CASES
The Chartered Association of Sport and Exercise Sciences

The CASES Resource on

Artificial Intelligence

Version 1

FAIRNESS PROFESSIONALISM HONESTY RESPONSIBILITY EXCELLENCE

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The CASES Resource on Artificial Intelligence

Contents

1 Executive Summary

This resource equips Sport and Exercise Scientists – whether new to artificial intelligence (AI) or already proficient – with insights and practical guidance to better understand and apply AI effectively.

Links are included to over 20 AI tools relevant to Sport and Exercise Science (SES), offering practical insights into their capabilities, limitations and applications. This work is underpinned by an extensive set of references.

The current impact of AI on SES is illustrated through material on digital twins, virtual and augmented reality, smart clothes and the 'Internet of Things', and markerless motion capture. AI's potential transformative impact on SES resulting from the development of large language models is explored, emphasising the importance of the human-in-the-loop.

Several AI tools that can be used for research in SES are presented. These fall into four main categories: literature review; data analysis; report writing; and grant acquisition.

AI is reshaping higher education teaching and assessment by generating lessons, scaffolding explanations for diverse learners, creating quizzes, and drafting formative feedback. Academics must shape environments that ensure AI is used ethically and constructively.

Sports-performance AI now delivers real-time analysis of physiology, biomechanics, tactics, and injury risk. Simulated environments and reinforcement-learning 'next-play' models safely let coaches test tactics and opponent behaviour. Practitioners must rigorously evaluate these tools to ensure responsible, ethical use that prioritises athlete wellbeing and performance.

The use of wearable technology to monitor and evaluate sport and fitness activity has become ever-present. Using AI and big data appears to have promising applications within health and fitness, but increased consideration of human factors may be needed to develop this technology further.

AI systems in exercise prescription are increasingly integrated into clinical and fitness settings to provide scalable and personalised exercise offerings. Many of these AI systems are rooted in the biomedical model, focusing on measurable outcomes like heart rate. Expanding their design to incorporate recreational, social and nature-based activities such as 'green' and 'blue' prescriptions might improve their impact on public health.

AI can inform ethical thinking but cannot be relied on to be ethical, fair, or to embody professional values. Ethical decisions remain a human responsibility.

SES faces several challenges if it is to ensure that AI has a positive impact on the profession. These include but are not limited to:

- preparing the next generation of professionals
- establishing what best practice in SES looks like in the use of AI
- preparing for other technological developments that will emerge because of, or alongside, AI.

AI is better than human ignorance but not human reasoning or uniquely human qualities. It is a tool for Sport and Exercise Scientists to improve the human condition, so whilst this resource highlights AI strengths, practitioners should focus on the tasks humans do best.

2 Introduction

The Purpose of This Resource

This resource aims to help SES practitioners, researchers, academics and students by:

- signposting them to relevant AI systems and expert information
- supporting them in the responsible use of AI, aligned to CASES values, commitments and behaviours
- providing a reference list that guides readers to the relevant literature
- acting as a primer for debate within the SES community about the role of AI in the future of the profession.

Due to the nature of this type of resource, it can become dated. CASES will continue to support members by updating its online resource webpage, running webinars, and issuing revisions to this document. Both the Association and the profession need to have an adaptable approach to AI. Maintaining flexibility is essential to ensure that SES can adapt quickly to new innovations, tools and applications as they arise.

The authors made extensive use of AI tools for background research and wording refinements. For example, Microsoft Copilot 2025 was used throughout the writing process. Nonetheless, CASES accepts full responsibility for the submission's accuracy and integrity at the time of publication.

Definitions

We use the definitions adopted in the Association's position stand on AI and assessment – an abridged version of which is presented below. The full set of definitions, including more detailed references, can be found here: Position Stand on Artificial Intelligence and Assessment.

AI: These systems are designed to mimic human-like intelligence, demonstrating the ability to think, learn and adapt over time[1].

Machine Learning (ML): A subset of AI that involves equipping computers with a general learning algorithm that allows them to discover patterns and relationships in data and improve over time, eliminating the need for programmers to write specific rules for each dataset[2].

Large Language Models (LLMs): These are capable of understanding and generating natural language. LLMs are trained on immense amounts of text data, from which they capture patterns and relationships within texts[3]. The training objective is to predict the next word in a sequence, much like an advanced version of the autocomplete feature used in texting. To do this effectively, LLMs must form an implicit model of the complex web of relationships between words, ideas, concepts, and of the subtleties of language, intention and meaning within the appropriate context[4]. To its human interlocutor, the LLM appears to 'understand', although the model works in an entirely different way to the human brain.

