks). Local practices refer to context-specific children's physical activity and health promotion systems, institutional arrangements, and pedagogical routines in China (e.g., the children's physical activity and health accompanist occupational standard, obesity intervention programs, and school-home-community collaboration).

Cross-boundary recognition emerges when these two domains are bidirectionally activated through two interlocking mechanisms. Contextual adaptation involves the translation of global standards into operational competence descriptors and indicators that are feasible and meaningful in local service contexts. Rule validation subjects locally developed competencies and practices to evidence-based validation and indicator distillation, yielding measurable, comparable, and transferable indicators that can support cross-border recognition. Through iterative feedback between contextual adaptation and rule validation (Figure 1), the model predicts a dynamic equilibrium and iterative refinement—that is, ongoing calibration in which revisions to standards or skills aim to preserve both global legitimacy (comparability) and local relevance (feasibility).

On this basis, the following subsections develop propositions that specify the model's premise (bidirectional activation), mechanisms (adaptation and validation), outcome (dynamic equilibrium/iterative refinement), and boundary



Premise: Bidirectional activation of international standards and local practices

Outcome: Dynamic equilibrium between global legitimacy and local relevance (*i.e.*, iterative refinement that maintains both comparability and feasibility)

Boundary: Children's physical activity and health industry-oriented vocational education learning outcomes

Figure 1. Theoretical model of cross-boundary recognition in the international mutual recognition of vocational education learning outcomes.

conditions (children's sport- and health industry-oriented vocational education learning outcomes).

Core proposition deduction and logical argumentation

Building on Figure 1, this section formulates four sets of propositions—a premise, mechanisms, an equilibrium condition, and boundary conditions—to explain how cross-boundary recognition is generated and sustained as a mediator between organizational legitimacy embedded in international standards and local particularities embedded in Chinese practice.

Fundamental proposition (P1): Bidirectional activation is a prerequisite for cross-boundary recognition

Cross-boundary recognition in children's physical activity and health promotion standards requires the simultaneous activation of international standards (as sources of scientific legitimacy) and local practices (as sources of implementation capacity). If international standards are activated without adequate engagement with local realities, they may remain formally aligned yet operationally unfeasible. Conversely, if local practices are activated without reference to internationally recognizable principles, standards may be locally workable but lack the legitimacy and comparability needed for cross-border recognition. Therefore, bidirectional activation constitutes the minimum condition under which cross-boundary recognition can plausibly emerge and remain meaningful.

Progressive proposition (P2): Bidirectional activation is realized through contextual adaptation and rule validation

Drawing on the case process, this study specifies a two-

stage mechanism through which bidirectional activation becomes operational: Contextual adaptation and rule validation. First, contextual adaptation involves translating generic international templates into locally actionable competence descriptors and indicators by specifying tasks, thresholds, and assessment items that match Chinese service routines. For instance, in response to childhood obesity as a high-frequency local challenge, a broad competence such as "enhancing children's physical fitness" can be operationalized into locally implementable items (*e.g.*, designing low-intensity interval exercises for obese children, or caregiver communication routines) alongside measurable indicators (*e.g.*, service frequency, dual thresholds combining heart rate and perceived exertion, adherence checks, and school-home communication checkpoints).

Second, rule validation involves subjecting locally developed competencies to evidence-based scrutiny and alignment against internationally recognizable criteria, thereby distilling them into measurable and transferable indicators. In the case studied, locally emphasized capacities (*e.g.*, school-home collaborative intervention; data/AI-enabled monitoring and feedback) were translated into observable metrics (*e.g.*, movement recognition and correction, real-time feedback report generation, movement quality scoring, target attainment rates) and linked to recognizable output carriers (*e.g.*, curriculum outcomes, training certificates, vocational certificates, competition credentials), thereby strengthening comparability and recognition potential across systems. Together, contextual adaptation and rule validation form an iterative loop that improves both implementability in local contexts and comparability under international reference logics.

Dialectical proposition (P3): Dynamic equilibrium is achieved through iterative calibration mediated by recognition

The field's core tension—between standardization demands associated with international legitimacy and contextual requirements associated with local relevance—is not treated as a binary opposition. Instead, the model posits that cross-boundary recognition mediates an iterative calibration between the two. When standardized descriptors become detached from service realities, contextual adaptation is triggered to restore feasibility; when local practices become difficult to justify under international reference criteria, rule validation is triggered to restore comparability. Through repeated cycles of adaptation and validation, a "dynamic equilibrium" is approached in the form of ongoing refinement rather than a one-off compromise. This is designed to preserve both scientific legitimacy and practical effectiveness in standard development.

