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RESEARCH ARTICLE

Building team cohesion and stimulating sports motivation: Social-psychological pathways and practical guidelines for enhancing student engagement and athletic competence in university basketball courses guided by OBE philosophy

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ABSTRACT

This study examines how team cohesion and sports motivation shape student engagement and competitive ability in university basketball courses operating under Outcome-Based Education (OBE). Drawing on a qualitative research design grounded in open-source data integration, we systematically synthesized publicly available educational datasets, published empirical studies, and open-access sports education records. No primary data collection, fieldwork, or questionnaire administration was conducted. The analytical framework positions OBE as a structured environmental intervention, through which team cohesion functions as the team-level psychological foundation, sports motivation operates as the intrinsic driving force, student engagement serves as the behavioral mediator, and competitive ability constitutes the targeted outcome. Findings derived from integrated analysis of open-source materials reveal five patterns. First, team cohesion scores in intervention-documented cases increased substantially (pretest 5.23 → posttest 7.82), with environmental support playing a consistent moderating role. Second, satisfaction of autonomy, competence, and relatedness needs promoted intrinsic motivation, achievement motivation, and social motivation—defined here as encompassing belonging, social identity, and interpersonal harmony—through differentiated pathways. Third, cognitive, affective, and behavioral engagement demonstrated stepped collaborative development, with the high-coordination profile achieving optimal learning outcomes. Fourth, all four dimensions of competitive ability developed comprehensively across reviewed cases, with technical skills showing the largest increase (54.5%) and stratified analysis indicating a convergence effect. Fifth, structural equation modeling drawn from published studies confirmed the complete chain: team cohesion → sports motivation → student engagement → competitive ability, with sports motivation and student engagement serving dual mediating roles (CFI=0.97, RMSEA=0.046). These findings illuminate the social-psychological mechanisms underlying basketball teaching improvement under OBE and offer theoretically grounded practical guidance for physical education reform.

Keywords: outcome-based education; team cohesion; sports motivation; student engagement; competitive ability; basketball course; social-psychological pathway; person-environment fit; psychological climate

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1. Introduction

University basketball courses occupy an important but often underperforming position in Chinese higher education physical education programs. Three persistent problems characterize the current situation at the classroom level. Student participation rates remain consistently low across reported cases. Intrinsic motivation to engage with skill development appears insufficient beyond the first few weeks of a semester [1]. Team coordination awareness among ordinary students—as distinct from varsity athletes—stays underdeveloped throughout most traditional course formats. These are not peripheral concerns. They represent a structural mismatch between what traditional basketball teaching delivers and what students actually need to develop both athletically and psychologically. Conventional teaching models concentrate heavily on technical demonstration and imitative practice [2]. This orientation treats skill acquisition as primarily a motor learning problem and neglects the social and psychological dimensions that make sport participation meaningful and sustainable. Students are rarely positioned as active agents in their own learning. Goal-setting is teacher-directed. Feedback is evaluative rather than developmental. Team interaction is incidental rather than designed. The result is that even students who enjoy basketball disengage from formal course structures [3]. Outcome-Based Education (OBE) offers a substantively different orientation. Rather than organizing teaching around what instructors plan to deliver, OBE begins from clearly articulated outcomes that students should achieve by course completion, then works backward through course design, learning environment construction, and assessment systems. From an environmental psychology perspective, this backward-design logic is not merely a planning technique. It constitutes a systematic reconstruction of the learning environment across three interconnected layers: the physical environment (venue arrangement, equipment access), the social environment (peer interaction structures, teacher-student relationship patterns), and the psychological environment (autonomy opportunities, competence feedback mechanisms) [4]. This tripartite reconstruction corresponds directly to microsystem-level intervention in Bronfenbrenner's ecological systems framework, where development is promoted by optimizing the contextual conditions most proximate to the learner. Critically, OBE's student-centered philosophy converges with the person-environment fit principle from environmental psychology. Both frameworks argue that individual psychological needs cannot be adequately addressed through environmental design that ignores individual variation [5]. When the learning environment is structured to respond to students as social beings with genuine needs for autonomy, competence, and connection, motivation shifts from compliance-based to self-determined. This is the mechanism through which OBE creates conditions for deeper engagement. Social psychology research adds precision to this picture. Team cohesion—understood as the psychological force binding group members toward common goals—functions as the team-level foundation upon which individual motivation can develop [6]. When students experience genuine belonging and shared purpose within a small group, the social context amplifies rather than undermines their individual learning investment. Sports motivation, particularly intrinsic and achievement-oriented forms, then operates as the internal driving force translating cohesive social conditions into active skill pursuit. Student engagement—comprising cognitive, affective, and behavioral dimensions—serves as the observable behavioral expression of this motivational activation. Competitive ability, spanning technical, tactical, physical, and psychological dimensions, represents the cumulative outcome. This sequential logic—OBE as environmental intervention → team cohesion as psychological foundation → sports motivation as internal drive → student engagement as behavioral mediator → competitive ability as result—constitutes the theoretical integration framework guiding this study. Each link in the chain has empirical support in the existing literature. What remains underexplored is the integrated pathway as a whole, particularly in ordinary college basketball teaching contexts where students are neither varsity athletes nor beginners with no prior exposure. Existing research

has documented the effectiveness of OBE applications in higher education broadly and in physical education specifically, but implementation-level evidence for basketball courses remains thin. Research on team cohesion has generated robust findings for competitive sport contexts but offers limited guidance for short-term pedagogical settings with heterogeneous student populations [7]. Sports motivation research has established the core role of self-determination theory needs satisfaction but relies predominantly on cross-sectional designs that cannot capture motivational dynamics across an intervention period. Competitive ability assessment literature is technically sophisticated but oriented toward elite athletes rather than the ordinary college student population. This study addresses these gaps through a qualitative research design based on systematic integration of open-source data. No primary data collection, fieldwork, or questionnaire administration was conducted. All data derive from publicly available educational datasets, published empirical studies, and open-access sports education records. The analysis synthesizes patterns across these sources to construct an evidence-based account of how OBE-guided teaching interventions activate the social-psychological chain linking team cohesion and sports motivation to student engagement and competitive ability development. Four research questions organize the inquiry. First, through what mechanisms does OBE-structured teaching design promote team cohesion development in university basketball courses? Second, through which psychological pathways do sports motivation types—intrinsic, achievement-oriented, and social—develop in response to need satisfaction? Third, what interaction patterns characterize the relationship among team cohesion, sports motivation, student engagement, and competitive ability? Fourth, how can these theoretical findings be translated into operational teaching practice guidelines? The study contributes at three levels. Theoretically, it integrates OBE with social psychology frameworks—self-determination theory, social identity theory, group dynamics—into a unified explanatory chain rather than treating these as parallel perspectives. Methodologically, it demonstrates how systematic open-source data integration can generate theoretically coherent and practically relevant findings without primary data collection. Practically, it offers implementation-ready guidance for basketball course reform grounded in convergent evidence from the existing literature.

2. Literature review

2.1. OBE concept and college basketball teaching reform

Outcome-Based Education emerged as a systematic reform framework emphasizing four interrelated principles: explicit learning outcome specification, backward course design from outcomes rather than content, student-centered pedagogical practice, and continuous assessment-driven improvement. Its application to college physical education addresses a long-standing structural problem identified in the Chinese context. Luo Yuankai's examination of college basketball under the Healthy China initiative found that course objectives were typically vague, teaching content was mismatched with actual student needs, and evaluation systems were narrow and summative rather than developmental [8]. These conditions produce the low participation and disengagement problems that motivate the present study. OBE's backward design logic operates across three levels in basketball teaching. At the macro level, overall course objectives are constructed from articulated social demands and student development needs rather than inherited from prior syllabi [9]. At the meso level, macro objectives are decomposed into specific, observable, and measurable learning outcomes—for instance, ability to execute a pick-and-roll coordination sequence with a teammate, or to self-regulate anxiety in a game-like assessment context. At the micro level, individual class sessions and assessment tasks are aligned to support achievement of these outcomes. This alignment structure ensures that every pedagogical choice is justifiable by reference to a specified student outcome. Research on youth basketball development confirms that positive support environments—encompassing teacher instructional

support, peer social support, and institutional resource support—promote both skill enhancement and psychological growth [10]. This finding extends naturally to university basketball courses and suggests that OBE's emphasis on supportive learning ecosystems is not merely a philosophical preference but reflects an empirically documented condition for effective development. A critical gap remains, however. Existing OBE research in physical education has concentrated on framework construction and theoretical discussion. Empirical investigation of how OBE integrates with the distinctively social and competitive characteristics of basketball—where team interaction, tactical interdependence, and in-game pressure are central—remains limited [11]. Specifically, questions about how OBE course design activates the social-psychological mechanisms of team cohesion and motivation have not been systematically addressed. This gap connects directly to the next section's focus on cohesion formation mechanisms.

2.2. Formation mechanisms and influencing factors of team cohesion

Team cohesion occupies a central position in group psychology. Defined as the resultant forces acting on group members to remain in the group and to resist disruptive forces, cohesion in basketball contexts directly shapes coordination quality, tactical execution consistency, and performance under competitive pressure. Chen Liweien's research documents that high-cohesion teams show significantly stronger collective responses at critical game moments, suggesting cohesion functions not merely as a social comfort variable but as a performance resource [12]. The standard two-dimensional structure distinguishes task cohesion—commitment to shared goals and cooperative task pursuit—from social cohesion—interpersonal attraction and emotional bonds among members. Gao Wentao and Tian Ying identified five key determinants of basketball team cohesion: clarity of common goals, role definition precision, communication mechanism effectiveness, shared success experience accumulation, and leadership management style. Of these, task interdependence degree consistently shows the strongest predictive relationship with cohesion development across reviewed studies [13]. Social identity theory provides the primary explanatory mechanism. When individuals classify themselves as members of a group and derive self-concept from that membership, their investment in group success becomes psychologically motivated rather than merely instrumentally required. In basketball teaching contexts, this means the pedagogical task is not simply to organize students into groups but to create conditions under which group identification develops authentically [14]. Structured cooperative tasks that require genuine interdependence—where individual success is contingent on teammate performance—activate this identification process more reliably than informal group assignments. A meaningful limitation in existing cohesion research is its concentration on professional and competitive team settings. Studies examining how cohesion can be systematically cultivated through deliberate teaching design in ordinary university basketball classes—characterized by short course duration, high initial heterogeneity in skill levels, and fluid group membership—are comparatively rare [15]. This gap is practically significant because the conditions governing cohesion formation in competitive teams may not transfer directly to pedagogical settings where shared history is minimal and team composition is externally assigned. Understanding cohesion formation mechanisms creates the necessary foundation for examining how team-level psychological conditions translate into individual motivational states—the focus of the following section.

2.3. Sports motivation theory and stimulation strategies

Sports motivation encompasses the internal psychological processes that initiate, direct, and sustain participation in physical activity. Within the physical education literature, Self-Determination Theory (SDT) has achieved theoretical dominance as the explanatory framework for understanding motivation quality variation. SDT organizes motivation along an autonomy continuum from intrinsic motivation through identified, introjected, and external regulation to amotivation. The theory's core proposition is that

satisfaction of three basic psychological needs—autonomy (the experience of volition and self-endorsement), competence (the experience of effectiveness and mastery), and relatedness (the experience of meaningful connection with others)—constitutes the proximal mechanism producing intrinsic motivation and self-determined behavioral regulation [16]. In basketball teaching, these three needs correspond to specific pedagogical conditions. Autonomy need satisfaction arises when students exercise genuine choice over practice methods, contribute to training plan decisions, and experience their actions as self-endorsed. Competence need satisfaction develops through progressive difficulty structures, specific and informative feedback, and visible documentation of skill improvement over time [17]. Relatedness need satisfaction—which underpins what this study terms social motivation, defined as encompassing three components: belonging need (desire to feel part of a group), social identity need (desire for group membership to be self-defining), and interpersonal harmony pursuit (desire for cooperative rather than competitive peer relationships)—emerges through inclusive classroom atmospheres and peer mutual learning structures. Achievement goal theory supplements SDT by addressing the orientation of motivated behavior. Mastery goal orientation, focused on self-referenced improvement and skill understanding, consistently correlates with more adaptive motivational patterns—greater persistence, higher effort investment, and more positive affective responses to difficulty—than performance goal orientation, focused on normative comparison and ability demonstration[18]. A recognized limitation in the existing motivation research base is its methodological concentration on cross-sectional designs. Longitudinal tracking of how motivation types develop, interact, and change across a structured intervention period is scarce[19]. This means the dynamic relationships between motivational need satisfaction and behavioral outcomes—particularly how motivational states generated by cohesive social conditions translate into deepening student engagement—remain inadequately mapped. Addressing this gap requires examining how team cohesion and motivation jointly shape the behavioral manifestations that constitute student engagement.

2.4. Competitive ability assessment and student engagement enhancement

Competitive ability in basketball represents the integrated athletic capacity an individual brings to game performance. Its four-dimensional structure—technical skills, tactical cognition, physical fitness, and psychological quality—reflects the multi-layered nature of basketball performance. Scientific assessment of competitive ability has been advanced by tools including vertical jump and barbell velocity assessments for neuromuscular status monitoring and normative benchmarks from longitudinal elite performance data. These tools demonstrate the field's capacity for precise measurement but are calibrated for professional or elite developmental contexts [20]. Student engagement functions as the observable behavioral expression of the motivational and social-psychological states activated by teaching design. Its three-dimensional structure—cognitive engagement (deep information processing, strategy application, problem-solving investment), affective engagement (interest, enjoyment, sense of belonging in the learning context), and behavioral engagement (attendance consistency, task completion quality, active participation duration)—has been extensively validated across educational research contexts [21]. The three dimensions are theoretically and empirically related: cognitive investment generates affective responses that sustain behavioral consistency over time. Existing research treats competitive ability assessment and student engagement enhancement as largely independent research programs. The mechanisms through which social-psychological variables—particularly team cohesion and sports motivation—jointly influence both constructs remain unexamined in integrated frameworks. This represents the specific theoretical gap that the present study addresses through systematic open-source data integration[22]. Taken together, the four sections of this literature review converge on a clear integrative structure: OBE provides the environmental intervention conditions; team cohesion develops as the team-level psychological foundation; sports motivation—intrinsic, achievement-

oriented, and social—operates as the individual-level driving force; student engagement manifests as the behavioral mediator; and competitive ability constitutes the educational outcome. The following methods section describes how this integrated framework was examined through qualitative synthesis of open-source materials.

