



Sport Sciences in the Age of Artificial Intelligence: Rethinking Education, Specialisation, and Professional Roles

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Artificial intelligence is already reshaping sport

Sport sciences has always developed at the intersection of human movement, biological adaptation, behaviour, technology, and performance. Artificial intelligence (AI), however, is not simply another instrument added to the laboratory. Machine learning, computer vision, generative models, wearable sensors, and decision-support systems are beginning to change how performance is measured, how evidence is interpreted, and how professional expertise is defined.

The International Olympic Committee's Olympic AI Agenda identifies applications ranging from talent identification and personalised training to athlete safety, officiating, event operations, and wider access to sport (1). Recent reviews likewise describe a growing role for AI in training design, performance analysis, and health management (2). The important question is therefore no longer whether AI will enter sport sciences. It already has. The more consequential question is whether our educational programmes and professional structures will change quickly enough to use it well.

More data do not automatically produce better decisions

AI can detect patterns across physiological, biomechanical, tactical, behavioural, and contextual data at a speed that is impossible for an individual practitioner. In team sports, algorithms have been used to explore performance prediction and injury-risk

assessment (3), while computer-vision and sensor-based systems can recognise sport-specific movements at scale (4). These capabilities are valuable, but they are often mistaken for certainty.

An algorithm is only as defensible as the data, labels, assumptions, and context on which it was built. A model trained predominantly on adult male elite athletes may not generalise to women, adolescents, older adults, para-athletes, or insufficiently active populations. A probability of injury is not a clinical diagnosis, and a model's ranking of talent is not a neutral account of human potential. Systematic reviews of injury-prediction models have repeatedly identified methodological heterogeneity, limited external validation, and risks of bias (3, 5). These are not minor technical details; they determine whether an apparently precise output can safely inform practice.

For this reason, AI should not be positioned as a substitute for physiology, biomechanics, motor behaviour, psychology, pedagogy, sports medicine, or coaching knowledge. Its value emerges when a qualified professional can interpret an output within the athlete's biological, psychological, social, and environmental circumstances. Algorithms can calculate, classify, and predict. They cannot assume moral responsibility for the consequences of a decision.

The central challenge is a competency gap

In many sport-science curricula, technology education remains limited to statistical software, laboratory equipment, or isolated performance-

analysis packages. That preparation is no longer sufficient for an environment in which multimodal data are collected continuously and commercial systems can generate training plans, movement assessments, and seemingly authoritative reports within seconds.

Future sport-science graduates do not all need to become software engineers. They do, however, need enough AI and data literacy to ask basic but decisive questions: What population produced these data? What outcome was predicted, and how was it labelled? How large and clinically meaningful is the error? Has the model been externally validated? Does it work equally well across sex, age, disability, ethnicity, and performance level? Who owns the data, and who is accountable when the recommendation causes harm?

UNESCO's AI Competency Framework for Teachers offers a useful educational principle: competence requires more than technical use; it combines a human-centred mindset, ethics, foundational knowledge, applied practice, and continuing professional development (6). Sport sciences needs an equivalent discipline-specific framework. AI literacy should be integrated across physiology, biomechanics, motor behaviour, psychology, physical education, sports management, rehabilitation, and research methods rather than confined to a single optional module.

From tool users to critical partners

Teaching students to operate today's software is not the same as preparing them for tomorrow's

profession. Platforms change rapidly; the ability to evaluate them endures. Curricula should therefore move from passive tool consumption towards critical appraisal, responsible application, and interdisciplinary design.

First, data literacy should become a core graduate competency. Students should be able to collect, clean, integrate, visualise, and interpret data, and should understand overfitting, class imbalance, calibration, uncertainty, external validity, and the difference between prediction and causation. Second, AI should be taught through authentic sport problems: video analysis, training-load monitoring, skill acquisition, physical-activity promotion, talent development, injury-risk communication, and sport management. Third, sport-science faculties should build sustained partnerships with computer science, engineering, statistics, ethics, and law. No single discipline can design, validate, and govern these systems adequately.

Assessment must change as well. If generative systems can produce a plausible training programme or literature summary in seconds, assignments should test whether students can scrutinise assumptions, verify evidence, justify adaptations, and defend a decision for a specific person. The educational goal is not to reward fluent output. It is to develop sound judgement.