It is the rapid development of the LLM that was the primary motivation behind the development of this resource.

3 Reflecting on the Impact of Artificial Intelligence (AI) on Sport and Exercise Science (SES)

In this section, we examine how AI is shaping SES today and explore its potential to drive transformative change over the next few years. We acknowledge the uncertainty of any forecast and invite readers to use this information as a springboard for reflecting on AI's impact on their own professional practice.

Current AI and Digital Technologies in SES

To date, AI's influence on SES has largely manifested itself through traditional machine learning techniques. The four areas below illustrate where some of these effects are already unfolding. These examples demonstrate how AI's impact is magnified through its integration with established and other emerging technologies.

- **Digital twins:** When creating a new exercise regime or performance intervention, being able to 'try it out' before you test it on humans would greatly improve the development time. The development of 'digital twin' technology, where mathematical models can predict responses, may be an important step towards developing this idea within SES. Creating personalised models that can also predict future outcomes, and integration with wearable technology such as heart rate sensors and exercise response, could potentially reshape our approach to physical sciences more generally. These ideas are currently being explored within musculoskeletal rehabilitation[5], exercise decision support within type 1 diabetes[6], and in performance cycling[7].

- **Virtual and augmented reality:** This technology from the gaming industry is being repurposed for use in injury rehabilitation and sports performance. Researchers[8] have explored the use of augmented reality and robotics with the LegUp device to create an interactive game that can be used in rehabilitation settings. Similar technology, using AI and machine learning, can assess sports performance and technique[9]. Virtual and augmented reality is also being considered within sports psychology to provide novel methods to undertake research and evaluate performance and confidence within sports settings[10].

- **Smart clothes and the 'Internet of Things':** Use of haptic technology powered by AI, where the user is provided with feedback via vibration or other tactile sensation, has been developing in healthcare settings in areas such as diabetic neuropathy[11]. This may now be applied to sport settings to provide ground reaction force data that could transform movement analysis[12]. Similar technology using smart gloves could allow capture of data and provision of feedback that may be critical in skill acquisition in sport, and which may also be useful in clinical settings[13]. Using exoskeletons within rehabilitation, in conjunction with augmented reality and AI, may have uses in improving long-term health conditions[14].

- **Markerless motion capture:** Three-dimensional (3D) motion capture is often considered the 'gold standard' for gathering high-quality kinematic data for biomechanical analysis. However, lab-based data capture has been criticised due to the lack of 'real-world' validity. Markerless motion capture, which uses AI to determine joint centres and other anatomical areas of interest, is a promising advance that allows the development of biomechanics research into clinical rehabilitation[15]. This technology is developing from sports performance. For example, the use of KinaTrax in baseball is being extended into clinical biomechanics[16]. It also shows promise when applied to other activities, such as racket sports[17]. As with the other three areas, more research is needed before its full potential can be known and realised.

AI's Potential Transformative Impact on SES

SES stands on the verge of transformation, driven by remarkable AI advances[18]. Over the next five years, LLMs could revolutionise the profession more profoundly than the significant impact of traditional machine learning.

If the optimists are right, we will see a fundamental shift from performing analytical work ourselves to delegating it to semi-autonomous systems, freeing us to focus on high-value activities[19].

These tireless, hyper-competent digital assistants could reshape the core functions of the profession, from research and athlete management, to what it means to be a Sport and Exercise Scientist[20]. The future may well be about commissioning and overseeing the work of AI agents that perform various tasks, and manage projects and training plans on our behalf [21].

AI promises to substantially boost productivity[22], but critics worry that managing these AI agents and scrutinising their work may cost more time than it saves[23]. Future AI agents, if they are to be trustworthy, must handle the complexities and nuances of the real world without hallucinations or false reasoning[24].

Scaling-up current transformer architectures has yielded enormous gains, yet if this trend continues, the costs over the next few years could become astronomical[25]. We would enter a 'pay-to-win' world where only the richest institutions have access to the most capable models[26]. If scaling-up fails to deliver, new efficient architectures[27] could democratise access to powerful AI, allowing small organisations to compete with elites. Moreover, small, efficient models could run directly on wearable devices, transforming them from passive data loggers into real-time coaching and injury prevention tools[28].