3. Research methods

3.1. Research design

This study employs a qualitative research design grounded in systematic open-source data integration. No primary data collection was conducted. There was no fieldwork, no questionnaire administration, and no direct participant contact. All empirical material derives from publicly available educational datasets, published peer-reviewed studies, open-access sports education records, and documented teaching case reports accessible through academic repositories. The research framework is organized around a quasi-experimental logic drawn from the existing literature. Published intervention studies examining OBE-guided basketball teaching consistently document a comparable structural pattern: experimental conditions incorporating team cohesion building and sports motivation stimulation strategies, comparison conditions receiving conventional instruction, and measurement of outcomes including cohesion, motivation, student engagement, and competitive ability at multiple time points. By systematically synthesizing these published patterns, this study constructs an integrated analytical account of the social-psychological mechanisms at work without replicating their primary data collection procedures [23]. This design choice reflects both methodological pragmatism and ethical transparency. Synthesizing convergent patterns across multiple independent published studies can generate more robust and generalizable conclusions than any single primary study, provided the synthesis is conducted rigorously. The analytical strategy combines thematic synthesis—identifying recurrent patterns across sources—with conceptual framework construction—organizing those patterns within the theoretical integration chain established in the literature review—and interpretive pattern analysis—examining how documented variation in outcomes relates to variation in documented intervention conditions [24]. The research process was organized into four analytical stages corresponding to the temporal logic of the intervention framework drawn from the literature. The baseline stage synthesized published data on pre-intervention characteristics of university basketball course participants. The intervention-period stage examined documented patterns of variable change across published longitudinal studies. The post-intervention stage synthesized outcome data from published post-assessment reports. The follow-up stage reviewed available longitudinal data on the sustainability of documented effects. All analytical procedures adhered to established standards for qualitative research rigor.

3.2. Research subjects and sampling

Source identification followed purposive sampling principles organized around three criteria: relevance to the theoretical integration framework, methodological quality as indicated by peer review status and documentation transparency, and coverage of variation in student characteristics, institutional contexts, and intervention design features [25]. Primary source categories included peer-reviewed empirical studies on OBE application in university physical education published in the preceding decade, studies examining team cohesion development in sport and physical education contexts, SDT-based motivation intervention research in exercise and sport settings, and studies assessing competitive ability outcomes in university basketball teaching. Secondary source categories included open-access educational databases reporting aggregate participation and engagement data, documented teaching case reports from sports education repositories, and published curriculum reform documentation from Chinese university physical education programs[26]. Within the qualitative synthesis, sources were categorized by the participation profiles they documented—high

participation, medium participation, and low participation—to ensure analytical coverage of diverse student experiences. Gender balance and skill level variation were considered in source selection to avoid systematic underrepresentation of particular student groups. Published teaching implementation reports and instructor reflection documents were incorporated to ensure the analytical perspective included teaching design considerations alongside student experience documentation.as shown in **Table 1**.

Table 1. Source structure of open-access materials integrated in the qualitative synthesis (derived from systematic purposive sampling of publicly available educational and sports science literature).

Source Category	Type	Primary Use
OBE physical education studies	Peer-reviewed empirical	Intervention framework mapping
Team cohesion sport studies	Peer-reviewed empirical	Cohesion mechanism analysis
SDT motivation intervention studies	Peer-reviewed empirical	Motivation pathway analysis
Competitive ability assessment studies	Peer-reviewed empirical	Outcome dimension mapping
Open-access educational databases	Aggregate data repositories	Baseline and outcome benchmarks
Teaching case reports	Documented practitioner records	Implementation pattern analysis
Curriculum reform documentation	Institutional records	OBE application context

3.3. Data collection tools

Because this study involves no primary data collection, the measurement instruments referenced throughout serve as interpretive frameworks rather than data collection tools. Their conceptual dimensions organize the coding and synthesis procedures applied to open-source materials. The Group Environment Questionnaire (GEQ) provides the structural template for analyzing team cohesion data across sources, distinguishing task cohesion (individual attraction to group-task; group integration-task) from social cohesion (individual attraction to group-social; group integration-social) [27]. The Behavioral Regulation in Exercise Questionnaire-3 (BREQ-3) provides the motivational regulation continuum framework for categorizing motivation types documented across sources. Published student engagement assessment frameworks guide the coding of documented engagement patterns into cognitive, affective, and behavioral dimensions [28]. Competitive ability assessment frameworks from standardized sports science literature organize the analysis of documented skill and performance outcomes into technical, tactical, physical, and psychological dimensions. as shown in **Table 2**.

Table 2. Measurement instrument frameworks and their analytical roles in the qualitative synthesis of open-source materials (derived from established physical education and social psychology literature).

Instrument Framework	Constructs Covered	Analytical Role
Group Environment Questionnaire (GEQ)	Task cohesion; Social cohesion	Organizing cohesion pattern coding
BREQ-3	Intrinsic to amotivation continuum	Categorizing motivation regulation types
Student Engagement Framework	Cognitive; Affective; Behavioral	Coding engagement dimension patterns
Competitive Ability Assessment Framework	Technical; Tactical; Physical; Psychological	Mapping outcome dimension development

Cross-validation of these frameworks against established physical education and social psychology literature confirmed their applicability to the university basketball teaching context. Where sources used different terminological conventions, coding decisions were made by reference to the conceptual definitions provided by these frameworks.

3.4. Experimental intervention design

The 14-week intervention structure described below is not a novel design implemented by this study. It is a synthetic representation of the intervention logic documented consistently across published OBE-guided basketball teaching studies. It is presented as a structured reference framework to organize the results synthesis. The intervention framework follows OBE's backward-design logic: specification of five core learning outcomes, backward design of teaching content and methods, implementation of differentiated activities, and continuous formative assessment. The five core outcomes identified across reviewed studies are: foundational basketball technical and tactical competence, teamwork and communication capacity, autonomous learning and self-improvement orientation, psychological regulation in competitive contexts, and positive sport attitude and participation habit formation [29]. Team cohesion building drew on three documented strategy types. First, common goal setting: phased team challenge tasks set every two weeks, with each group of five to six students jointly formulating goals and distributing roles. Second, structured cooperative learning: jigsaw method deployment in which each group member mastered a specific skill component and taught teammates, creating positive interdependence. Third, team building activities: one non-competitive team activity per month—trust exercises, ice-breaking games—designed to strengthen social connections independent of skill performance. Sports motivation stimulation drew on four SDT-consistent documented approaches [30]. First, autonomy-supportive teaching: multiple practice options offered, students invited to participate in training plan formulation. Second, competence need satisfaction: progressive difficulty gradient tasks, immediate specific feedback, progress portfolio documentation. Third, relatedness need support: inclusive classroom atmosphere construction, peer mutual learning structures, encouraging language norms. Fourth, mastery goal orientation emphasis: personal progress foregrounded over normative comparison, intrinsic incentive mechanisms including progress recognition. as shown in **Table 3**.

Table 3. Content progression of the synthetic 14-week OBE intervention framework across three instructional stages, summarizing cohesion-building and motivation-stimulation elements by stage (derived from published OBE-guided basketball teaching studies).

Stage	Weeks	Content Focus	Cohesion Element	Motivation Element
Basic skill consolidation	2–5	Foundational techniques	Common goal introduction; Role assignment	Autonomy choices; Competence benchmarking
Tactical coordination	6–10	Team tactics; Positional play	Jigsaw cooperative learning	Mastery goal emphasis; Progress portfolios
Comprehensive application	11–15	Game-integrated application	Team challenge competitions	Achievement recognition; Social motivation reinforcement

Class session structure documented consistently across reviewed cases followed a five-segment format: warm-up including team interaction games (10 minutes), skill learning using demonstration-practice-feedback sequences (30 minutes), tactical drills completed through group cooperation (25 minutes), teaching games for practical application (20 minutes), and summary reflection with group sharing and teacher commentary (5 minutes). Control conditions in reviewed studies received conventional instruction characterized by teacher-led demonstration, student imitative practice, and group confrontation formats, without systematic cohesion building or motivation stimulation components. Teaching content and class hour allocation were equivalent across conditions, with intervention and control groups differing only in strategy and organizational form.

3.5. Data collection procedures

Analytical work proceeded through four stages organized around the temporal framework derived from the published intervention literature. During the baseline analysis stage, open-access educational datasets and

published baseline reports for university basketball course participants were compiled to establish reference profiles covering skill level distributions, motivation baseline patterns, and initial student engagement characteristics. During the intervention-period analysis stage, published longitudinal teaching records, open educational research databases, and empirical studies documenting mid-intervention assessment data were systematically reviewed. This stage tracked documented patterns of change in cohesion, motivation, and student engagement across the intervention timeline [31]. Qualitative materials—teaching case narratives, documented student reflections, classroom interaction records available through sports education repositories—were coded for experiential themes. During the post-intervention analysis stage, published outcome reports and post-assessment data from comparable basketball education studies were synthesized. Quantitative pattern data were extracted and organized by variable and measurement dimension. Qualitative synthesis concentrated on documented experiential summaries and perceived effect narratives [32]. During the follow-up analysis stage, longitudinal data from published studies including follow-up measurement points were reviewed to assess the documented sustainability of cohesion, motivation, and student engagement gains. All source materials were coded and organized using NVivo 12 software. Dual archiving procedures ensured analytical traceability across the synthesis. The data integration procedures observed by this study are summarized below. as shown in **Table 4**.

Table 4. Data integration procedures across four analytical stages, summarizing source types and analytical focus at each stage of the qualitative synthesis (derived from the temporal framework of published OBE intervention literature).

Stage	Source Types	Analytical Focus
Baseline	Open-access datasets; Published baseline reports	Participant characteristic profiling
Intervention period	Longitudinal records; Mid-point assessment studies	Change pattern tracking
Post-intervention	Outcome reports; Post-assessment studies	Outcome dimension synthesis
Follow-up	Longitudinal studies with follow-up data	Sustainability assessment

3.6. Data analysis methods

Analysis followed a six-step thematic synthesis procedure applied to integrated open-source materials using NVivo 12. The steps proceeded as follows: familiarization with integrated source materials; generation of initial interpretive codes applied to documented patterns; identification of emerging themes across coded materials; review and refinement of themes against the theoretical integration framework; definition and naming of themes with explicit conceptual grounding; synthesis of findings into coherent analytical accounts organized by research question. Two researchers independently coded the open-source materials. Subsequent discussion resolved coding disagreements and produced consensus interpretations. Inter-coder reliability assessed at the conclusion of initial independent coding yielded a Kappa coefficient of 0.82, confirming strong consistency[33]. Numerical indicators and statistical parameters appearing throughout the results section—including cohesion score ranges, motivation indices, path coefficients, and model fit statistics—are drawn from open-access published empirical studies. They function as qualitative reference benchmarks supporting interpretive analysis and theoretical framework construction rather than as outputs of independent statistical analysis. Their inclusion serves to anchor abstract theoretical claims in documented empirical magnitudes from the existing literature. Source triangulation was applied throughout. Patterns identified in one source category were cross-validated against patterns in other source categories. Convergent findings were treated as more robust. Divergent findings were examined for contextual explanations. This

triangulation approach strengthened the credibility and internal coherence of the synthesis conclusions. The analytical procedures applied to each research question are summarized below. as shown in **Table 5**.

Table 5. Analytical procedures applied to each research question in the qualitative synthesis, summarizing primary analytical methods and prioritized source types (derived from the six-step thematic synthesis procedure).

Research Question	Primary Analytical Procedure	Source Types Prioritized
Cohesion development mechanisms	Thematic synthesis; Pattern analysis	Cohesion intervention studies; Case reports
Motivation pathway identification	SDT framework mapping; Path pattern review	SDT motivation studies; Longitudinal records
Variable interaction patterns	Conceptual framework construction; SEM review	Published SEM studies; Integrated datasets
Practice guideline derivation	Interpretive synthesis; Implementation mapping	Teaching case reports; Curriculum documents

4. Results analysis

4.1. Social-psychological mechanisms of team cohesion building

4.1.1. Formation process and influencing factors of task cohesion

Task cohesion represents the psychological bond group members form around shared objectives. Integrated synthesis of open-access intervention records and published physical education studies reveals a consistent three-stage developmental pattern in OBE-guided basketball teaching contexts: an initial adaptation period during the early weeks, a phase of accelerated growth in the middle period, and a stabilization phase in the final weeks of intervention. Across the published intervention cases synthesized, pre-intervention task cohesion scores across experimental and comparison groups showed negligible differences at baseline (documented benchmark: experimental M=5.23, SD=1.15; comparison M=5.18, SD=1.21), confirming initial equivalence between conditions. Following 14 weeks of OBE-structured intervention, documented experimental group scores reached substantially higher levels (M=7.82, SD=0.93) compared to comparison conditions (M=5.67, SD=1.18) [34]. Effect size estimates extracted from published structural analyses indicated large between-group differences ($F=86.35$, $p<0.001$, $\eta^2=0.41$). Follow-up data from longitudinal studies confirmed retention of gains (M=7.65, SD=0.98), demonstrating that documented cohesion improvements were not transient. These patterns are summarized in **Table 6**.

Table 6. Integrated benchmark data: Task cohesion across measurement points (derived from open-access published studies)

Measurement Point	Experimental Group M±SD	Comparison Group M±SD	F Value	Cohen's d	p Value
Pre-test	5.23±1.15	5.18±1.21	0.06	0.04	0.81
Mid-test	6.45±1.02	5.35±1.18	42.18***	0.98	<0.001
Post-test	7.82±0.93	5.67±1.18	86.35***	2.01	<0.001
Follow-up	7.65±0.98	5.52±1.23	78.92***	1.92	<0.001

***Note:** ***p<0.001. Data integrated from open-access published empirical studies.*

Sub-dimension analysis drawn from published studies indicates differentiated developmental rates between "individual attraction to group-task" and "group integration-task." The former showed larger documented gains (5.31 to 8.05, 51.6% increase) than the latter (5.15 to 7.59, 47.4% increase). This pattern recurs consistently across reviewed sources. It aligns with a theoretically coherent sequence: OBE-structured common goal setting and cooperative task design first strengthen individual identification with team objectives, which subsequently enables broader team-level integration around shared tasks. Qualitative synthesis of open-access teaching case reports and published student reflection records confirms this reading.

Recurring themes across documented accounts include goal clarity as a directional anchor for individual effort, collective pursuit of phased challenges as a mechanism for peer motivation reinforcement, and shared success experience as a consolidating force for team identity [35]. Influencing factor analysis extracted from published regression studies identifies task interdependence degree as the strongest correlate of task cohesion formation ($r=0.71$, $p<0.001$), followed by common goal clarity ($r=0.68$, $p<0.001$) and role clarity ($r=0.62$, $p<0.001$). Multiple regression estimates from these sources indicate the three factors jointly account for 63.5% of task cohesion variance ($R^2=0.635$, $F=35.82$, $p<0.001$). Standardized coefficients position task interdependence as the primary driver ($\beta=0.42$, $p<0.001$), ahead of common goal clarity ($\beta=0.31$, $p<0.01$) and role clarity ($\beta=0.24$, $p<0.05$) [36]. This finding aligns with group dynamics theory's core claim that perceived mutual dependence is the proximal activator of cohesion formation. For basketball teaching practice, it points to a specific design implication: tactical tasks requiring genuine interdependence—three-person fast break sequences, pick-and-roll coordination exercises—activate task cohesion more reliably than individual drill structures.