Boundary conditions (P4): The propositions apply to children's physical activity- and health promotion industry-oriented vocational education and training learning outcomes

The above propositions are context dependent and intended for international mutual recognition scenarios in which vocational education and training learning outcomes are anchored in industry-oriented service competencies in children's physical activity and health promotion. They may require modification in contexts where learning outcomes are primarily oriented toward cultural heritage transmission or purely academic theoretical knowledge, as either international comparability or local service implementability plays a fundamentally different role.

In sum, P1 specifies the prerequisite for generating cross-boundary recognition, P2 explicates the mechanisms that operationalize bidirectional activation, P3 clarifies how tensions are iteratively calibrated through recognition as a mediator, and P4 delineates the scope of the previous propositions' applicability.

Theoretical dialogue and innovative perspective construction

This study does not displace existing theories of international mutual recognition. Instead, it advances a mechanism-focused synthesis by positioning cross-boundary recognition as the mediating construct that connects international legitimacy with local implementability. Specifically, the bidirectional activation model (Figure 1) complements and extends three established lines of scholarship.

First, it is consistent with legitimacy-oriented accounts that

emphasize internationally referenced standards and measurable indicators as sources of comparability and acceptance in cross-border recognition.

Second, it resonates with context-sensitive perspectives that argue that learning outcomes must be embedded in locally workable routines, institutional responsibilities, and service settings to remain implementable.

Third, rather than examining whether alignment or adaptation occurs automatically, it complements boundary-focused research by specifying how recognition is practically produced through translation/Localization and evidence-based validation or indicator distillation.

This dialogue also clarifies how the propositions operationalize the synthesis: P1 specifies the minimum legitimacy-implementability premise of bidirectional activation; P2 explicates the two mechanisms (contextual adaptation and rule validation); P3 describes their iterative calibration toward dynamic equilibrium; and P4 delineates the boundary conditions for children's sport- and health industry-oriented vocational education and training learning outcomes.

Accordingly, the innovative perspective of this study lies not in introducing new labels but rather in making the mediating function of recognition explicit, observable, and repeatable across standard-development cycles.

Up to this point, discussions of children's physical activity and health promotion standards have often treated international legitimacy and local relevance as competing priorities. Legitimacy-oriented studies tend to prioritize standardized metrics and interoperable indicators, whereas locally oriented studies caution that excessive standardization may detach descriptors from concrete needs (e.g., obesity intervention constraints in specific institutional settings). The present study reframes this divide by showing that the tension persists when the mediating work of cross-boundary recognition is underspecified. International templates require contextual adaptation to become operational in local conditions (e.g., through translating guideline recommendations into feasible routines under urban space and schooling constraints), while locally developed practices require rule validation to be distilled into indicators that remain defensible and comparable beyond the local setting (e.g., testing feasibility and outcomes using population-specific baseline evidence and pilot feedback).

From an innovation perspective, we propose a new organization: The International Health Promotion with Advanced Technologies Institute. This institute can be conceptualized

as a boundary-spanning vehicle that supports this mediation work. It can provide a structured platform for standard translation and indicator codesign, organize pilot-based validation and iterative revision using real-world service data, and build recognition carriers and quality assurance interfaces that allow locally workable standards to be presented in internationally legible forms. In this way, the institute would not replace existing frameworks but rather operationalize a repeatable cycle that strengthens both international legitimacy and local problem-solving capacity in children's physical activity promotion.

CONCLUSION

This study examines international mutual recognition of TVET learning outcomes in the emerging field of children's physical activity and health by theorizing cross-boundary recognition as a construct that mediates between international standards and local practices. Using the development of the occupational standard for children's physical activity and health accompanists as a qualitative case, the analysis shows how global normative templates and context-specific routines can be bidirectionally activated through contextual adaptation and rule validation. It clarifies how ongoing mutual calibration of global legitimacy and local relevance can be established through iterative standard revision in accordance with the case evidence.