Either way, the consensus points to a future where AI assists rather than replaces us[29]. The human-in-the-loop will remain essential for deep contextual interpretation, complex communication and ethical governance – the roles machines cannot perform[30]. This shift will fundamentally change the skills the profession values[31].

In summary, with the assistance of the advanced Claude Sonnet 4.0, we have identified that AI is having an impact across a broad range of areas on SES. Such areas include:

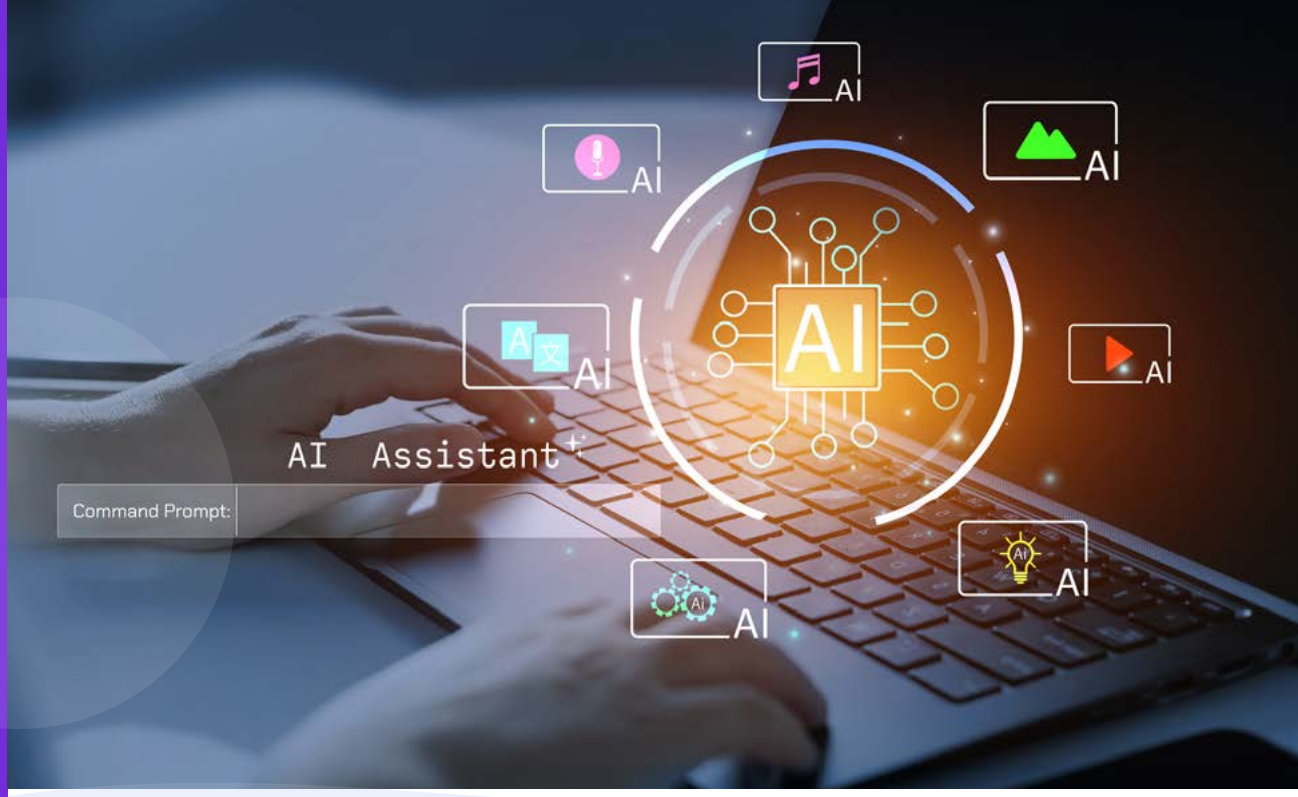
- Statistical modelling and machine learning
- Pattern recognition in biomechanics
- Physiological monitoring and analysis
- Performance prediction and optimisation.

Note: Whilst at the time of writing we used Claude Sonnet 4.0, version 4.5 is now available – Claude Sonnet 4.5 \ Anthropic

In addition, new LLMs and related emerging technologies have the potential to transform professional practice. Table 1 captures some of these possibilities.