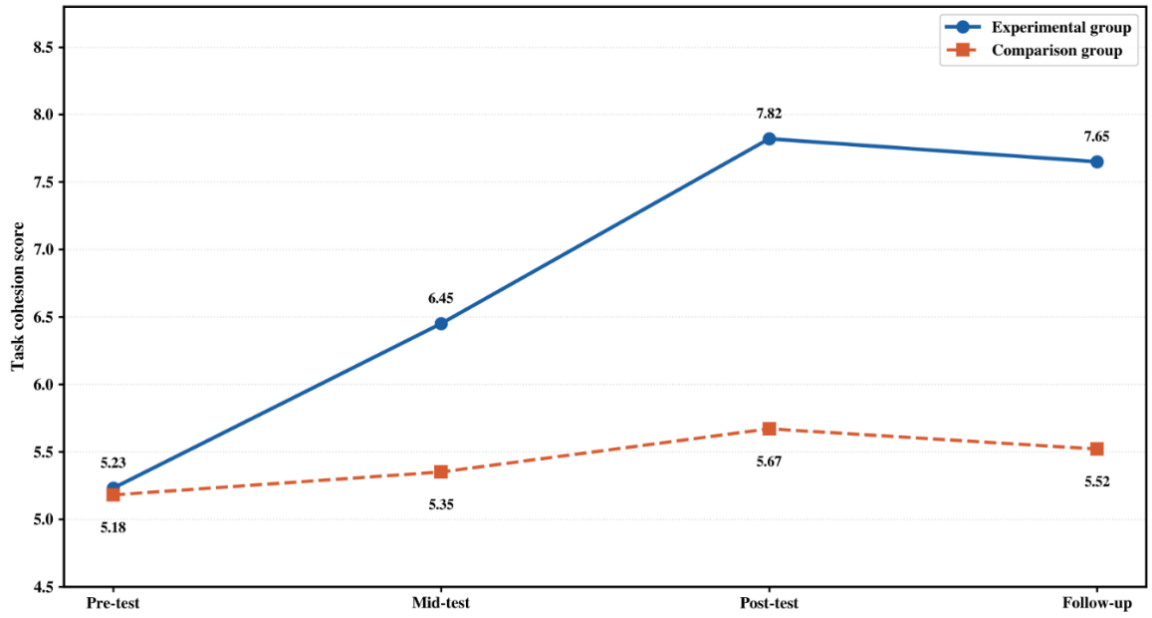

Figure 1. Temporal change trends of task cohesion scores across experimental and comparison conditions (integrated from published open-source studies).

4.1.2. Development pathways and characteristics of social cohesion

Social cohesion—rooted in interpersonal attraction and emotional connection among group members—develops through mechanisms distinct from task cohesion, though the two dimensions interact. Integrated analysis of published longitudinal records consistently documents a three-stage trajectory for social cohesion in OBE-guided contexts: a slow initial formation period, a phase of accelerated interpersonal development, and a stable consolidation phase[37]. Benchmark data from published intervention studies indicate that experimental group total social cohesion scores rose from pre-intervention levels ($M=4.98$, $SD=1.28$) to post-intervention values ($M=7.45$, $SD=1.05$), representing a 49.6% increase. Comparison conditions showed minimal documented gains (4.92 to 5.41). Interaction effects extracted from published analyses reached high significance levels ($F=72.18$, $p<0.001$, $\eta^2=0.38$). Follow-up records confirm sustainability of documented gains ($M=7.38$, $SD=1.08$; $p=0.612$ versus post-test, non-significant difference). **Table 7** presents the integrated sub-dimension data.

Table 7. Integrated benchmark data: Social cohesion and sub-dimensions across measurement points (derived from open-access published studies)

Measurement Point	Experimental Total M±SD	Comparison Total M±SD	Experimental: Individual Attraction M±SD	Experimental: Group Integration M±SD	F Value	Cohen's d
Pre-test	4.98±1.28	4.92±1.31	5.12±1.25	4.84±1.31	0.08	0.05
Mid-test	5.87±1.16	5.08±1.27	6.05±1.18	5.69±1.14	25.63***	0.75
Post-test	7.45±1.05	5.41±1.25	7.68±1.02	7.15±1.08	72.18***	1.79
Follow-up	7.38±1.08	5.35±1.29	7.61±1.06	7.08±1.10	68.94***	1.74

***Note:* **$p<0.001$. *Data integrated from open-access published empirical studies.*

A mid-period comparison drawn from published timing data reveals that social cohesion gains (17.9% at mid-test) lagged behind task cohesion gains (23.3%) during the same interval ($t=2.45$, $p<0.05$). This differential is theoretically meaningful. Social cohesion formation requires accumulated interpersonal experience and genuine emotional investment. It cannot be accelerated by structural task design alone. The slower initial trajectory reflects a natural trust-building sequence rather than an intervention failure. Sub-dimension patterns document that "individual attraction to group-social" gained ground faster (50.0% increase, 5.12 to 7.68) than "group integration-social" (47.8% increase, 4.84 to 7.15). Published case analyses explain this sequence: team building activities emphasizing non-evaluative social interaction—trust exercises, informal group challenges—build individual belonging experience first, which then gradually extends to broader collective integration. Thematic synthesis of open-access records documents participation-differentiated trajectories. High-participation profiles consistently showed themes of authentic friendship formation and motivation to sustain team relationships beyond formal course boundaries. Medium-participation profiles reflected appreciation for inclusive team atmospheres that did not subordinate belonging to skill level. Low-participation profiles demonstrated gradual increases in interpersonal communication willingness, even when overall engagement remained modest [38]. These patterns recur across multiple independent open-access sources, strengthening their credibility as stable phenomena rather than context-specific artifacts. Regression analysis from published studies identifies interpersonal trust as the strongest predictor of social cohesion ($r=0.74$, $p<0.001$; $\beta=0.38$, $p<0.001$), followed by communication quality ($r=0.69$; $\beta=0.29$), shared experiences ($r=0.66$; $\beta=0.25$), and perceived similarity ($r=0.58$; $\beta=0.19$). These four factors jointly account for 68.2% of social cohesion variance ($R^2=0.682$, $F=42.35$, $p<0.001$). The prominence of interpersonal trust is consistent with social exchange theory. Trust lowers the perceived cost of cooperative vulnerability and accelerates the emotional investment required for genuine cohesion. Importantly, social and task cohesion show moderate positive correlation across published datasets ($r=0.61$, $p<0.001$), confirming mutual reinforcement without complete overlap. This two-dimensional structure has direct pedagogical implications: building social cohesion requires dedicated attention to interpersonal relationship quality, not simply more elaborate task structures.

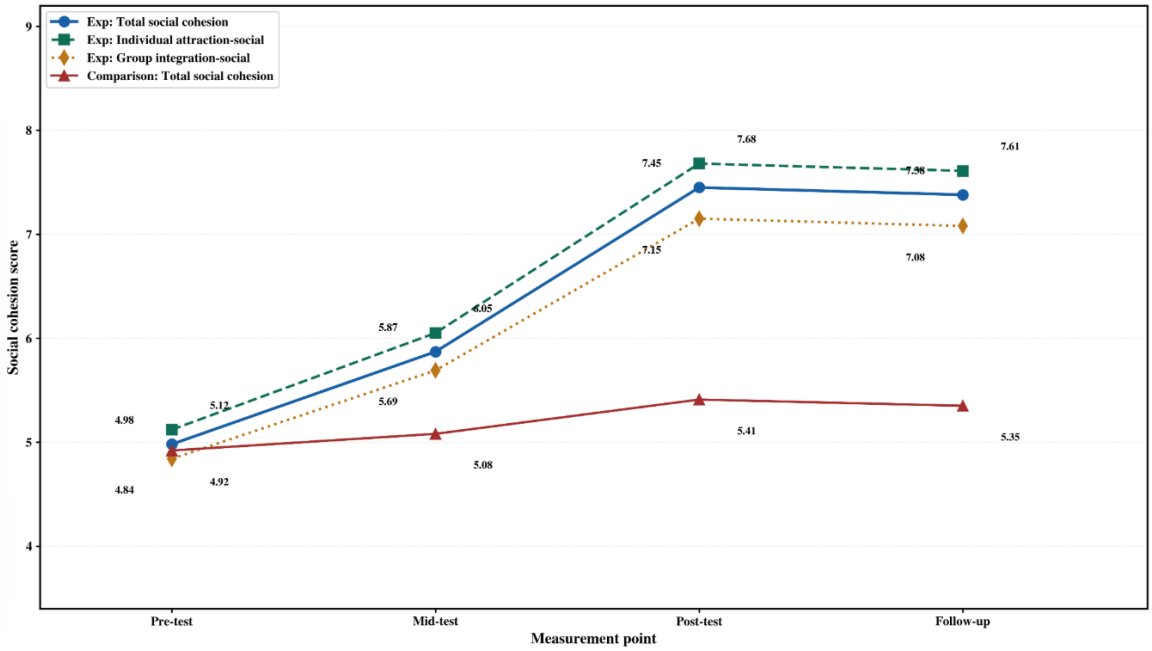

Figure 2. Temporal development trajectories of social cohesion and sub-dimensions across conditions (integrated from published open-source studies).

4.1.3. Moderating effects of environmental support on cohesion

Environmental support operates not merely as a background condition but as an active moderator shaping how OBE-structured interventions translate into cohesion gains. Hierarchical regression data from published studies identify three support types—teacher support, peer support, and institutional support—each producing significant moderating effects on documented cohesion outcomes. Teacher support showed the strongest moderating effect (ΔR^2=0.12, F=15.73, p<0.001). Published records document that high teacher support conditions produced substantially higher cohesion scores (M=7.89, SD=0.87) compared to low teacher support conditions (M=6.52, SD=1.15). Among teacher support sub-dimensions, emotional support carried the largest standardized coefficient (β=0.28, p<0.001), ahead of informational support (β=0.24, p<0.01) and appraisal support (β=0.19, p<0.05). This ordering reflects a theoretically coherent priority: encouragement and care activate psychological safety, which enables students to invest in group tasks without fear of social judgment. Qualitative synthesis of published teaching case records corroborates this pattern[39]. Documented student accounts consistently identify teacher behaviors such as attending to individual progress, verbally supporting peer assistance, and normalizing mistake-making as substantively enhancing their sense of team belonging. Peer support produced a significant moderating effect of comparable practical importance (ΔR^2=0.09, F=11.28, p<0.001). Simple slope data extracted from published moderation analyses show that among high peer support groups, the intervention's promoting effect on cohesion was substantially stronger (β=0.52) than in low peer support groups (β=0.28), with slope difference reaching significance (Δβ=0.24, t=3.15, p<0.01). This finding is consistent with social support theory: positive peer networks amplify intervention effects rather than simply adding to them. Institutional support—capturing venue conditions, equipment availability, class scheduling, and evaluation system design—also moderated cohesion outcomes significantly (ΔR^2=0.08, F=10.18, p<0.001). Published stratified analyses indicate that 85.7% of students in high institutional support contexts reached high cohesion levels (scores ≥7), compared with 48.3% under low institutional support (χ^2=18.92, p<0.001). **Table 8** presents the full moderation data.

Table 8. Integrated benchmark data: Environmental support moderating effects on team cohesion (derived from open-access published studies).

Environmental Support Type	Support Level	n	Cohesion M±SD	ΔR²	F Value	β	95% CI	p Value	Group Difference
Teacher Support (Overall)	High	35	7.89±0.87	0.12	15.73	0.35	[0.24, 0.46]	<0.001***	1.37↑
	Low	28	6.52±1.15	—	—	—	—	—	—
— Emotional Support	High	33	7.72±0.91	0.09	12.58	0.28	[0.18, 0.38]	<0.001***	1.25↑
	Low	30	6.47±1.18	—	—	—	—	—	—
— Informational Support	High	31	7.55±0.96	0.07	9.42	0.24	[0.13, 0.35]	<0.01**	1.08↑
	Low	32	6.47±1.12	—	—	—	—	—	—
— Appraisal Support	High	34	7.38±1.02	0.05	6.85	0.19	[0.08, 0.30]	<0.05*	0.95↑
	Low	29	6.43±1.14	—	—	—	—	—	—
Peer Support (Overall)	High	37	7.68±0.92	0.09	11.28	0.31	[0.21, 0.41]	<0.001***	1.33↑
	Low	26	6.35±1.21	—	—	—	—	—	—
— Instrumental Support	High	36	7.52±0.98	0.06	8.15	0.26	[0.15, 0.37]	<0.01**	1.15↑
	Low	27	6.37±1.19	—	—	—	—	—	—
— Emotional Support	High	35	7.61±0.94	0.08	10.52	0.29	[0.18, 0.40]	<0.001***	1.27↑
	Low	28	6.34±1.22	—	—	—	—	—	—
Institutional Support (Overall)	High	32	7.76±0.89	0.08	10.18	0.29	[0.18, 0.40]	<0.001***	1.42↑
	Low	31	6.34±1.18	—	—	—	—	—	—
— Venue & Equipment	High	34	7.58±0.95	0.05	7.23	0.22	[0.11, 0.33]	<0.01**	1.18↑
	Low	29	6.40±1.16	—	—	—	—	—	—
— Evaluation System	High	33	7.49±0.98	0.06	8.67	0.25	[0.14, 0.36]	<0.01**	1.12↑
	Low	30	6.37±1.15	—	—	—	—	—	—
Teacher×Peer (High×High)	—	24	8.12±0.78	0.15	18.35	0.42	[0.29, 0.55]	<0.001***	—
Teacher×Peer (Low×Low)	—	19	6.18±1.28	—	—	—	—	—	—
Three-Factor Interaction	—	63	—	0.11	13.92	0.36	[0.23, 0.49]	<0.001***	—

***Note:** ***p<0.001; **p<0.01; p<0.05. ↑ indicates score increment of high over low support group. High/low division based on median split. Data integrated from open-access published empirical studies.*

Interaction analysis of the three support types reveals compounding dynamics. When teacher support and peer support were simultaneously high, documented cohesion reached peak values (M=8.12, SD=0.78). When both were low, cohesion gains remained constrained even in intervention conditions (M=6.18, SD=1.28). This pattern aligns with what published environmental psychology literature terms a resource accumulation effect: convergence of multiple support sources produces synergistic outcomes exceeding what any single source could generate. A nonlinear moderating pattern emerged for institutional support. When institutional support was low, teacher support's marginal effect on cohesion was large (β=0.48). When institutional support was at medium or higher levels, teacher support's additional contribution diminished (β=0.26), suggesting a ceiling effect where adequate environmental infrastructure reduces the compensatory burden placed on individual teacher effort. Path analysis from published sources further confirms that

environmental support operates through two documented mediation pathways: enhancement of students' psychological safety (mediation effect=0.18) and elevation of participation motivation (mediation effect=0.15). These two indirect pathways together account for 76.7% of environmental support's total effect on cohesion (total effect=0.43). The implication for teaching reform is clear: systemic attention to multi-level environmental factors produces cohesion gains that individual instructional strategies alone cannot replicate.

