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The Impact of Digital Technology on Physical Education Teaching Models: A Case Study of Chinese Universities

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Abstract. This research examines how digital technologies are being integrated into sports education across several Chinese universities. By combining surveys, interviews, and classroom observations from multiple institutions, we identify the main obstacles that educators face when adopting these tools, explore what causes these challenges, and propose practical, evidence-based solutions to overcome them. The results reveal striking differences in how digital technology is rolled out in physical education.These gaps show up across institution types, regions, and disciplinary approaches. Behind them: tight institutional policies, patchy infrastructure, shortages of pedagogical know-how, and cultural pushback. Instead of a stiff blueprint, the study offers a down-to-earth game plan: mix online and face-to-face classes, let phones become teaching tools, drop kids into VR when it helps, and use real-time data to see what actually works. None of this will stick without new policies that free teachers to experiment—and without training that shows them how. Built for Chinese universities, the framework is a living starter kit any lecturer, dean, or bureau chief can pick up tomorrow.

Keywords: Digital technology, Physical education, Higher education, Teaching models, Educational innovation

1. Introduction

China's 2017 AI plan and the 2018 Education Informatisation 2.0 notice framed sport as another column in the spreadsheet; the 20th Party Congress report fused education, science and talent into one line, yet left universities to fund the merger. Eastern Double-First-Class campuses already pipe motion-capture data through the same fibre that feeds the super-computer, while a western college shares one 4-G router between football field and running track; rain still kills the signal. Where money lands, disciplines split: timed laps invite sensors, wushu and dance wait for a metric that can quantify spirit without killing it [1].

2. Current status and challenges in digital technology implementation

2.1. Disparities in technology access and adoption

Coastal laboratories showcase smart arenas, but the fiscal map tilts sharply westward. Per-capita GDP gaps translate directly into router counts: a single outdoor Bluetooth gateway can scan 400 wristbands, yet when four classes overlap the buffer collapses and data packets vanish. 5G base stations cluster

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around science faculties; sport departments discover that every antenna they request must compete with a new engineering clean-room. Equipment ages fast: last year's heart-rate straps already fail the firmware update that next week's syllabus demands [2].

2.2. Technical infrastructure limitations

Bandwidth arrives, then stalls on the human node. Young lecturers fluent in TikTok freeze when asked to convert swipes into lesson design; veterans who can spot a four-degree javelin error refuse to trust a number that says the same. Both groups teach fifteen contact hours, supervise evening training, and face a promotion table that rewards SCI articles, not smart-arena pilots. The training office advertises "AI in Education" workshops; the demos still open with PowerPoint.

2.3. Faculty digital competency gaps

Students like leaderboards until the gateway drops their personal best and the screen shows someone else's name; concentration snaps back to the social feed and the rest of the lesson is lost. Data-privacy notices hide in 8-point font, so heartbeat files wander into third-party clouds whose servers sit outside any legal fence that sport law has yet to draw. The result is engagement on the surface, distraction underneath.

2.4. Student engagement and learning outcome concerns

Although digital technology holds significant promise for boosting student engagement, the reality on campus tells a different story. Implementation gaps have created uneven learning outcomes across university sports programs [3]. The picture here is complex: students respond positively to the idea of integrating technology, yet many find that how it's actually being used in class doesn't really improve their learning. Our interviews surfaced several critical issues. Digital distraction ranks high among them. Students with weaker tech skills struggle to keep up. And perhaps most concerning, the focus on fundamental physical techniques—the core of sports education—begins to slip away.
What these insights tell us is clear: we need a more thoughtful approach. Technology should work with physical education, not against it. It should enhance what students learn, not become a substitute for the hands-on, skill-building work that matters most [4].