Table 1: The Potential Transformation of Professional Practice Resulting from AI

Area of Professional Practice	Potential Transformations
Research workflow	Literature reviewing, paper writing and peer review
Clinical practice enhancement	Report writing, programme design and client communication
Education and training	Material development, student feedback and assessment
Professional development	Continuous learning and knowledge synthesis
Administrative efficiency	Documentation, correspondence and reporting



4 AI Systems Relevant to SES

AI and Research in SES

The following section is relevant to Sport and Exercise Scientists who conduct research and evaluation in:

- an academic setting to make an original contribution to knowledge
- an applied setting to achieve evidence-based practice
- industry for product and service development.

AI tools for SES research fall into four main categories: literature review; data analysis; report writing; and grant acquisition. Specialised tools exist in each category that can significantly accelerate research workflows whilst maintaining scientific rigour. Some of the AI systems presented in Tables 2 to 6 can also be used for other purposes in SES, as well as for research.

Literature review tools like Elicit, ResearchRabbit and FutureHouse help researchers navigate the overwhelming volume of scientific publications. These platforms can produce superior output thanks to user interfaces designed for academic workflow, with direct access to publishing databases. However, they typically don't use the latest frontier AI models nor the smartest chatbots available, which often handle nuance better, hallucinate less and master complexity more assuredly. The specialist tools' advantage lies in their streamlined interfaces and task-specific workflows, rather than superior underlying intelligence.

Data analysis tools like Julius and GraphMaker democratise statistical analysis through no-code interfaces, enabling researchers without programming expertise to perform complex analyses and create publication-ready visualisations that enhance research communication.

Grant application tools increasingly operate autonomously. Manus can work in the background on complex tasks, while Grantable and Grantboost streamline proposal generation. This autonomy demands well-considered, specific prompts from users, as these tools may work independently for hours. Success requires balancing the benefits of automation with maintaining control.

The critical factors are human oversight and careful prompting. Even high-accuracy tools require verification to prevent inaccuracies and maintain academic integrity. With autonomous tools becoming prevalent, clear initial instructions are vital – vague requests may lead to unusable outputs. Choose specialised tools for their streamlined workflows, but consider frontier models for complex, nuanced tasks.

Table 2: AI Tools for Literature Reviews

Tool	Uses	Possible Limitations
Elicit https://elicit.com/ An AI research assistant designed to automate and streamline academic literature reviews and knowledge discovery, leveraging LLMs to find relevant papers, summarise findings, and extract key information with transparent source citing	Automating systematic reviews (80% time reduction), extracting data from hundreds of papers into tables, finding relevant papers via semantic search, and integrating with reference managers like Zotero	Outputs may require verification, with reported accuracy rates between 80–90%. The tool may face challenges in evaluating source trustworthiness and is less optimised for non-empirical studies. Users should also check exported citations for missing bibliographic elements
ResearchRabbit https://www.researchrabbit.ai/ An AI-powered platform that reimagines literature search and alerts, acting as a 'Spotify for Papers' by learning user preferences to provide personalised recommendations and interactive visualisations of paper networks	Discovering influential papers and authors, visualising citation networks, receiving personalised alerts for new relevant papers, and collaborating on research collections	As an emerging tool, there are fewer user reviews available compared to more established platforms. Some users find the interface has a learning curve. Its source coverage may not be exhaustive, and the tool is designed primarily for discovery rather than in-depth analysis
FutureHouse https://platform.futurehouse.org An ambitious platform building an 'AI scientist' with specialised AI agents (Crow, Falcon, Owl, Phoenix) to automate scientific research and accelerate discovery by overcoming the information bottleneck in scientific literature	General literature search (Crow), deep literature reviews (Falcon) with access to specialised databases, comprehensive precedent searches to avoid redundant work (Owl), and planning chemistry experiments (Phoenix)	As an early-stage platform, it is still gathering a comprehensive body of user reviews. Its long-term market position will depend on how its capabilities evolve in a competitive landscape