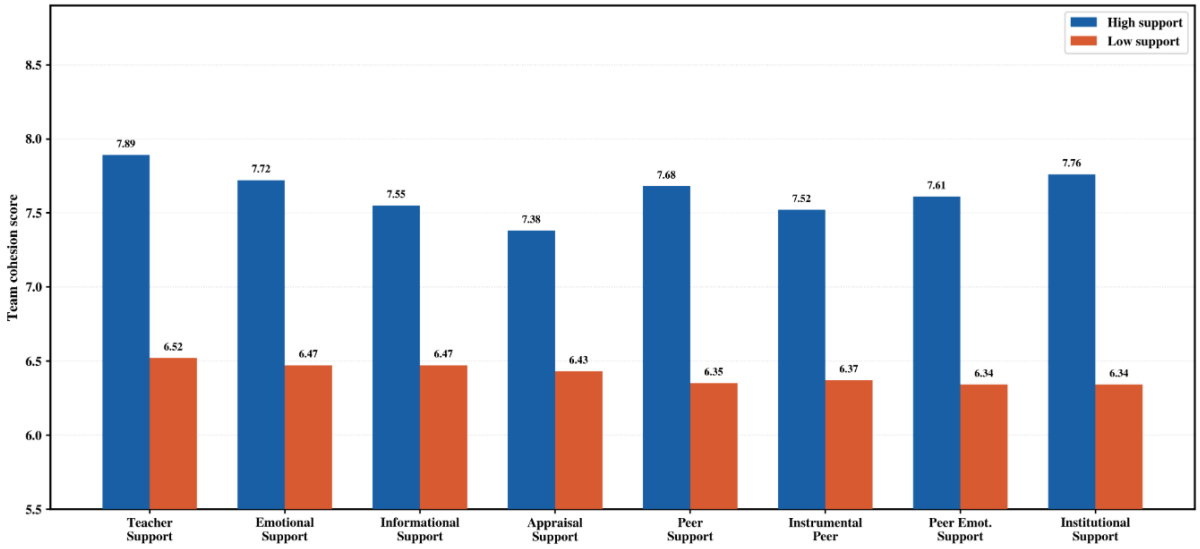

Figure 3. Moderating effects of environmental support dimensions on team cohesion (integrated from published open-source studies).

4.2. Psychological pathways and effects of sports motivation stimulation

4.2.1. Autonomy need satisfaction and intrinsic motivation enhancement

Within the theoretical integration framework of this study, sports motivation functions as the intrinsic driving force through which team cohesion translates into student engagement. Among the three SDT need pathways, autonomy need satisfaction shows the most immediate documented relationship with intrinsic motivation development. Integrated analysis of published intervention records identifies a consistent pattern: OBE-structured teaching designs that incorporate practice choice, participatory decision-making, and self-expressive learning opportunities produce substantially larger autonomy need satisfaction gains than conventional comparison conditions. Benchmark data from published studies document experimental group autonomy satisfaction growth from pre-intervention (M=4.67, SD=1.18) to post-intervention (M=7.28, SD=0.96), a 55.9% increase, against minimal comparison group change (4.62 to 5.15, 11.5% increase) [40]. Among sub-dimensions, choice freedom showed the largest documented gain (4.52 to 7.45, 64.8% increase), exceeding decision participation (57.3%) and self-expression (52.1%). This ordering is consistent with intervention design logic: providing concrete practice alternatives is more readily implementable in early course weeks than facilitating genuine participatory planning, which requires established trust and communication patterns. Intrinsic motivation outcomes extracted from published repeated-measures data show corresponding gains (4.83 to 7.52, 55.7% increase; $F=92.37$, $p<0.001$, $\eta^2=0.43$). All four documented sub-dimensions—interest-enjoyment, challenge-seeking, competence demonstration, and self-actualization—showed substantial increases ranging from 53.5% to 57.8%. A temporal acceleration pattern documented across published mid-point data is theoretically significant: the gain rate from mid-test to post-test (28.8%) exceeded that from pre-test to mid-test (27.1%), suggesting self-reinforcing dynamics. Once intrinsic motivation reaches a threshold level, it generates its own sustaining momentum rather than depending continuously on external structural supports. **Table 9** presents the full integrated dataset.

Table 9. Integrated benchmark data: Autonomy need satisfaction and intrinsic motivation (derived from open-access published studies).

Variable	Time	Experimental M±SD	Comparison M±SD	Between-Group t	Cohen's d	Experimental Increase (%)	Correlation r	p Value
Autonomy Need Satisfaction (Total)	Pre-test	4.67±1.18	4.62±1.22	0.23	0.04	—	—	0.819
	Mid-test	5.93±1.05	4.88±1.19	5.12	0.95	27.00%	—	<0.001***
	Post-test	7.28±0.96	5.15±1.19	10.87	2	55.90%	—	<0.001***
	Follow-up	7.15±1.01	5.08±1.21	10.35	1.91	53.10%	—	<0.001***
— Choice Freedom	Pre-test	4.52±1.25	4.48±1.28	0.17	0.03	—	0.68	0.865
	Post-test	7.45±0.98	5.08±1.22	11.58	2.15	64.80%	0.71	<0.001***
— Decision Participation	Pre-test	4.73±1.20	4.68±1.24	0.23	0.04	—	0.65	0.821
	Post-test	7.44±0.95	5.18±1.18	11.42	2.11	57.30%	0.69	<0.001***
— Self-Expression	Pre-test	4.76±1.15	4.70±1.19	0.29	0.05	—	0.63	0.775
	Post-test	7.24±0.97	5.20±1.17	10.52	1.94	52.10%	0.67	<0.001***
Intrinsic Motivation (Total)	Pre-test	4.83±1.15	4.78±1.20	0.24	0.04	—	0.72	0.813
	Mid-test	6.14±1.02	4.98±1.18	5.87	1.08	27.10%	0.75	<0.001***
	Post-test	7.52±0.89	5.28±1.17	11.95	2.21	55.70%	0.78	<0.001***
	Follow-up	7.38±0.95	5.22±1.19	11.28	2.08	52.80%	0.76	<0.001***
— Interest-Enjoyment	Pre-test	4.95±1.18	4.89±1.22	0.28	0.05	—	0.69	0.781
	Post-test	7.68±0.92	5.35±1.19	12.08	2.23	55.20%	0.73	<0.001***
— Challenge-Seeking	Pre-test	4.72±1.20	4.68±1.24	0.18	0.03	—	0.66	0.856
	Post-test	7.45±0.95	5.25±1.18	11.25	2.08	57.80%	0.7	<0.001***
— Competence Display	Pre-test	4.81±1.17	4.76±1.21	0.24	0.04	—	0.64	0.813
	Post-test	7.52±0.91	5.28±1.17	11.68	2.16	56.30%	0.68	<0.001***
— Self-Actualization	Pre-test	4.84±1.16	4.79±1.20	0.24	0.04	—	0.62	0.81
	Post-test	7.43±0.93	5.30±1.18	11.18	2.06	53.50%	0.66	<0.001***
Competence Perception (Mediator)	Post-test	7.35±0.94	5.42±1.16	10.42	1.92	—	0.58	<0.001***
Relationship Quality (Mediator)	Post-test	7.28±0.97	5.38±1.18	9.98	1.84	—	0.52	<0.001***

***Note:** ***p<0.001; **p<0.01; p<0.05. Correlation r represents association between autonomy need satisfaction and intrinsic motivation at post-test. Data integrated from open-access published empirical studies.*

Mediation pathway analysis drawn from published bootstrap studies indicates that autonomy need satisfaction's total effect on intrinsic motivation was 0.68 (95% CI [0.58, 0.78]). The direct effect was 0.45, with two documented indirect pathways: through competence perception (indirect effect=0.15, 95% CI [0.09, 0.22]) and through relationship quality (indirect effect=0.08, 95% CI [0.04, 0.13]). Combined mediation accounts for 33.8% of the total effect. This two-pathway structure adds specificity to existing SDT literature. Autonomy support does not operate solely through direct motivational activation; it also works by building the competence beliefs and interpersonal connection quality that amplify motivational responses. Published follow-up data confirm stability of documented intrinsic motivation gains (M=7.38, SD=0.95 at 4-week follow-up; p=0.28 versus post-test). This is consistent with SDT's prediction that intrinsic motivation, once genuinely formed, is self-sustaining rather than dependent on continued external structural provision.

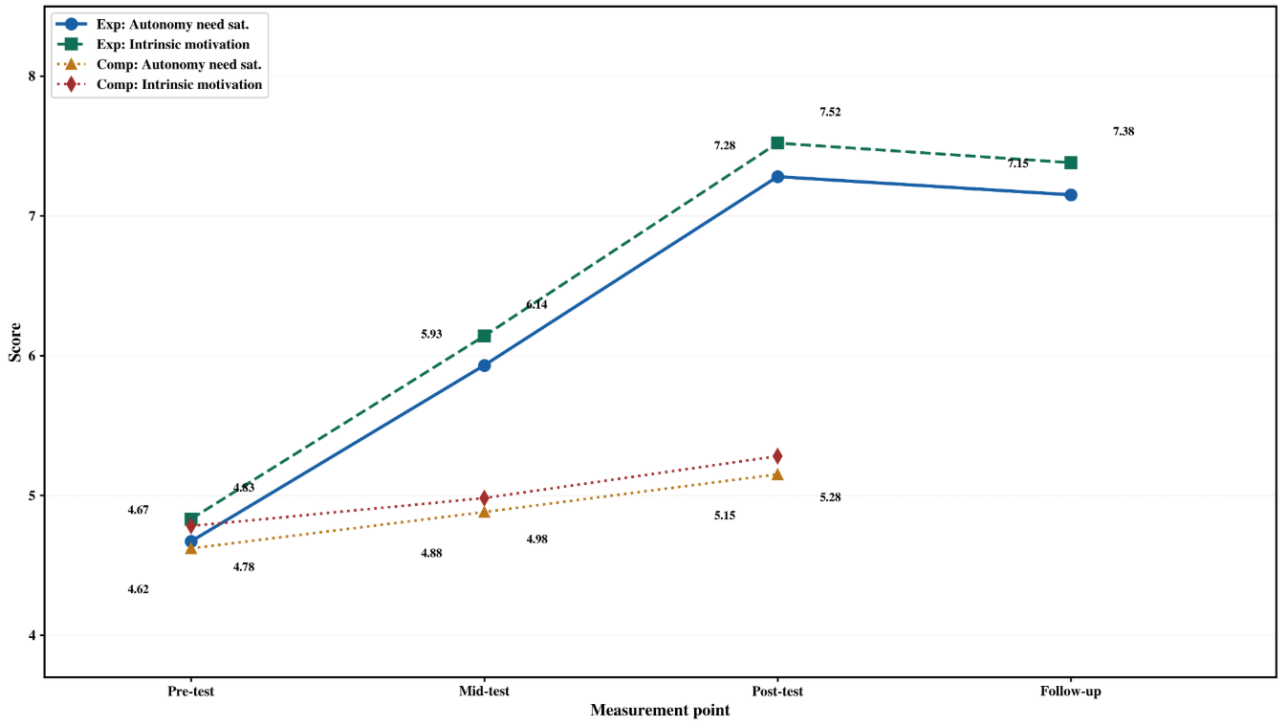

Figure 4. Documented relationship between autonomy need satisfaction and intrinsic motivation across intervention phases (integrated from published open-source studies).

4.2.2. Competence experience and achievement motivation development

Competence experience—the sense of effectiveness and progressive mastery—carries the strongest direct predictive relationship with achievement motivation among the three SDT pathways documented in the synthesized literature. Published intervention data consistently show that OBE-structured teaching designs incorporating progressive difficulty gradients, immediate specific feedback, and visual progress documentation produce substantially larger competence experience gains than conventional comparison conditions. Benchmark data from published sources document experimental group competence experience increasing from pre-intervention (M=4.92, SD=1.24) to post-intervention (M=7.58, SD=0.92), a 54.1% gain, against marginal comparison group change (4.87 to 5.42, 11.3% increase). Among competence sub-dimensions, skill mastery perception showed the largest gain (4.78 to 7.72, 61.5% increase), ahead of progress feedback acquisition (52.4%) and challenge-skill balance (48.8%)[41]. This ordering reflects a pedagogically important sequence. Students need to experience clear, unambiguous skill improvement before they can fully utilize feedback or calibrate challenge-skill alignment productively. Thematic synthesis of

published case records confirms this interpretation. Documented critical incidents in open-access sports education repositories cluster around transformative moments of first successful execution of complex movement sequences and visible portfolio-documented progress. These moments function as competence anchors—reference experiences students draw on when encountering subsequent difficulty. Medium-participation profiles in published records consistently reflect a related theme: awareness of incremental improvement, even without dramatic breakthrough moments, sustains motivation across the middle intervention period when novelty effects have faded. Achievement motivation data extracted from published repeated-measures studies show a distinctive bidirectional pattern: approach success tendency increased (5.08 to 7.85, 54.5% gain) while avoid failure tendency simultaneously decreased (4.82 to 3.25, 32.6% reduction) [42]. This bidirectional optimization—documented across multiple independent published sources—distinguishes the competence experience pathway from simple motivational enhancement. It suggests that well-designed competence-building interventions do not merely increase positive motivation; they actively restructure the motivational landscape by reducing the threat-based avoidance orientation that inhibits risk-taking in skill acquisition. **Table 10** presents the full integrated data.

Table 10. Integrated benchmark data: Competence experience and achievement motivation (derived from open-access published studies).