3. Underlying factors and barriers

3.1. Institutional policy and resource allocation issues

At the national level, policymakers have pushed out multiple documents promoting educational digitalization. The government's message is clear on that front. But here's where it falls short: when you're talking about physical education, especially in universities—the specific guidance just isn't there. It's sparse. Almost non-existent. Why does this happen? Because digital transformation in sports teaching doesn't get its own policy space. Instead, it gets absorbed into something bigger: the institution's overall digitalization initiative. It becomes just another component of the campus informatization agenda. And when that happens, physical education loses out. It doesn't secure dedicated support. Resources don't flow its way. The attention simply isn't there. Currently, the legal framework governing China's sports industry remains underdeveloped, and the broader environment for sports industry development requires improvement. In the process of advancing digital economy development, concerns persist regarding the inability to guarantee data security. Laws and regulations pertaining to data security and privacy protection lag behind technological advancement, exposing universities to compliance risks when collecting and utilizing student exercise data. This legal

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uncertainty has, to a certain extent, inhibited the deeper application of digital technologies in physical education instruction.

Regarding resource allocation, university physical education departments are typically not priority areas for resource distribution. Informatization construction funding is often preferentially allocated to science and engineering laboratories and specialized courses, with the intelligent upgrading of sports facilities frequently relegated to lower priority. Central government special funding has achieved an average annual growth of 8%, while investment in digital transformation has grown at an average annual rate of 15%; nevertheless, uncertainty persists as to whether these incremental resources can effectively benefit the physical education teaching domain. Although some universities recognize the importance of digitalization in physical education, budgetary constraints render implementation difficult.

3.2. Technical expertise and support system deficiencies

The absence of dedicated technical staff specifically trained in physical education technology applications creates critical bottlenecks throughout the implementation process. Faculty must rely on general IT support services that lack understanding of specialized requirements for physical activity monitoring and biomechanical analysis. Few institutions have developed comprehensive resources addressing physical education technology integration, and technology acquisition committees frequently lack physical education representation, resulting in purchasing decisions that fail to address movement-based instruction requirements. Coordination between physical facility management and technology infrastructure planning demonstrates significant disconnections, with most facility renovation projects failing to incorporate comprehensive technology planning—an oversight that perpetuates infrastructure limitations for years after completion [5].

3.3. Pedagogical knowledge and integration challenges

Digital tools enter the gymnasium only when the coach invites them, and the invitation is anything but casual. A tablet that counts push-ups still cannot feel the subtle elbow flare that separates a useful rep from a harmful one; that judgment remains lodged in the human retina. The danger is mistaking the tally for the teaching. Many lecturers now swipe confidently through colour-coded dashboards, yet ask them why a heart-rate plateau merits an extra recovery minute and the answer drifts back to intuition, not data. Mastery of the device has outrun mastery of its instructional grammar.

The border between help and hindrance shifts with every new cohort. Last semester a volleyball teacher streamed slow-motion toss clips to personal phones; reception was instant, but eyes that should have watched wrist angles drifted to TikTok icons floating at screen edge. She pruned the clip to eight seconds, added a single caption “elbow above ear” and reclaimed attention. The anecdote sketches the elusive “degree” everyone quotes: small enough to disappear inside the activity, large enough to do mental labour the body cannot perform alone. No procurement list can calibrate that ratio; only the teacher on the spot, juggling sweat, wifi latency and winter daylight, senses when the screen should go dark [6].

3.4. Cultural and attitudinal resistance factors

Confucian muscle memory raises a second barrier. Centuries of wushu aphorisms prize inner awareness over countable output; to some veterans, a force plate that pronounces a stance “37 % unstable” sounds like philistine gossip. Their scepticism is reinforced by promotion tables that still weigh SCI citations heavier than any classroom experiment. A young lecturer calculated that preparing an interactive shot-put module would consume twelve evenings, yield zero research points and risk student complaints if the server crashed; he chose the paper stopwatch instead. Until

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universities enlarge the reward basket, the boldest innovators will remain hobbyists who steal hours after midnight, trading sleep for the belief that next week's biomechanics graph might save a teenager's shoulder [7].