Table 3: AI Tools for Data Analysis and Visualisation

Tool	Uses	Possible Limitations
Julius https://julius.ai/ An AI data analyst that enables users to analyse data, gain insights, and generate visualisations and reports using natural language queries, without requiring coding expertise	Creating charts and graphs, cleaning and sorting data, performing predictive modelling, generating polished analyses and summaries, and conducting statistical significance testing	User reviews indicate some technical issues, such as application instability and problems with file downloads. The tool may be less effective with very large or complex datasets. Output accuracy is highly dependent on prompt specificity and data quality
GraphMaker https://www.graphmaker.ai/ A tool designed to simplify the creation of visual data representations, allowing users to generate various chart types (bar, line, pie, scatter, histogram) from natural language prompts or uploaded data	Rapidly creating charts for presentations and reports, transforming complex data into understandable visuals, and customising chart elements like colours and fonts	Certain versions may offer limited options for design customisation. The tool's performance can be affected by highly complex queries or inconsistent data types. Users should verify its compliance with any relevant industry-specific data regulations
ChatGPT https://chat.openai.com/ A general-purpose conversational AI tool that, with its Data Analyst plugin, can process data from Excel / CSV files, conduct statistical analyses, generate code, and create charts	Assisting with high-level data analyses, generating R code for visualisations, deriving stories from report-based market research, and creating infographic skeletons	May have significant limitations when working with raw survey data. There is a potential for generating inaccurate information (hallucinations), and its knowledge base has a cut-off date. Users should be aware of data privacy policies, as conversations may be used for model training

Table 4: AI Tools for Report Writing

Tool	Uses	Possible Limitations
Manus https://manus.im/ An autonomous AI agent designed to independently plan and execute multi-step tasks across various domains, including report writing, spreadsheet creation, and data analysis, with minimal human input	Compiling research lists, analysing complex datasets (e.g. sales data) and generating detailed reports, checking information accuracy by gathering data from multiple sources, and autonomous task execution	Users have reported system instability, particularly when processing large amounts of text. The tool can be hindered by paywalls and captchas. Its outputs synthesise existing information rather than generating novel concepts. The credit-based system may lead to rapid consumption, and output formatting may require manual refinement
Grammarly https://www.grammarly.com/ A writing assistant focused on enhancing existing text by providing real-time corrections for grammar, spelling and style, and offering generative AI features for drafting outlines and summaries	Refining grammar, spelling and punctuation, adjusting tone, length and formality, generating outlines and summaries for reports, plagiarism detection, and citation generation	May sometimes provide excessive or unnecessary suggestions and can misinterpret nuanced language. The reliability of the integrated AI detector has been questioned by some users. Its content generation capabilities are less extensive than those of dedicated AI writing platforms
HyperWrite https://www.hyperwriteai.com/ An AI-powered writing assistant and content creation platform that helps users write faster and smarter by generating content, providing sentence completions, and integrating web search and citation capabilities	Overcoming writer's block with AutoWrite, personalised sentence completions (TypeAhead), brainstorming ideas with HyperChat, finding peer-reviewed articles with Scholar AI, and creating custom AI tools	Outputs can sometimes be generic or repetitive and may deviate from the topic, necessitating human oversight. The free version has restrictive usage limits. For academic writing, users should be mindful of ensuring output originality to avoid potential plagiarism