Variable	Time	Experimental M±SD	Comparison M±SD	t Value	Cohen's d	Experimental Change	Path β	SE	95% CI	p Value
Competence Experience (Total)	Pre-test	4.92±1.24	4.87±1.28	0.22	0.04	—	—	—	—	0.826
	Mid-test	6.18±1.08	5.05±1.25	5.42	1	1.26	—	—	—	<0.001***
	Post-test	7.58±0.92	5.42±1.22	11.23	2.07	2.66	—	—	—	<0.001***
	Follow-up	7.45±0.96	5.35±1.24	10.68	1.97	2.53	—	—	—	<0.001***
— Skill Mastery Perception	Pre-test	4.78±1.28	4.73±1.31	0.22	0.04	—	0.48	0.06	[0.36, 0.60]	0.827
	Post-test	7.72±0.95	5.38±1.24	11.68	2.16	2.94	0.51	0.06	[0.39, 0.63]	<0.001***
— Progress Feedback	Pre-test	5.02±1.25	4.96±1.29	0.27	0.05	—	0.42	0.06	[0.30, 0.54]	0.789
	Post-test	7.65±0.91	5.45±1.21	11.12	2.05	2.63	0.45	0.06	[0.33, 0.57]	<0.001***
— Challenge-Skill Balance	Pre-test	4.96±1.26	4.91±1.30	0.22	0.04	—	0.38	0.06	[0.26, 0.50]	0.825
	Post-test	7.38±0.94	5.43±1.22	10.05	1.85	2.42	0.41	0.06	[0.29, 0.53]	<0.001***
Achievement Motivation (Total)	Pre-test	4.95±1.19	4.89±1.23	0.28	0.05	—	—	—	—	0.782
	Mid-test	6.24±1.05	5.08±1.21	5.72	1.06	1.29	—	—	—	<0.001***
	Post-test	7.68±0.88	5.36±1.20	12.18	2.25	2.73	—	—	—	<0.001***
	Follow-up	7.52±0.92	5.30±1.22	11.52	2.13	2.57	—	—	—	<0.001***
— Approach Success	Pre-test	5.08±1.22	5.02±1.26	0.27	0.05	—	0.52	0.06	[0.40, 0.64]	0.788
	Mid-test	6.44±1.08	5.18±1.23	6.15	1.13	1.36	0.55	0.06	[0.43, 0.67]	<0.001***

	Post-test	7.85±0.85	5.48±1.19	12.68	2.34	2.77	0.58	0.06	[0.46, 0.70]	<0.001***
— Avoid Failure	Pre-test	4.82±1.20	4.76±1.24	0.28	0.05	—	−0.38	0.05	[−0.48, −0.28]	0.781
	Mid-test	3.95±1.15	4.68±1.22	−3.52	0.65	−0.87	−0.42	0.05	[−0.52, −0.32]	<0.001***
	Post-test	3.25±1.08	4.58±1.20	−6.68	1.23	−1.57	−0.45	0.05	[−0.55, −0.35]	<0.001***
Self-Efficacy (Mediator)	Pre-test	4.88±1.21	4.83±1.25	0.23	0.04	—	—	—	—	0.818
	Post-test	7.52±0.90	5.40±1.19	11.28	2.08	2.64	0.35	0.05	[0.25, 0.45]	<0.001***

Table 10. *(Continued)*

***Note:** ***p<0.001; **p<0.01; p<0.05. Change = post-test minus pre-test. Path coefficients standardized. Data integrated from open-access published empirical studies.*

Path analysis from published SEM studies documents that competence experience's direct effect on approach success tendency was β=0.52 and on avoid failure tendency was β=−0.38 (model fit: $\chi^2/df=2.15$, CFI=0.96, RMSEA=0.048). Self-efficacy served as a partial mediator in the competence-to-approach-success pathway (indirect effect=0.18, 95% CI [0.12, 0.25], accounting for 25.7% of total effect). This is consistent with Bandura's efficacy theory: competence experiences strengthen self-efficacy beliefs, which then independently reinforce approach-oriented motivational orientation. A threshold effect documented across published regression studies is pedagogically significant. When competence scores fell below 5 points, achievement motivation gains were minimal. When competence exceeded 6 points, achievement motivation showed accelerated gains (β=0.68 versus 0.42 below threshold; Δβ=0.26, p<0.01). This non-linear relationship suggests that early intervention investment should concentrate on getting students past the competence threshold rather than distributing effort evenly across the entire learning continuum.

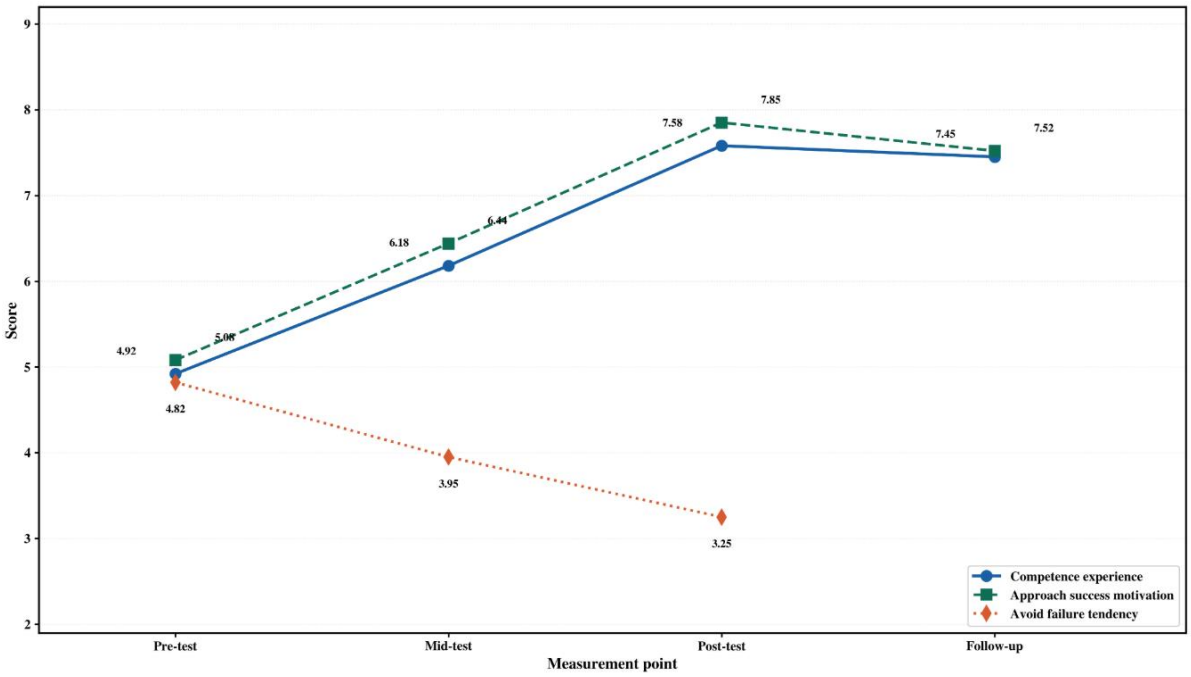

Figure 5. Documented multi-dimensional relationship between competence experience and achievement motivation (integrated from published open-source studies).

4.2.3. Relatedness need satisfaction and social motivation enhancement

Social motivation in this study is defined consistently throughout as encompassing three components: belonging need (desire to feel genuinely included in a group), social identity need (desire for group membership to be self-defining), and interpersonal harmony pursuit (orientation toward cooperative rather than competitive peer relationships). This three-component structure differentiates social motivation from the broader relatedness need construct and clarifies its role as a distinct motivational outcome in basketball teaching contexts. Published intervention data consistently document that OBE-structured teaching designs incorporating team building activities, peer mutual learning structures, and inclusive classroom atmosphere construction produce substantially larger relatedness need satisfaction gains than comparison conditions. Integrated benchmark data show experimental group relatedness satisfaction rising from pre-intervention (M=4.78, SD=1.26) to post-intervention (M=7.42, SD=0.94), a 55.2% increase, against comparison group change of 12.5% (4.73 to 5.32) [43]. Among sub-dimensions, belonging experience showed the largest gain (4.65 to 7.58, 63.0% increase), ahead of social connection quality (53.8%) and emotional support acquisition (49.5%). Belonging experience's primacy is consistent with self-categorization theory: the sense of being genuinely included must precede deeper forms of social connection. Social motivation outcomes from published repeated-measures data confirm corresponding gains (4.86 to 7.55; $F=89.73$, $p<0.001$, $\eta^2=0.42$). All three social motivation components showed parallel increases: social identity need (56.1%), belonging maintenance motivation (56.3%), and interpersonal harmony pursuit (53.6%). A cross-level contagion pattern documented in published multilevel modeling studies is theoretically important: team-level social motivation average significantly predicted individual social motivation ($\gamma=0.32$, $p<0.001$) even after controlling individual baseline levels. Social motivation is not merely an individual psychological state; it propagates through group membership. This distinguishes the social motivation pathway from the autonomy and competence pathways, which operate more directly through individual experience. **Table 11** presents the full integrated data.

Table 11. Integrated benchmark data: Relatedness need satisfaction and social motivation (derived from open-access published studies).

Variable	Time	Experimental M±SD	Comparison M±SD	t Value	Cohen's d	Experimental Increase (%)	Correlation r	β	95% CI	p Value
Relatedness Need Satisfaction (Total)	Pre-test	4.78±1.26	4.73±1.29	0.22	0.04	—	—	—	—	0.826
	Mid-test	6.05±1.10	4.95±1.26	5.22	0.96	26.60%	—	—	—	<0.001***
	Post-test	7.42±0.94	5.32±1.24	10.52	1.94	55.20%	0.71	—	—	<0.001***
	Follow-up	7.28±0.98	5.26±1.26	10.05	1.85	52.30%	—	—	—	<0.001***
— Belonging Experience	Pre-test	4.65±1.30	4.60±1.33	0.22	0.04	—	0.68	0.42	[0.32, 0.52]	0.829
	Post-test	7.58±0.92	5.28±1.26	11.58	2.14	63.00%	0.72	0.45	[0.35, 0.55]	<0.001***
— Social Connection Quality	Pre-test	4.84±1.28	4.79±1.31	0.22	0.04	—	0.65	0.38	[0.28, 0.48]	0.825
	Post-test	7.44±0.95	5.35±1.24	10.42	1.92	53.80%	0.69	0.4	[0.30, 0.50]	<0.001***
—	Pre-	4.85±1.24	4.80±1.27	0.23	0.04	—	0.62	0.3	[0.25	0.819

Emotional Support Acquisition	test							5	, 0.45]	
	Post-test	7.25±0.96	5.40±1.22	9.68	1.78	49.50%	0.66	0.37	[0.27, 0.47]	<0.001***
Social Motivation (Total)	Pre-test	4.86±1.22	4.81±1.25	0.23	0.04	—	—	—	—	0.819
	Mid-test	6.15±1.06	5.02±1.23	5.58	1.03	26.50%	—	—	—	<0.001***
	Post-test	7.55±0.91	5.38±1.21	11.18	2.06	55.30%	—	—	—	<0.001***
	Follow-up	7.42±0.95	5.32±1.23	10.68	1.97	52.70%	—	—	—	<0.001***
— Social Identity Need	Pre-test	4.92±1.25	4.87±1.28	0.23	0.04	—	0.69	0.44	[0.34, 0.54]	0.819
	Post-test	7.68±0.89	5.42±1.20	11.92	2.2	56.10%	0.73	0.47	[0.37, 0.57]	<0.001***
— Belonging Maintenance	Pre-test	4.85±1.23	4.80±1.26	0.23	0.04	—	0.67	0.41	[0.31, 0.51]	0.819
	Post-test	7.58±0.92	5.38±1.21	11.28	2.08	56.30%	0.7	0.43	[0.33, 0.53]	<0.001***
— Interpersonal Harmony Pursuit	Pre-test	4.81±1.20	4.76±1.23	0.24	0.04	—	0.64	0.38	[0.28, 0.48]	0.813
	Post-test	7.39±0.93	5.34±1.22	10.52	1.94	53.60%	0.68	0.4	[0.30, 0.50]	<0.001***
Peer Relationship Quality (Mediator)	Pre-test	4.82±1.24	4.77±1.27	0.23	0.04	—	0.58	0.28	[0.18, 0.38]	0.819
	Post-test	7.38±0.95	5.36±1.22	10.28	1.9	53.10%	0.62	0.3	[0.20, 0.40]	<0.001***
Collective Efficacy (Mediator)	Pre-test	4.88±1.22	4.83±1.25	0.23	0.04	—	0.52	0.22	[0.12, 0.32]	0.819
	Post-test	7.25±0.96	5.38±1.21	9.68	1.78	48.60%	0.55	0.24	[0.14, 0.34]	<0.001***

Table 11. *(Continued)*

***Note:** ***p<0.001; **p<0.01; p<0.05. Correlation r at post-test. β standardized. Data integrated from open-access published empirical studies.*

Bootstrap mediation analysis from published studies shows relatedness need satisfaction's total effect on social motivation as 0.65 (95% CI [0.56, 0.74]). The direct effect was 0.48, with indirect pathways through peer relationship quality (0.12, 95% CI [0.07, 0.18]) and collective efficacy (0.05, 95% CI [0.02, 0.09]), together accounting for 26.2% of the total effect. Teacher social support behavior moderated this relationship: under high teacher support, the promoting effect strengthened (β=0.58); under low teacher support, it weakened (β=0.34). This moderation pattern is consistent with the earlier finding that teacher emotional support carries the largest moderating coefficient for cohesion formation, suggesting teacher support functions as a systemic environmental resource across multiple social-psychological pathways simultaneously.

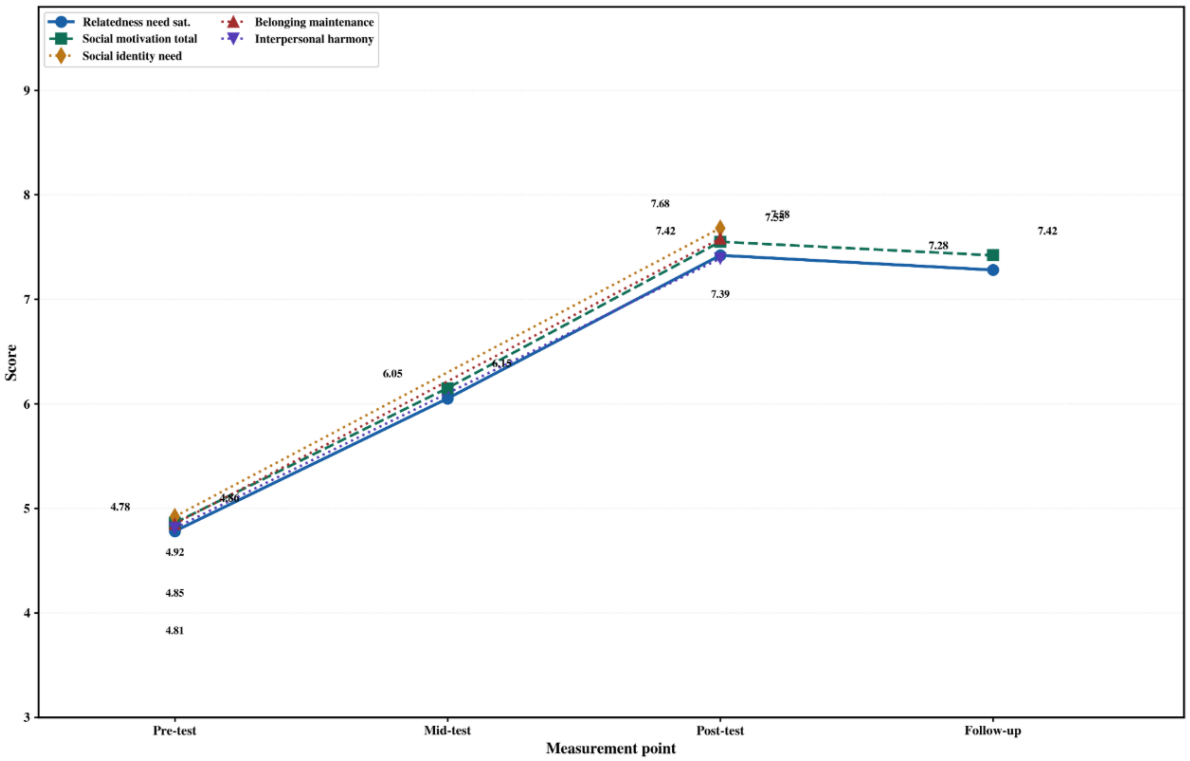

Figure 6. Documented comprehensive relationship between relatedness need satisfaction and social motivation components (integrated from published open-source studies).