Theoretical contributions

This study advances existing research in three ways. First, it moves beyond single-perspective approaches that prioritize either organizational legitimacy or local specificity by specifying how the two can be linked through an intermediary outcome—namely, competence descriptors, indicators, and assessment routines that are simultaneously locally implementable and defensible under internationally referenced criteria. Second, it draws on insights from boundary and identity scholarship to illuminate the actor-level negotiation involved in standards development while analytically distinguishing transboundary identity work (how actors interpret and enact roles across contexts) from cross-boundary recognition (the intermediary outcome produced through standards and assessment routines). Third, it proposes an integrated model of cross-boundary recognition. This model is articulated in the form premise-mechanism-equilibrium-boundary conditions: (P1) bidirectional activation as a prerequisite, (P2) contextual adaptation and rule validation as the two interlocking mechanisms, (P3) iterative calibration as the equilibrium condition, and (P4) children's physical activity and health industry-oriented TVET learning outcomes as the scope of applicability.

Methodological contributions

Methodologically, the study demonstrates a case-based

approach to theorizing standard development and recognition mechanisms. Treating the development of the children's physical activity and health accompanist standard as a qualitative case, it integrates document analysis, expert workshops, Delphi consultations, and pilot-related process records into a coherent analytic strategy. The analysis uses iterative coding and process tracing to connect standard revisions and stakeholder deliberations to the two mechanisms of contextual adaptation and rule validation, showing how standard development can be understood as an observable, repeatable cycle rather than a purely administrative procedure.

Practical contributions

Practically, the findings offer guidance for policymakers, standards developers, and TVET providers engaged in mutual recognition. At the policy level, recognition schemes are likely to remain fragile if they activate only international templates without serious contextual adaptation, or only local practices without systematic rule validation. For standards developers, the study suggests constructing competence profiles as composite configurations that integrate universal health promotion competencies with the locally specific capabilities required by China's child health challenges (e.g., obesity-related needs and constraints in time/space and institutional routines). Institutionally, the proposed International Health Promotion with Advanced Technologies Institute may be conceptualized as a boundary-spanning platform that facilitates the translation and codesign of indicators, pilot-based validation and iterative revision using service and training process data, and recognition carriers and quality assurance interfaces that represent locally workable standards in internationally legible forms.

Limitations and directions for future research

This study has limitations that restrict the generalizability of its findings. First, it is a single-case study of one emerging field in China; the mechanisms identified are analytically informative but may not transfer to mature sectors or different institutional environments without modifications. Second, the empirical material is drawn mainly from stakeholders involved in the standard development process; learners, frontline practitioners beyond the project, and employers in diverse settings are underrepresented. Third, the standard remains in a nascent stage, and the long-term stability of the iterative calibration between legitimacy and relevance has not yet been observed across changing policy and market conditions. Future research could test and refine the model through comparative and multi-case designs, longitudinal tracking of standard implementation and revision, and measurement development to operationalize cross-boundary recognition, contextual adaptation, and rule

validation for mixed-method testing. Incorporating learners, frontline workers, and employers through surveys, ethnography, or participatory research would further illuminate how recognition is enacted "on the ground" and how it shapes mobility, employability, and professional identity.

DECLARATIONS

Acknowledgments

None.

Author contributions

Huang CH: Conceptualization, Writing—Original draft preparation. Liu XJ: Writing—Review and Editing. Li W: Formal analysis. Su Y: Methodology and investigation. Li YS: Investigation. Liang JT: Resources. All authors have read and approved the final version.

Funding

Funding was received from the Guangxi College for Preschool Education 2024 Major Research Project: International Mutual Recognition of Occupational Standards in Infant and Toddler Care Services within the New Paradigm of Health Promotion (project number: 2024GXYSZD01), Guangxi Higher Education Institutions' Thousand Young and Middle-aged Key Teachers Cultivation Program Humanities and Social Sciences Research Project: Building Guangxi's Infant and Toddler Health Promotion and Service System from an Early Development Perspective (project number: 2023QGRW053) and 2023 China-ASEAN Vocational Education Research Centre (Guangxi) self-funded project: Research on Mechanisms and Pathways for Vocational Education to Facilitate the Integration of International Exercise and Health Talent Development (project number: ZGDMKT2023ZC013).

Ethical approval

Not required.

Informed consent

The participants were informed that the data were only used for research purposes and that their information would be anonymized when presenting the research results. Moreover, they were allowed to stop at any moment during the research, and they could refuse to respond to any questions asked during the interview.

Declaration of conflicting interests

The authors have no conflicts of interest to declare.

Generative AI use declaration

During the preparation of this work, the authors used ChatGPT to polish the text. After using this tool, the authors reviewed and edited the content as needed.

Data availability statement

No additional data.

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