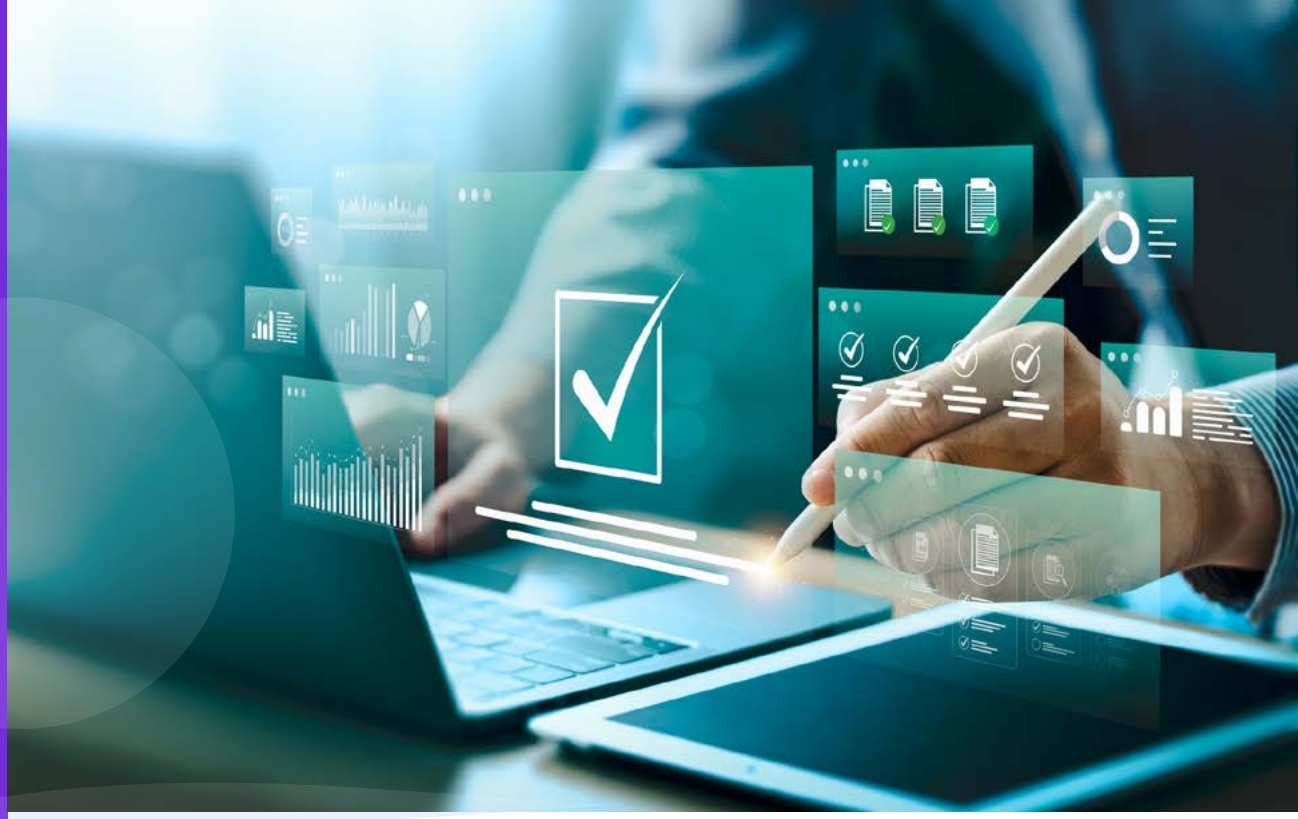


Table 5: AI Tools for Grant Writing

Tool	Uses	Possible Limitations
Grantable https://www.grantable.co/ An AI-powered grants platform designed to transform how organisations secure funding by combining an intelligent content library with dual AI capabilities, streamlined grants management, and collaboration tools	AI-powered grant matching, automated proposal writing to draft key sections, organising work in a smart content library for future projects, tracking application statuses and deadlines, and facilitating team collaboration	The subscription cost may be a consideration for some people. Some users have reported issues with account creation. AI-generated content often requires significant editing for a unique voice. It has fewer integrated research tools than some competitors, and its output may be flagged by AI detectors
Grantboost https://www.grantboost.io/ An AI-powered grant writing tool specifically designed to help nonprofits and organisations secure funding with ease, aiming to simplify and expedite the entire grant writing journey	Crafting tailored grant proposals based on organisational details and grant opportunity information, extracting key information from grant details, customising and editing AI-generated output, and streamlining the overall grant writing workflow	Users should be mindful of over-relying on this AI tool, as the output may lack unique insights. The tool may provide inaccurate or outdated information. The content can be repetitive, requiring editing to avoid plagiarism. The website provides limited information about AI training data
HyperWrite https://www.hyperwriteai.com/ A general AI writing assistant with capabilities that can be leveraged for various aspects of grant writing, particularly drafting and refining textual components, including finding peer-reviewed articles and incorporating citations	Drafting initial sections of grant proposals (e.g. problem statements, rationale), brainstorming ideas for narratives, finding peer-reviewed articles and integrating citations (Scholar AI), and refining overall text for clarity and style	Does not include specialised grant-writing features like automated matching or compliance checks. As a general-purpose AI tool, its output may be generic and require substantial editing by an expert to meet funding requirements

AI and Learning, Teaching and Assessment in SES

AI is rapidly transforming higher education, particularly in teaching and assessment. AI tools can support educators by, for example, generating lesson content, scaffolding explanations for diverse learners, creating quizzes, and drafting formative feedback. They can potentially support student engagement with mapping tools to visualise connections between ideas, paper-summarising AI to distil key arguments from academic texts, and podcast-generating AI for audio-based learning resources.

Platforms such as Julius enable advanced data interpretation, reducing the need for specialist software knowledge and shifting the teaching focus from statistical execution to critical interpretation. In assessment, AI can streamline marking and feedback through rubric-aligned evaluations and automated text analysis. These tools could enhance efficiency and support consistency in grading, but their effectiveness relies on carefully constructed prompts and professional oversight.