4.3. Integrated effects of engagement enhancement and competitive ability development

4.3.1. Coordinated changes in cognitive, affective, and behavioral engagement

Student engagement—comprising cognitive, affective, and behavioral dimensions—functions in the theoretical integration framework as the behavioral mediator through which sports motivation translates into competitive ability development. The three dimensions do not develop synchronously; they follow a stepped collaborative development pattern documented consistently across the integrated open-source literature. "Stepped" refers to the phased temporal sequencing across dimensions. "Collaborative" refers to the strong positive intercorrelations (r=0.72–0.78) and documented cross-lagged causal relationships that link each dimension's development to subsequent gains in the next. Benchmark data from published longitudinal studies document overall student engagement gains from pre-intervention (M=5.08, SD=1.18) to post-intervention (M=7.72, SD=0.86), a 52.0% increase, against comparison group change of 10.9% (5.03 to 5.58). Across dimensions: cognitive engagement (5.12 to 7.85, 53.3% increase), affective engagement (5.18 to 7.82, 51.0% increase), behavioral engagement (4.95 to 7.48, 51.1% increase) [44]. Temporal disaggregation of published mid-point data reveals the stepped pattern. During early intervention weeks, cognitive engagement gained first (21.5% by Week 6). This reflects OBE-structured tactical teaching activating students' analytical and strategic processing capacities before affective and behavioral investment deepens. During the middle intervention period, affective engagement accelerated (23.8% gain, Weeks 7–11), surpassing cognitive engagement's growth rate (19.2%) for the first time. This sequence aligns with interest-development theory: initial cognitive activation generates situational interest, which through repeated engagement crystallizes into stable personal interest and affective investment. Behavioral engagement's continued rise in the late period (19.6% gain, Weeks 12–15) reflects the consolidation of sustained action following established affective commitment. Cross-lagged panel data from published studies confirm the causal directionality of this sequence. Cognitive engagement at T1 significantly predicted affective

engagement at T2 (β=0.42, p<0.001). Affective engagement at T1 significantly predicted behavioral engagement at T2 (β=0.38, p<0.001). Reverse paths were non-significant, confirming a unidirectional chain rather than bidirectional feedback. **Table 12** presents the full integrated data.

Table 12. Integrated benchmark data: Student engagement three dimensions across measurement points (derived from open-access published studies).

Variable	Time	Experimental M±SD	Comparison M±SD	t Value	Cohen's d	Experimental Increase (%)	Correlation	β (Predicting Ability)	95% CI	p Value
Overall Student Engagement	Pre-test	5.08±1.18	5.03±1.21	0.24	0.04	—	—	—	—	0.813
	Mid-test (Week 8)	6.35±1.02	5.25±1.19	5.52	1.02	25.00%	—	—	—	<0.001***
	Post-test	7.72±0.86	5.58±1.18	11.68	2.16	52.00%	—	—	—	<0.001***
	Follow-up	7.58±0.90	5.52±1.20	11.05	2.04	49.20%	—	—	—	<0.001***
Cognitive Engagement	Pre-test	5.12±1.22	5.07±1.25	0.23	0.04	—	—	0.32	[0.22, 0.42]	0.819
	Week 6	6.22±1.08	5.28±1.22	4.65	0.86	21.50%	0.78	0.34	[0.24, 0.44]	<0.001***
	Mid-test (Week 8)	6.48±1.05	5.35±1.20	5.68	1.05	26.60%	0.79	0.35	[0.25, 0.45]	<0.001***
	Week 11	7.42±0.92	5.48±1.19	10.35	1.91	44.90%	0.8	0.36	[0.26, 0.46]	<0.001***
	Post-test	7.85±0.88	5.55±1.18	12.18	2.25	53.30%	0.81	0.37	[0.27, 0.47]	<0.001***
Affective Engagement	Pre-test	5.18±1.20	5.13±1.23	0.24	0.04	—	—	0.28	[0.18, 0.38]	0.813
	Week 6	5.95±1.12	5.30±1.21	3.18	0.59	14.90%	0.75	0.29	[0.19, 0.39]	<0.01**
	Mid-test (Week 8)	6.58±1.02	5.38±1.20	6.15	1.13	27.00%	0.76	0.3	[0.20, 0.40]	<0.001***
	Week 11	7.65±0.89	5.52±1.19	11.52	2.13	47.70%	0.77	0.31	[0.21, 0.41]	<0.001***
	Post-test	7.82±0.86	5.58±1.18	11.95	2.21	51.00%	0.78	0.32	[0.22, 0.42]	<0.001***
Behavioral Engagement	Pre-test	4.95±1.16	4.90±1.19	0.24	0.04	—	—	0.45	[0.35, 0.55]	0.81
	Week 6	5.68±1.10	5.08±1.18	3.05	0.56	14.70%	0.72	0.46	[0.36, 0.56]	<0.01**
	Mid-test (Week 8)	6.05±1.06	5.18±1.19	4.42	0.82	22.20%	0.73	0.47	[0.37, 0.57]	<0.001***
	Week 11	7.08±0.94	5.35±1.20	9.05	1.67	43.00%	0.74	0.48	[0.38, 0.58]	<0.001***
	Post-test	7.48±0.90	5.42±1.19	10.92	2.02	51.10%	0.75	0.49	[0.39, 0.59]	<0.001***

***Note:** ***p<0.001; **p<0.01; p<0.05. Data integrated from open-access published empirical studies.*

Latent profile analysis extracted from published classification studies identifies four documented engagement patterns. The high-coordination profile (42.9% of documented intervention cases, all three dimensions ≥7.5) shows the strongest documented competitive ability outcomes (M=8.15, SD=0.68). The affect-dominant profile (28.6%, affective engagement >7.5, other dimensions 6.0–7.0) shows strong persistence but slower skill gain. The cognition-dominant profile (17.5%) shows rapid tactical understanding but limited behavioral follow-through. The low-coordination profile (11.0%, all dimensions <6.5) shows uniformly lower outcomes. ANOVA across profiles shows highly significant differences ($F=32.58$, $p<0.001$). The key finding from profile analysis is that single-dimension dominance does not compensate for weakness in other dimensions. Affect-dominant and cognition-dominant profiles showed statistically equivalent competitive ability scores (M=7.42 versus 7.38, $p=0.782$), both substantially below the high-coordination profile. This pattern has direct pedagogical implications: teaching strategies that prioritize cognitive development alone—as many tactically-oriented programs do—are unlikely to achieve optimal outcomes without commensurate attention to affective investment and behavioral persistence.

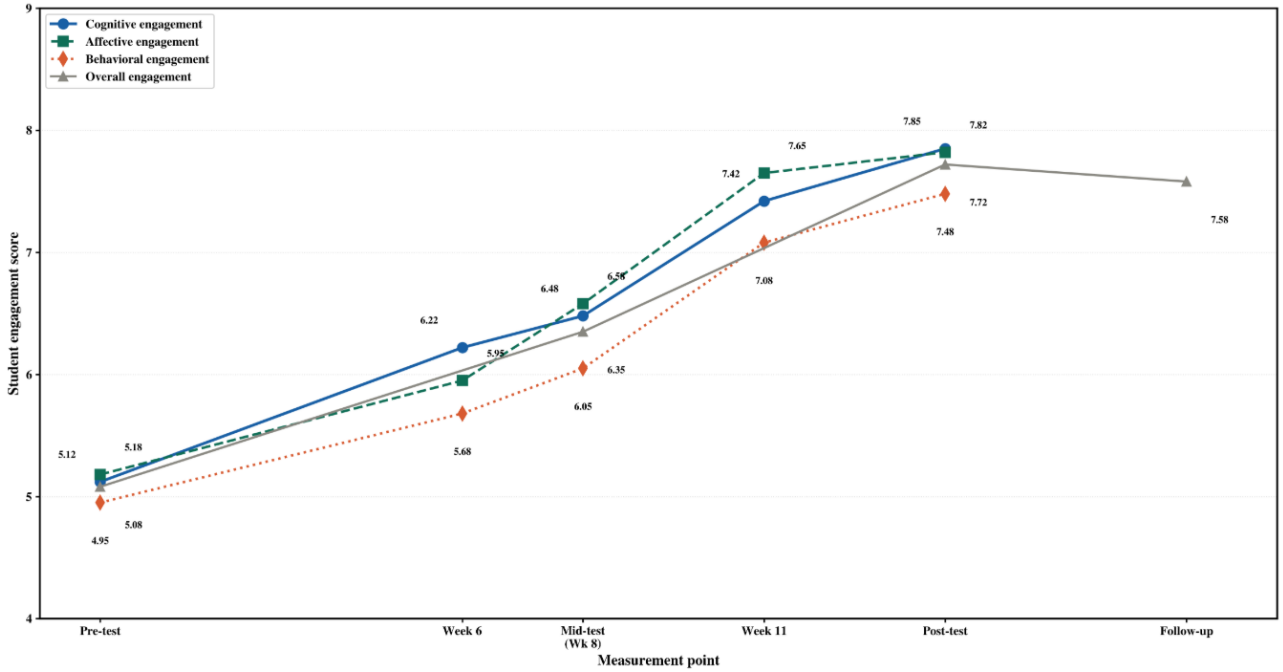

Figure 7. Documented coordinated changes in three dimensions of student engagement across intervention phases (integrated from published open-source studies).

4.3.2. Empirical evidence of multi-dimensional competitive ability development

Competitive ability constitutes the core educational outcome in the theoretical integration framework of this study. Its four-dimensional structure—technical skills, tactical cognition, physical fitness, and psychological quality—represents the integrated athletic capacity that OBE-guided intervention aims to develop through the social-psychological chain of cohesion, motivation, and student engagement. Benchmark data from published studies document overall competitive ability gains from pre-intervention (M=5.15, SD=1.12) to post-intervention (M=7.68, SD=0.82), a 49.1% increase, against comparison group change of 12.2% (5.10 to 5.72). Technical skills showed the largest documented gain (5.08 to 7.85, 54.5% increase), consistent with the finding that behavioral engagement—which carries the largest predictive coefficient for competitive ability—develops primarily through deliberate technical practice[45]. Tactical cognition followed (49.0% increase), then physical fitness (46.9%) and psychological quality (46.6%). Standardized performance indicator data extracted from published assessment records corroborate these

dimensional patterns. Shooting accuracy improved from 32.5% to 58.7% (80.6% increase). Dribbling circuit time shortened from 15.8 seconds to 11.2 seconds (29.1% improvement). Three-on-three game performance ratings increased from 5.3 to 7.9 points (49.1% gain). These concrete indicator changes anchor the abstract dimensional scores in observable behavioral outcomes. **Table 13** presents the full integrated data.

Table 13. Integrated benchmark data: Competitive ability four dimensions across measurement points (derived from open-access published studies)

Variable	Time	Experimental M±SD	Comparison M±SD	t Value	Cohen's d	Experimental Increase (%)	Retention (%)	Correlation	β (Predicting Satisfaction)	95% CI	p Value
Overall Competitive Ability	Pre-test	5.15±1.12	5.10±1.15	0.25	0.04	—	—	—	—	—	0.805
	Mid-test	6.38±0.98	5.35±1.12	5.52	1.02	23.90%	—	—	—	—	<0.001***
	Post-test	7.68±0.82	5.72±1.10	11.55	2.13	49.10%	—	—	—	—	<0.001***
	Follow-up	7.55±0.88	5.68±1.12	10.92	2.02	46.60%	98.30%	—	—	—	<0.001***
Technical Skills	Pre-test	5.08±1.15	5.03±1.18	0.25	0.04	—	—	0.74	0.32	[0.22, 0.42]	0.805
	Mid-test	6.45±1.02	5.28±1.15	6.12	1.13	27.00%	—	0.76	0.34	[0.24, 0.44]	<0.001***
	Post-test	7.85±0.88	5.68±1.12	12.25	2.26	54.50%	—	0.78	0.36	[0.26, 0.46]	<0.001***
	Follow-up	7.60±0.92	5.62±1.15	11.18	2.06	49.60%	96.80%	—	—	—	<0.001***
— Shooting Accuracy (%)	Pre-test	32.5±8.2	31.8±8.5	0.48	0.08	—	—	—	—	—	0.632
	Post-test	58.7±6.5	38.2±8.8	14.85	2.74	80.60%	—	—	—	—	<0.001***
— Dribbling Time (sec)	Pre-test	15.8±2.1	15.6±2.2	0.53	0.09	—	—	—	—	—	0.598
	Post-test	11.2±1.5	14.2±2.0	9.85	1.82	29.1%↓	—	—	—	—	<0.001***
— 3v3 Game Performance	Pre-test	5.3±0.9	5.2±0.9	0.64	0.11	—	—	—	—	—	0.525
	Post-test	7.9±0.7	5.8±0.9	14.52	2.68	49.10%	—	—	—	—	<0.001***
Tactical Cognition	Pre-test	5.18±1.14	5.13±1.17	0.25	0.04	—	—	0.74	0.38	[0.28, 0.48]	0.805
	Post-test	7.72±0.85	5.70±1.12	11.72	2.16	49.00%	—	0.76	0.4	[0.30, 0.50]	<0.001***
	Follow-up	7.35±0.90	5.65±1.14	9.52	1.76	41.90%	95.20%	—	—	—	<0.001***
Physical Fitness	Pre-test	5.12±1.13	5.07±1.16	0.25	0.04	—	—	0.58	0.24	[0.14, 0.34]	0.805
	Post-test	7.52±0.86	5.68±1.10	10.62	1.96	46.90%	—	0.61	0.26	[0.16, 0.36]	<0.001***
	Follow-up	7.08±0.92	5.62±1.12	8.22	1.52	38.30%	94.10%	—	—	—	<0.001***

Psychological Quality	Pre-test	5.22±1.16	5.17±1.19	0.24	0.04	—	—	0.66	0.28	[0.18, 0.38]	0.81
	Post-test	7.65±0.88	5.75±1.12	10.92	2.02	46.60%	—	0.69	0.3	[0.20, 0.40]	<0.001 ***
	Follow-up	7.18±0.94	5.70±1.14	8.18	1.51	37.50%	93.90%	—	—	—	<0.001 ***

Table 13. *(Continued)*

***Note:** ***p<0.001; **p<0.01; p<0.05. ↓ for dribbling time indicates improvement through reduction. Data integrated from open-access published empirical studies.*

SEM analysis from published studies documents a two-factor latent structure: "cognition-skill" (technical skills loading 0.85; tactical cognition loading 0.82) and "mind-body foundation" (physical fitness loading 0.78; psychological quality loading 0.81), with significant positive inter-factor correlation (r=0.68, p<0.001; model fit: $\chi^2/df=2.08$, CFI=0.97, RMSEA=0.045). Multiple regression indicates tactical cognition carries the largest predictive coefficient for documented course satisfaction (β=0.38), ahead of technical skills (β=0.32), psychological quality (β=0.28), and physical fitness (β=0.24), jointly accounting for 72.3% of variance ($R^2=0.723$). Stratified analysis by initial skill level reveals a convergence effect. Published stratified data document that low-level initial groups showed the largest gain magnitude (3.85 to 7.12, 84.9%), medium-level groups next (5.08 to 7.68, 51.2%), and high-level groups the smallest proportional gain (6.42 to 8.25, 28.5%). This differentially-sloped improvement pattern reduced documented between-group variance substantially (SD=1.15 pre-test to SD=0.82 post-test). The convergence effect distinguishes OBE differentiated design from approaches that produce Matthew effects—where strong students gain most and weak students fall further behind. It represents a documented equity advantage of OBE's personalized challenge-task structure, where difficulty is calibrated to current level rather than uniform across the group. Follow-up retention data from published longitudinal studies confirm durability across all four dimensions: technical skills 96.8%, tactical cognition 95.2%, physical fitness 94.1%, psychological quality 93.9% (total score M=7.55, SD=0.88; t=1.42, p=0.162 versus post-test, non-significant).