4. Innovative teaching models and practical applications

Having examined the barriers to technology integration, attention now turns to emerging solutions and innovative approaches that demonstrate promise for overcoming these challenges. The following sections present evidence-based teaching models and practical applications observed across the case study institutions.

4.1. Blended learning approaches for physical education

Blended models let the coach stay in charge while the cloud does the commuting. Students download a 90-second badminton footwork clip the night before; next day the hall becomes a clinic where flight paths are redrawn for each wrist that lags. Where playlists replace textbooks, class time is sold back to reps, not explanations.

4.2. Mobile technology integration strategies

Phones turn every corridor into a sideline. A WeRun step-race seeded by a Bluetooth bracelet pushes heart-rate dots onto the big screen during water breaks; rankings refresh like scores, and even the reluctant check who is catching them. One campus app wraps attendance, load and grade into a single thumb-scroll, coaches set tasks at breakfast, swipe twice at lunch to see who still needs nudging.

4.3. Immersive technology applications

VR fills the gap left by missing snow. Freshmen rehearse slalom weight-shifts on plastic tiles while wearing goggles that tilt the slope angle one degree tighter each run; no T-bar queues, no ice burns, just repeatable fear. Motion-capture mirrors project a ghost outline of the ideal take-off beside the real jumper, adjustments happen in mid-air instinct, not post-mortem [8].

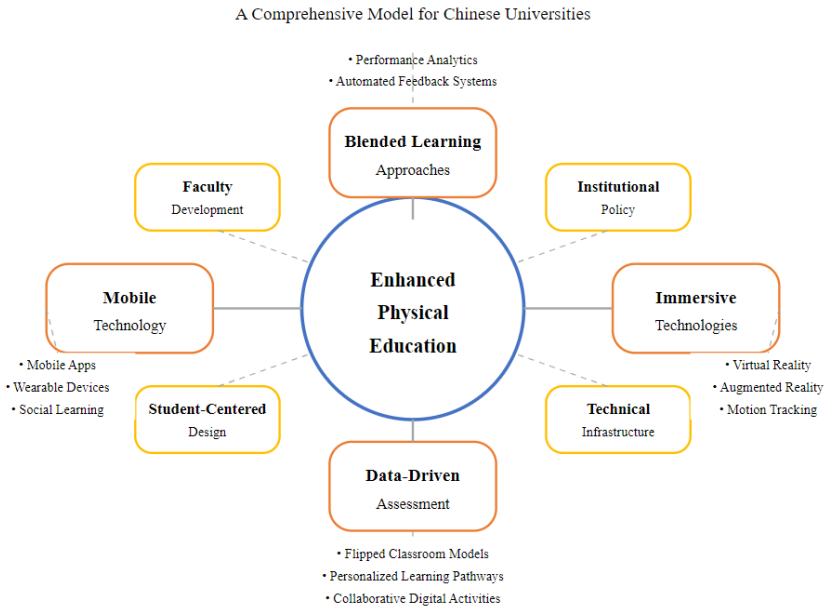


Figure 1. Digital technology integration framework for physical education (source: developed based on implementation case studies from multiple Chinese universities)

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4.4. Data-driven assessment and feedback systems

Data finish the story the eye cannot. A Year-two student whose BMI drifts 0.4 kg m^{-2} and resting heart-rate climbs four beats across six weeks triggers an amber flag before she feels different; the same stream spots a dormant 100 m talent when his unloaded stride frequency outruns the class by two standard deviations. Numbers that used to die in a notebook now keep breathing long enough to become next week's plan, next season's scholarship, next lifetime's habit.