As AI becomes capable of producing well-structured answers to factual or routine questions, assessment design must evolve. Greater emphasis should be placed on evaluation, critical thinking, synthesis, creativity, and the application of knowledge areas where human insight still excels. Assessments that encourage original thought and personal reflection help ensure that students engage meaningfully, rather than relying solely on AI.

Nonetheless, caution is needed. AI tools may generate convincing but inaccurate information, making critical evaluation skills essential for staff and students. Educators must remain vigilant and knowledgeable to assess AI-generated content accurately.

Ultimately, the role of academics is to shape environments where AI is used ethically and constructively. With thoughtful integration, teaching and assessment could be enhanced without compromising educational standards or student learning integrity.

Examples of AI resources relevant to learning, teaching and assessment include:

- ChatGPT 40 Hello GPT-4o | OpenAI (overall)
- Jenni | AI academic writer and research tool for students and academics (writing)
- Julius | AI for data analytics (data analysis)
- Musely.ai (prompt generation)
- Google NotebookLM | AI research tool and thinking partner (creating interactive podcasts)
- SciSpace (paper-summarising)
- ResearchRabbit (mapping)
- Andy Stapleton (YouTube reviewer on AI in academia).

Readers are also directed to the Association's Position Stand on Artificial Intelligence and Assessment, which addresses a range of issues including personalised learning and assessment.

AI and Sports Performance

AI is playing an increasingly central role in advancing sports performance by enabling deeper, real-time analysis of athlete physiology, biomechanics, tactics, and injury risk. Through the integration of wearable sensors and machine learning models, practitioners can continuously monitor variables such as heart rate, movement velocity, acceleration, and training load. This data can be used to personalise training plans, enhance recovery strategies, and flag early signs of fatigue or overtraining[32]. In elite sport, computer vision systems now track detailed movement patterns and tactical behaviours. Tools such as Second Spectrum in basketball and FIFA's optical tracking system in football provide comprehensive insights into team formations, spatial positioning, and player efficiency, improving both coaching decisions and post-match analysis[33]. In baseball, tennis and cricket, AI techniques, including convolutional neural networks, are being used for pitch analysis, shot classification, and predictive performance modelling. Injury prevention is another critical application area. AI models such as XGBoost and recurrent neural networks can process historical training data, biomechanical markers and neuromuscular trends to predict non-contact injuries with increasing accuracy[34]. These systems also support talent identification by profiling athletes based on biomechanical and tactical data, while markerless motion capture technologies extend this capability to real-world environments.

Simulated environments and reinforcement learning models are now being deployed in 'next-play analytics' to help coaches explore tactical scenarios, opponent behaviour, and match strategy in a risk-free virtual setting[35]. While the adoption of AI brings immense potential, it also raises challenges around data ethics, algorithmic transparency, and equity in access. Practitioners must critically evaluate these technologies to ensure they are applied responsibly, ethically, and in support of athlete wellbeing and performance optimisation.

AI and Health-enhancing Physical Activity

The use of wearable technology to monitor and evaluate sport and fitness activity has become ubiquitous, with smart watches and associated applications becoming more able to capture data on heart rate, activity type and time, as well as blood pressure and oxygen saturation levels. The quantity of information calculated enables big data, machine learning and AI to provide tailored approaches to producing training programmes and tracking progress[36]. Machine learning approaches allow the identification of patterns and have been used successfully in several sport and fitness contexts, to approximate energy cost[37], as well as develop interventions to prevent frailty in older adults[38]. In addition, LLMs have been used to develop physical activity interventions[39], and smartphone apps can implement behaviour change interventions for people with diabetes based on tracking physical activity data[40].

Using AI and big data appears to have promising applications within health and fitness, but increased diversity and consideration of human factors may be needed to progress this further as technology develops[41]. Current applications focus on developing data collection and programming. Further research on using AI to increase accessibility and prevent injury would add useful applications for this method[42]. The use of AI to develop fitness-based recommendations and fully exploit the data collected by these applications has been well received by the public, suggesting that this is a developing area that may have a transformative effect on the future of fitness tracking and activity prediction[43].