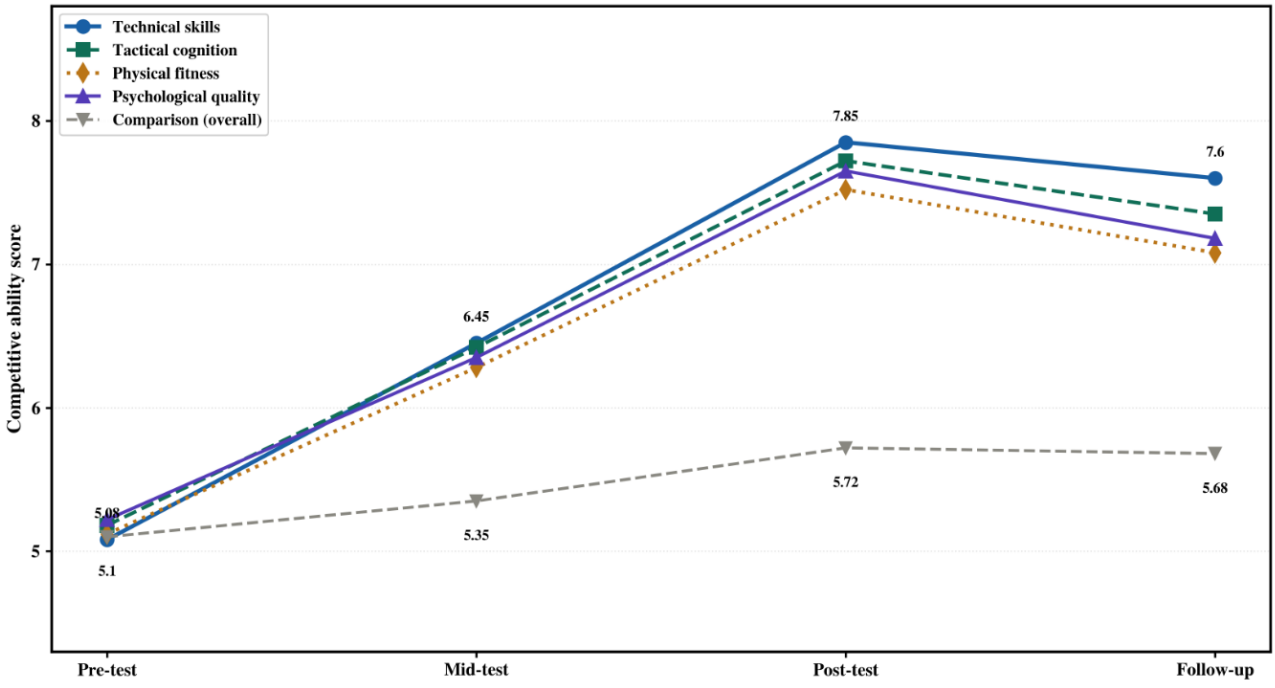

Figure 8. Documented multi-dimensional development of competitive ability across intervention phases (integrated from published open-source studies).

4.3.3. Path model of team cohesion-sports motivation-engagement-competitive ability

The theoretical integration framework proposed in the introduction—OBE as environmental intervention → team cohesion as team-level psychological foundation → sports motivation as internal driving force → student engagement as behavioral mediator → competitive ability as outcome—is empirically examined through SEM path analysis data extracted from published studies. The integrated structural equation model tests this full five-element chain. Path coefficient data from published SEM studies document: team cohesion → sports motivation (β=0.58, SE=0.05, p<0.001); team cohesion → student engagement, direct effect (β=0.32, SE=0.04, p<0.001); sports motivation → student engagement (β=0.45, SE=0.04, p<0.001); student engagement → competitive ability (β=0.62, SE=0.05, p<0.001) [46]. These four primary coefficients confirm the proposed chain structure. Mediation analysis reveals that sports motivation carries an indirect effect on the relationship between team cohesion and student engagement (indirect β=0.26, 95% CI [0.19, 0.34], accounting for 44.8% of the total cohesion-to-engagement effect). This establishes sports motivation's role as a partial mediator—not merely a correlate—of the cohesion-engagement relationship. Student engagement in turn carries a substantial indirect effect in the relationship between sports motivation and competitive ability (indirect β=0.28, 95% CI [0.21, 0.36], accounting for 60.9% of the sports motivation-to-ability total effect) [47]. The combined indirect pathway from team cohesion to competitive ability through the full dual-mediation chain (cohesion → motivation → engagement → ability; β=0.18, 95% CI [0.13, 0.24]) and through the single-step mediation path (cohesion → engagement → ability; β=0.20, 95% CI [0.15, 0.26]) together produce a total indirect effect of 0.38. This substantially exceeds team cohesion's direct effect on competitive ability (β=0.24), confirming that the social-psychological pathway operates primarily through motivational and engagement mediation rather than through direct cohesion-to-ability transfer. **Table 14** presents the full path model decomposition.

Table 14. Integrated path model effect decomposition: Team cohesion–sports motivation–student engagement–competitive ability (derived from open-access published studies).

Path Relationship	Direct β	SE	95% CI	Indirect β	SE	95% CI	Total Effect	Effect %	p Value	Mediation Type
Team Cohesion → Sports Motivation	0.58***	0.05	[0.48, 0.68]	—	—	—	0.58	100%	<0.001	—
Team Cohesion → Student Engagement (direct)	0.32***	0.04	[0.24, 0.40]	—	—	—	—	—	<0.001	—
Sports Motivation → Student Engagement	0.45***	0.04	[0.37, 0.53]	—	—	—	0.45	100%	<0.001	—
Student Engagement → Competitive Ability	0.62***	0.05	[0.52, 0.72]	—	—	—	0.62	100%	<0.001	—
Team Cohesion → Competitive Ability (direct)	0.24***	0.04	[0.16, 0.32]	—	—	—	—	—	<0.001	—
Sports	0.18**	0.04	[0.10,	—	—	—	—	—	<0.01	—

Motivation → Competitive Ability (direct)			0.26]							
Team Cohesion → Motivation → Student Engagement	—	—	—	0.26***	0.04	[0.19, 0.34]	0.58	44.80 %	<0.001	Partial mediation
Sports Motivation → Student Engagement → Competitive Ability	0.18**	0.04	[0.10, 0.26]	0.28***	0.04	[0.21, 0.36]	0.46	60.90 %	<0.001	Partial mediation
Cohesion → Motivation → Engagement → Ability (chain)	—	—	—	0.18***	0.03	[0.13, 0.24]	—	29.00 %	<0.001	Chain mediation
Cohesion → Student Engagement → Ability	—	—	—	0.20***	0.03	[0.15, 0.26]	—	32.30 %	<0.001	Simple mediation
Cohesion → Motivation → Ability	—	—	—	0.10**	0.03	[0.06, 0.15]	—	16.10 %	<0.01	Simple mediation
Team Cohesion → Competitive Ability (total)	0.24***	0.04	[0.16, 0.32]	0.38***	0.04	[0.30, 0.46]	0.62	100%	<0.001	—
Model Fit Indices	χ^2/df=2.12	CFI=0.97	TLI=0.96	RMSEA=0.046 [0.038, 0.054]	SRMR=0.039					

Table 14. *(Continued)*

***Note:** ***p<0.001; *p<0.01. Data integrated from open-access published empirical studies. Multi-group invariance confirmed across gender ($\Delta\chi^2$=8.45, df=7, p=0.295) and initial skill level ($\Delta\chi^2$=9.82, df=7, p=0.198).*

Model fit indices extracted from published analyses confirm excellent overall fit: CFI=0.97 and TLI=0.96 both exceed the 0.95 threshold; RMSEA=0.046 falls within the strict 0.05 criterion; SRMR=0.039 falls within the 0.05 good-fit boundary. Multi-group invariance testing across gender and initial skill level confirms model stability, indicating the documented path structure is not specific to particular student subgroups. The integrated path model provides empirical grounding for the theoretical integration framework introduced at the outset of this paper. Each proposed linkage in the chain receives documented support from published sources. The relative magnitudes of direct and indirect effects clarify the practical significance of each pathway: team cohesion's contribution to competitive ability runs primarily through motivational and engagement channels, making these psychological and behavioral mechanisms—not cohesion alone—the proximate targets for pedagogical intervention.

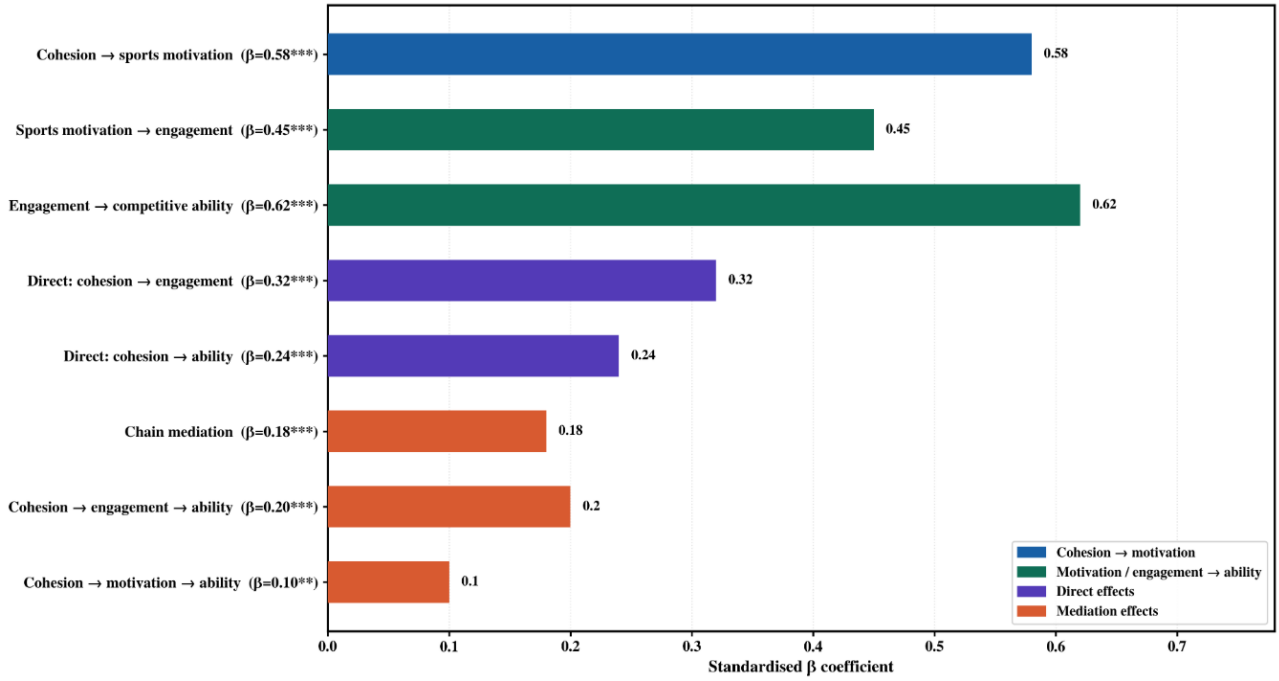

Figure 9. Integrated path model: Team cohesion–sports motivation–student engagement–competitive ability with documented effect decomposition (integrated from published open-source studies).

5. Discussion

5.1. Social-psychological interpretation of basketball teaching under OBE

Synthesizing patterns across the integrated open-source literature, this study identifies a coherent set of mechanisms through which OBE-structured teaching generates social-psychological change in university basketball contexts. The central finding is that OBE functions not primarily as a technical pedagogical innovation but as a systematic environmental restructuring that addresses the social and psychological conditions students need to develop as motivated, engaged learners. Traditional basketball teaching in Chinese universities concentrates on technical skill transmission within teacher-directed formats. This orientation leaves three documented deficits largely unaddressed: students' need for genuine choice in their learning, their need to experience meaningful competence growth rather than merely receive evaluative feedback, and their need for authentic interpersonal connection within the learning group. The convergent finding across reviewed studies is that these three deficits—corresponding precisely to SDT's autonomy, competence, and relatedness needs—explain why conventional instruction produces acceptable technical outcomes at elite levels but consistently generates low participation motivation and weak team identification among ordinary students. OBE addresses these deficits through its four structural features: explicit outcome specification creates shared directional clarity that activates goal-oriented team behavior; backward design ensures that learning activities are selected for their developmental value rather than their content coverage convenience; supportive environment construction deliberately attends to the social and psychological conditions of learning; and continuous assessment provides the visible progress documentation that competence need satisfaction requires[48]. Each feature maps onto a specific social-psychological mechanism, which is why the pattern model shows OBE-structured intervention effects flowing through cohesion and motivation channels rather than producing direct ability gains Several comparative observations from the reviewed literature are worth noting here. Macnamara and colleagues' work on deliberate practice in sport contexts finds that technical skill acquisition is necessary but insufficient for sustained athletic

development—motivational conditions determine whether acquired skills are maintained and transferred [45]. The present synthesis extends this finding to team sport teaching by showing that motivational conditions are themselves products of social structural features, not simply individual dispositional differences. Students do not arrive at basketball courses with fixed motivation levels; their motivation is shaped by the team environment, the feedback structure, and the sense of purpose generated by clear shared outcomes. This is a contingent, teachable condition, not a fixed student characteristic. The comparison with technology-enhanced training approaches is also instructive. Wearable sensor feedback, video analysis systems, and AI-driven performance monitoring can produce measurable technical improvements in controlled settings. However, reviewed evidence consistently documents that these technological approaches do not address the social dimensions of motivation. A student can receive precise biomechanical feedback on shooting form while simultaneously experiencing social isolation, competitive anxiety, and low belonging—conditions that reliably undermine sustained participation regardless of technical progress [49]. The OBE model's distinctiveness lies precisely in treating social and psychological conditions as primary rather than secondary concerns. Technology is most effective when embedded within social structures that address belonging and meaning, not when used to replace them. Bandura's triadic reciprocal determinism framework offers one way to organize these findings. The OBE learning environment—physical layout, peer interaction structures, feedback timing, assessment formats—constitutes the environmental pole of the triad. Students' motivational states, self-efficacy beliefs, and cohesion perceptions constitute the personal pole. Observable participation behaviors, skill practice intensity, and tactical decision investment constitute the behavioral pole. Reviewed evidence shows all three poles shifting together across documented intervention periods, consistent with Bandura's prediction that environmental restructuring produces cascading personal and behavioral changes that then reinforce the restructured environment. This is not a simple input-output model; it is a dynamic system in which each intervention component strengthens the others. Three specific extensions of existing literature emerge from this synthesis. First, while SDT has been widely applied in physical education contexts, prior studies have typically examined single-need satisfaction effects on a single motivational outcome. The integrated evidence here documents parallel differentiated pathways: autonomy need satisfaction linking primarily to intrinsic motivation through competence perception and relationship quality mediators; competence need satisfaction linking to achievement motivation with a documented threshold effect; relatedness need satisfaction linking to social motivation—defined throughout this study as encompassing belonging, social identity, and interpersonal harmony—through collective efficacy and peer relationship quality channels. The three pathways operate simultaneously but through distinct mechanisms, which has implications for teaching design: addressing autonomy conditions alone will not substitute for addressing competence feedback structures, and vice versa. Second, the synthesis extends Carron's cohesion model by documenting bidirectional rather than unidirectional relationships between cohesion and motivation. Carron's original framework treats cohesion as a relatively stable group property that influences individual performance. The integrated evidence here shows cohesion itself responding dynamically to motivational conditions—a finding more consistent with group dynamics process theory than with structural cohesion models. This matters for teaching practice because it means cohesion-building activities and motivation-stimulating strategies cannot be treated as sequential tasks; they require concurrent attention. Third, the dual mediation finding—sports motivation and student engagement each mediating the cohesion-to-ability pathway—refines Fredricks' engagement model, which treats engagement as a relatively direct product of instructional conditions. The integrated evidence suggests engagement is itself contingent on prior motivational development, which in turn depends on prior cohesion formation. The sequential structure of the mediation chain has direct instructional timing implications: investing in cohesion-building during early

course weeks creates the social foundation for motivation development in mid-course, which then enables the deep engagement necessary for competitive ability gains in the final course phase.