Professional roles must be redefined

AI is unlikely to remove the need for sport-science professionals, but it will reduce the value of roles built mainly around routine data entry, descriptive reporting, or uncritical use of

proprietary dashboards. The more automated these tasks become, the more professional value will lie in problem formulation, contextual interpretation, communication, and accountability.

In elite sport, the performance scientist should evolve from a reporter of metrics into an architect of decisions. This means integrating training, competition, recovery, sleep, injury, nutrition, and psychological information while recognising when data are incomplete or misleading. An algorithmic forecast should be one input into a multidisciplinary conversation, not the final verdict on selection, readiness, or return to play.

In community sport and physical-activity promotion, AI may support personalisation and extend access to guidance. Yet systems that depend on expensive wearables, high-end smartphones, or stable connectivity may deepen rather than reduce inequality. Professionals must judge not only whether a tool works, but also for whom it works, who is excluded, and whether a low-technology alternative would be safer or more equitable.

In sport management, AI is already relevant to resource allocation, audience analysis, event operations, marketing, and integrity. Managers will therefore need competence in algorithmic procurement, data governance, and organisational change. Across all these settings, the professional role shifts from producing information to ensuring that information becomes a defensible human decision.

Responsible adoption requires governance, not enthusiasm alone

Sport data can reveal health status, sleep, psychological state, workload, location, and estimated injury risk. These data may influence contracts, team selection, insurance, and career progression. Consent, privacy, security, data ownership, explainability, fairness, and the right to contest an algorithm-informed decision are therefore central professional concerns, not administrative afterthoughts.

The World Health Organization argues that AI used in health-related settings should protect human autonomy, promote safety and public interest, remain transparent and explainable, assign responsibility, and support equity (7). These principles are directly relevant to sport. The recent Olympic discussion has similarly stressed that progress will depend on collaboration among athletes, practitioners, researchers, governing bodies, and technology developers (8). Athlete participation is especially important: systems that act on athletes should not be designed without them.

Universities and professional bodies should establish minimum standards for approving AI tools. At a minimum, evaluation should address purpose, evidence, population validity, error, subgroup performance, data protection, conflicts of interest, human oversight, and procedures for appeal. Procurement should never be treated as scientific validation.

Bridging the implementation gap

Evidence and policy statements rarely change practice by themselves. Implementation requires education, organisational support, monitoring, and accountability. This lesson is well established in sports injury prevention, where Raftery and Falvey described the value of a 'compliance wedge': proportionate mechanisms that reinforce a desired practice while education and culture mature (9). Sport sciences may need a comparable competency wedge for responsible AI adoption.

Such a wedge could begin with minimum AI competencies for all graduates, followed by discipline-specific outcomes, faculty development, supervised use of tools, independent validation, and periodic audit. Professional accreditation and continuing education should then reinforce these expectations. The sequence matters. Purchasing technology before investing in people does not close the innovation gap; it creates dependence on vendors whose systems practitioners may be unable to challenge.

A practical agenda should include five linked actions: define core competencies; redesign curricula and assessment; create interdisciplinary teaching and research environments; require human-centred governance for sport data; and evaluate whether AI improves decisions, safety, participation, and equity in real-world settings. These actions should be iterative because both the technology and its risks will continue to change.

The enduring advantage is human expertise

Sport sciences should not respond to AI by becoming a weaker version of computer science. Its distinctive contribution is an understanding of movement, adaptation, learning, motivation, culture, and the lived realities of sport and physical activity. The aim is not to replace professional judgement with an algorithm, but to combine computational capability with contextual and ethical reasoning.

The future specialist must know when to trust a model, when to challenge it, and when not to use it. Four abilities will define professional relevance: framing the right problem, evaluating the evidence, interpreting data in context, and accepting responsibility for the decision. These abilities are difficult to automate precisely because they depend on human values and relationships.

The future of sport sciences will be neither wholly human nor wholly algorithmic. It will belong to professionals who understand the language of human movement, learn the language of data, and keep safety, fairness, and dignity at the centre of practice. If education, specialisation, and professional roles are revised now, AI can expand the reach and quality of sport sciences. If they are not, the discipline risks becoming a passive consumer of technologies it should be helping to shape.

Conflict of interest

The author declares no competing interests.

Authors' contributions

M.T. conceived the editorial, developed its argument, and approved the final manuscript.

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