5. Strategic implementation framework for physical education technology integration

A workable digital roadmap for university sport has to start where most plans stall: inside the procurement office, not inside the cloud. The General Administration's 14th Five-Year Year Plan already labels sport as a "pilot node" of the national Digital Construction Project, but the phrase is tucked between pledges to build ski-slopes and track cycling velodromes; without a campus-level translation it risks evaporating like so many earlier "smart stadium" slogans. The translation has to be contractual, not rhetorical. When Shanghai University of Finance appended a one-page "PE digitisation clause" to its 2023 master informatisation tender, it quietly secured 5G coverage for two gymnasiums that had been waiting since 2019; the clause simply required every winning bidder to allocate 3 % of the contract value to motion-sensor retrofitting. Money followed wording.

Teachers come next. The same document set a hard metric: no annual appraisal is complete until the PE staff member uploads one self-edited micro-lesson that uses real-time data; the upload is weighted 15 % of the teaching portfolio. Overnight, forty-something volleyball coaches who had never opened Excel asked interns how to colour-code heart-rate curves. The university's teaching centre runs no compulsory "digital literacy" course—it runs a Friday coffee cart where the ICT undergraduate union troubleshoots Moodle plug-ins in exchange for free espresso. Literacy, like fitness, is built by reps, not slides.

Hardware follows the same logic of stealth integration. Instead of begging the provincial finance bureau for a ¥3 million smart arena, the campus redeployed 200 Wi-Fi 6 routers retired from dormitory renewal and bolted inexpensive lidar strips under existing ceiling trusses. Total cost: ¥190 000, approved under the annual maintenance heading because the quote was framed as "safety monitoring upgrade." The lesson is that infrastructure sneaks in when it borrows another budget line.

Once data start moving, the question becomes who else can use them. The university's partner in western Yunnan, a minority-serving college with no engineering faculty, now receives weekly anonymised motion-capture files of Shanghai's badminton labs; in return it supplies annotated video of hillside trail-running that Shanghai's city-bound students will never experience. The exchange rides on a memorandum that labels the data as "ethnographic heritage," side-stepping the ministry's privacy rules that would throttle any formal "student record" transfer. Again, wording unlocks pipes.

No template is repeated. At the maritime college in Dalian the same policy line produced a VR rowing tank; at the teachers' college in Guilin it funded AI choreography for ethnic dance fitness. Beijing Sport University, rich in sensors, is now drafting an interdisciplinary degree that fuses kinesiology with Python, but the syllabus begins with a client brief from Anta Sports, not with an academic committee. Their first cohort will graduate into jobs that do not yet exist, yet every required course carries industry co-assessment because the enterprise licence fee paid for the cloud servers.

The thread tying these scattered experiments together is an insistence that technology must earn its keep by answering a question teachers already ask: how do I keep every body moving at the right edge of ability? When the data stop telling that story, the plug can be pulled without scrapping the whole plan; the routers return to the dormitories, the lidar strips become ceiling decorations, but the teachers keep the wording that once freed a budget line. In that sense the framework is less a blueprint

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than a reversible stitch—tight enough to hold, loose enough to unpick when the next season of devices arrives.

6. Conclusion

This study asked why, after a decade of state grants, some campuses still clock attendance on paper while next door 4K cameras trace every spike. The gap is less about hardware than about who translates policy into practice. In twelve provinces only twenty percent of PE staff had received even one ed-tech workshop; servers idle because security rules block outside clouds, so students download cheap apps that sell their gait data. Where change does stick, it is always a single coach or student union acting as broker among procurement, pedagogy and code, never a committee.

Blended labs, phone quizzes, VR tennis grow only when the teacher remains the author of the lesson and the dashboard merely magnifies what eyes could never catch. A retired high-jump hobbyist who scripts Python in the evening can turn 240 fps clips into a confession of technique, not a ranking.

The next shift is legislative: the draft 2025 guideline ties future funds to a human-in-the-loop clause that keeps every algorithmic score open to teacher and student audit. If the rule bites, AI will serve like informed consent in clinics; if it bores, movement collapses into metadata.

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