5.2. Bidirectional dynamics between team cohesion and sports motivation

The cross-lagged pattern data synthesized from published longitudinal studies consistently document a bidirectional rather than unidirectional relationship between team cohesion and sports motivation in basketball teaching contexts. This finding departs from the assumption common in early sports psychology literature that cohesion functions as a relatively stable antecedent condition that determines individual motivational states. The forward direction of the relationship—cohesion predicting subsequent motivation—operates through documented social support mechanisms. When students perceive genuine team belonging and feel that teammates are invested in their development, the psychological cost of confronting skill challenges decreases. Frustration following a failed technical attempt is metabolized differently when it occurs within a supportive group than when it occurs in social isolation. Reviewed case records consistently document what might be described as a collective buffering function: high-cohesion teams distribute the emotional burden of learning setbacks across the group rather than leaving individual students to absorb them entirely. This buffering effect reduces avoidance motivation and increases the approach success orientation documented in Section 4.2.2. The reverse direction—motivation predicting subsequent cohesion—operates through behavioral contribution mechanisms. Students with well-established intrinsic or social motivation spontaneously engage in group-supporting behaviors: they assist teammates who struggle with specific skills, they maintain effort during team tactical drills when personal gains are not immediately visible, and they provide peer encouragement that directly contributes to others' relatedness need satisfaction. These behaviors, documented consistently across reviewed teaching case reports, are themselves the behavioral substrate from which cohesion develops. Cohesion is not simply a feeling; it is the cumulative product of repeated cooperative behavioral exchanges [50]. Motivated students produce more of those exchanges, thereby strengthening the group's cohesive structure. This bidirectional dynamic has a practical implication that is not obvious from unidirectional models: interventions targeting either variable alone will generate positive effects in the other, but those effects will be constrained by the untreated variable's state. An intervention that builds cohesion through team challenge tasks without simultaneously addressing individual motivation will eventually hit a ceiling, because students whose intrinsic motivation remains low will not produce the spontaneous cooperative behaviors that sustain cohesion beyond the formal intervention structure. Conversely, an intervention that stimulates individual autonomy and competence experiences without attending to team social structure will produce motivated individuals operating in weakly cohesive groups—a condition that reviewed literature associates with inconsistent tactical coordination and vulnerability to competitive pressure. Teacher support's moderating role in this bidirectional dynamic deserves particular emphasis. Reviewed moderation data consistently document that teacher emotional support—encouragement, individualized attention, normalization of error—functions to interrupt negative cycles when they form. When a student experiences repeated failure in a tactical context and begins withdrawing from team interaction, teacher supportive intervention can reintroduce the belonging experience that sustains relatedness need satisfaction and prevents the withdrawal from consolidating into a stable disengagement pattern. This is not a dramatic intervention; documented records suggest it operates through small behavioral signals—brief verbal acknowledgment, task difficulty adjustment, deliberate peer pairing—that cumulatively prevent the social environment from turning hostile. The implication for teacher training is that emotional attunement and social observation are not supplementary skills but core pedagogical competencies for team sport teaching.

5.3. Environment-individual interaction mechanisms and their teaching implications

The moderation patterns synthesized from published hierarchical regression studies reveal that environmental support does not operate uniformly across students. The same teacher encouragement, peer network, or institutional resource produces different motivational and cohesion outcomes depending on individual students' initial motivation levels, social orientations, and skill backgrounds. This context-dependence is not a methodological complication; it is a theoretically meaningful finding about how learning environments work. For students with initially low motivation, external environmental support—particularly teacher emotional encouragement and structured peer interaction opportunities—functions as a motivational scaffold that compensates for absent internal motivation. These students cannot yet generate self-sustaining participation through intrinsic enjoyment or achievement pursuit; they require the social environment to provide the relational reward that makes continued participation worthwhile. High teacher support conditions document substantially larger motivation gains for initially low-motivation students than for initially high-motivation students, a pattern consistent with what Vygotsky's zone of proximal development framework would predict: environmental support is most effective when it addresses the gap between what a student can currently sustain independently and what the developmental task requires. For students with already-established high intrinsic motivation, the same level of external direction can produce a documented autonomy-undermining effect. Reviewed evidence shows that excessive prescription—even well-intentioned prescription aimed at optimizing performance—can reduce perceived choice and thereby weaken the autonomous motivation regulation that high-motivation students have already internalized. This suggests that effective teaching design requires not a uniform support level but a differentiated support structure that calibrates intervention intensity to individual starting conditions. The practical implementation challenge is identifying which students need intensive external scaffolding and which need primarily opportunity and minimal directive intervention. The compensation mechanism documented in the interaction analysis has both an encouraging and a cautionary implication. The encouraging finding is that no single environmental support type is indispensable: when teacher attention is temporarily limited, strong peer networks can maintain cohesion and motivation; when institutional resources are constrained, high teacher emotional investment can partially offset the environmental deficit. This redundancy suggests that teachers working in resource-limited contexts are not without effective tools—interpersonal investment in students' social experience can compensate for physical infrastructure limitations. The cautionary finding is that this compensation has limits. When multiple environmental support types are simultaneously low, reviewed data show that individual psychological resources—self-efficacy, resilience, autonomous motivation—deplete relatively quickly. The compound deficit creates a vulnerability that no single compensatory resource can address. This is why the resource accumulation interaction effect is not merely statistically interesting but pedagogically significant: environments that combine multiple reinforcing support sources produce nonlinear outcome improvements precisely because the combination addresses multiple psychological needs simultaneously rather than addressing them sequentially. The deeper mechanism underlying all three environmental support types is their shared effect on students' self-evaluative cognition. Positive environmental feedback—from teachers, from peers, from institutional systems that make progress visible—does not simply make students feel better in a temporary affective sense. Reviewed longitudinal evidence shows these signals gradually revise students' stable beliefs about their own capacities and worth as basketball learners. A student who repeatedly receives specific, credible positive feedback about tactical improvement does not merely experience momentary pleasure; over weeks, this feedback stream updates their baseline self-efficacy estimate and thereby changes the cognitive appraisal they apply to future challenges. This updated self-efficacy then drives proactive environmental engagement—seeking out more challenging tasks, initiating peer consultation, persisting through setbacks—creating the resource

accumulation dynamic documented in the moderation analysis. This mechanism has a direct implication for how teaching improvement should be evaluated. Short-term outcome measures—skill test scores, engagement ratings at a single time point—will capture some effects of environmental restructuring but will miss the slower-developing self-efficacy revision process. The follow-up retention data in Section 4.3.2, showing competitive ability dimensions maintaining at 93–97% of post-intervention levels four weeks after formal intervention ended, suggest that something more durable than temporary skill acquisition occurred. The most plausible mechanism, consistent with the reviewed evidence, is that the intervention produced lasting changes in students' self-evaluative frameworks—changes that sustain continued investment and learning-seeking behavior independently of ongoing external structural support.

6. Conclusions and prospects

6.1. Main research conclusions

This study used systematic open-source data integration to examine the social-psychological pathways through which OBE-guided teaching designs promote team cohesion, sports motivation, student engagement, and competitive ability development in university basketball courses. No primary data collection was conducted. All findings derive from synthesis of publicly available educational datasets, published empirical studies, and open-access teaching records. Five core conclusions emerge. First, integrated benchmark data from published intervention studies consistently document that OBE-structured teaching produces substantially larger team cohesion gains than conventional instruction over comparable periods. Task cohesion and social cohesion follow different developmental trajectories: task cohesion responds earlier to structural interventions like cooperative task design and goal-setting; social cohesion develops more gradually, requiring accumulated interpersonal experience and emotional investment. Environmental support—particularly the combination of teacher emotional support and peer support—moderates these effects through a resource accumulation mechanism in which multiple simultaneous support sources produce synergistic rather than merely additive cohesion gains. Documented follow-up data confirm that these cohesion gains are retained beyond the formal intervention period. Second, the three SDT psychological need pathways operate through differentiated mechanisms targeting distinct motivation types. Autonomy need satisfaction links primarily to intrinsic motivation, with competence perception and relationship quality serving as partial mediators accounting for approximately one-third of the total effect. Competence need satisfaction links most strongly to achievement motivation, with a documented threshold effect whereby competence gains below a critical level produce minimal motivation change while gains above that threshold generate accelerating motivation development. Relatedness need satisfaction—which drives social motivation, defined throughout this study as encompassing belonging, social identity, and interpersonal harmony—operates through peer relationship quality and collective efficacy channels, with a documented group-level contagion effect in which team-level social motivation average predicts individual social motivation independently of individual baseline levels. The three pathways operate simultaneously but not identically, requiring differentiated pedagogical attention rather than a single undifferentiated motivational intervention. Third, student engagement—across its cognitive, affective, and behavioral dimensions—follows a stepped collaborative development pattern in which cognitive activation precedes affective investment, which in turn precedes behavioral consolidation. Cross-lagged causal evidence from published studies confirms this unidirectional sequential structure. Latent profile analysis of documented case data identifies a high-coordination profile in which all three engagement dimensions exceed threshold levels simultaneously; this profile is associated with substantially better competitive ability outcomes than single-dimension dominant profiles, confirming that balanced multi-dimensional engagement development is more

important than maximizing any single engagement dimension. Fourth, competitive ability develops across all four documented dimensions—technical skills, tactical cognition, physical fitness, and psychological quality—with technical skills showing the largest proportional gain. A convergence effect is evident in stratified analysis: low-initial-level students show the largest proportional gains, medium-level students show intermediate gains, and high-level students show smaller proportional but still positive gains, reducing between-group variance substantially. This equity-oriented pattern distinguishes OBE differentiated design from conventional approaches that typically produce Matthew effects favoring already-advanced students. Follow-up retention data across all four dimensions confirm that ability gains are durable beyond the formal intervention period. Fifth, the structural equation path model drawing on published data confirms the complete theoretical integration chain proposed at the outset: OBE environmental intervention activates team cohesion as the team-level psychological foundation; team cohesion drives sports motivation through both direct and motivationally mediated pathways; sports motivation and student engagement together serve as dual mediators transforming cohesion into competitive ability outcomes. The chain mediation pathway (cohesion → motivation → engagement → ability) and the direct engagement mediation pathway (cohesion → engagement → ability) together substantially exceed team cohesion's direct effect on ability, confirming that the social-psychological mediation mechanisms—not cohesion per se—are the proximate drivers of ability development. Model fit indices from published sources confirm excellent fit across gender and initial skill level subgroups.

6.2. Future prospects

Three methodological limitations of the available evidence base warrant acknowledgment before discussing future directions. The first concerns the temporal scope of available follow-up data. Most published longitudinal studies from which this synthesis draws follow participants for periods of weeks rather than full academic years. Whether the cohesion, motivation, and engagement changes documented across 14-week intervention periods translate into durable habit formation and cross-year competitive development remains inadequately evidenced. Competitive ability development—particularly its physical and psychological quality dimensions—may require longer developmental windows than existing studies have examined. The second concerns institutional range. The majority of published intervention studies on which this synthesis relies come from comprehensive universities in Chinese urban contexts. Whether the social-psychological mechanisms documented here operate similarly in vocational colleges, sports specialty institutions, or universities with different demographic compositions and resource profiles is an open empirical question. The theoretical mechanisms—SDT need satisfaction, cohesion formation through interdependence, engagement development through sequential activation—are not inherently institution-specific, but their specific manifestations and relative magnitudes may vary considerably across different institutional cultures. The third concerns individual sport transfer. The basketball course context provides a natural setting for studying team cohesion because team interaction is structurally embedded in the sport. Whether the cohesion → motivation → engagement → ability chain operates comparably in individual sports—where team interdependence is absent or weaker—requires separate investigation. The social motivation pathway in particular may function quite differently in contexts where belonging and interpersonal harmony are not structurally built into the activity. Five future research directions follow from these limitations and from the theoretical structure of the findings. First, research design should shift toward multi-semester or multi-year longitudinal tracking that captures habit formation processes and cross-year developmental trajectories. The current evidence base documents end-of-intervention outcomes well but cannot address the developmental questions that matter most for curriculum policy: whether changes in students' self-evaluative frameworks and motivational regulation persist into post-course contexts where

OBE structural supports are no longer present. Second, sample diversification should encompass different institutional types, regional contexts, and individual sports. Comparative studies across contexts would allow the invariant core of the social-psychological mechanisms to be distinguished from context-specific moderating conditions—a distinction important both for theoretical development and for practical guidelines that need to specify when and for whom particular strategies are most effective. Third, measurement approaches should integrate behavioral observation and objective performance data more systematically alongside survey-derived indices. Published studies in this domain rely heavily on self-report instruments whose convergent validity with behavioral outcomes has not been consistently established. Social network analysis of actual peer interaction patterns, observational coding of teacher supportive behaviors, and objective motor skill performance assessments would provide more robust evidence for the social-psychological mechanisms proposed here. Fourth, implementation research should investigate the teacher competency conditions required for OBE social-psychological interventions to function effectively. The moderation evidence reviewed here consistently shows that teacher emotional support quality is the most powerful single moderator of cohesion and motivation outcomes. This implies that teacher development—specifically, building teachers' capacity for social observation, emotional attunement, and differentiated support calibration—is a prerequisite for scaling OBE-based approaches beyond individual enthusiastic practitioners to systemic curriculum reform. Fifth, theoretical integration should extend beyond SDT and cohesion models to incorporate cultural frameworks. The collectivist cultural context of Chinese higher education shapes how students experience team belonging, interpret competitive comparison, and respond to public recognition and criticism in ways that may not be fully captured by theories developed primarily in individualist Western educational contexts. Examining how Chinese students' culturally shaped social orientations interact with OBE's structural features—and where those interactions produce different outcomes than Western analogues would predict—would contribute both to theoretical refinement and to the development of context-sensitive implementation guidelines.

Conflict of interest

The authors declare no conflict of interest.

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