AI and Exercise Prescription

AI systems in exercise prescription are increasingly integrated into clinical and fitness settings to provide scalable, personalised exercise prescriptions. These systems use data from wearables, user inputs and clinical metrics to generate and adapt activity plans that meet individual health needs.

In clinical environments, the EXi platform is reported to be one of the world's first personalised exercise prescription apps aimed at sedentary individuals and those with long term health conditions. Launched in 2020, Exi aims to assess user risk factors and activity levels, delivering tailored exercise prescriptions informed by the scientific evidence[44].

Kaia Health, a digital musculoskeletal therapy platform, offers app-based interventions for people with non-specific lower back pain. A randomised controlled trial[45], published in *NPJ Digital Medicine*, found that Kaia significantly reduced pain and improved function compared to standard physiotherapy. Long-term observational data from subsequent studies has shown continued improvements in pain management and healthcare cost reduction[46].

In consumer fitness, Fitbod[47] exemplifies the use of AI for strength training. The app dynamically generates personalised workout plans by analysing users' previous sessions, equipment access, and recovery data. It has become one of the most popular fitness apps, praised for its adaptive algorithms and sustained user engagement. While Fitbod is not a clinical tool, its widespread adoption highlights how AI can effectively support individualised, goal-oriented fitness routines.

Most of these AI systems are rooted in the biomedical model, focusing on measurable outcomes like heart rate, volume or mobility. Expanding their design to incorporate recreational, social and nature-based approaches such as 'green' and 'blue' prescriptions might improve long-term adherence, especially for older adults and public health applications. This is where the human Exercise Scientist plays a vital role in providing context, motivation and a holistic oversight.

Table 6: Some AI Systems in Exercise Prescription

AI System	Setting	Primary Function	Notable Use
Kaia Health	Clinical (musculoskeletal and back pain)	Multimodal therapy (exercise education, mindfulness)	Used by healthcare providers for back pain
EXi	Clinical and public health	Personalised exercise for chronic conditions	Reportedly one of the first apps of its kind with adaptive programmes
Physitrack	Clinical rehabilitation	AI-assisted remote exercise prescription	Used by physiotherapists globally for recovery tracking and progression
Fitbod	Fitness / consumer market	AI-generated strength training routines	Over three million users, it adapts workouts based on performance and available equipment

Vignettes Demonstrating the Use of AI in SES

The following vignettes describe how some of the authors are currently working on AI. They highlight how AI is being used in a range of SES settings.

Vignette from Dr Tim Donovan: At present I am trying to map the AI tools currently available to support academic work, focusing on their application in both teaching and research. This work will provide an overview of each platform's primary function, key features, and access model (cost), helping academics identify which tools best suit their needs.

Some platforms are tailored for academic writing, offering support with drafting, referencing, paraphrasing and editing. Others are geared towards teaching, enabling users to create slides, generate lesson plans, or develop interactive content. There are also tools designed for literature review, research idea generation, and advanced data analysis, including those using machine learning techniques. It will not be possible to check the functionality of the platforms reviewed, so the inclusion of 'hallucinations' and the effectiveness of each site will have to be independently assessed.

Current observations indicate that there is a growing number of AI tools on the market, with each offering slightly different functionalities. There is a variety of free tools, although, generally, you seem to get what you pay for! Some platforms are highly specialised, while others are more general-purpose. As the capabilities of AI continue to evolve rapidly, staying informed about these developments is essential for maximising the benefits to academics. This project will serve as a practical resource for academics looking to incorporate AI meaningfully into their work.

Vignette from Dr Mark G.E. White: I use large language models extensively as digital assistants in my work as a machine learning researcher. I may use them to explore ideas in a dialogue, such as to understand new research or to learn new techniques often in statistics. However, primarily, I use them for programming, such as writing code to fulfil requirements or to debug it. Essentially, I direct machines with natural language rather than programming language – English rather than Python.

When laying out requirements, I write detailed descriptions of what I need. I find that the more time I spend thinking through the request, the better the outcome. Engaging in dialogue with the model helps me understand problems in much more depth. It is essential to ask the model to restate requirements to check its understanding before proceeding, as we might do when delegating work to a colleague. Once satisfied, I ask it to write the code, which I then test. Models have improved significantly over time, requiring minimal hand-holding now. They write excellent, well-structured code, though misunderstandings can be difficult to fix if I don't understand the implementation details. Usually, error messages provide enough information for the model to correct issues in one or two attempts. These models have boosted my productivity enormously. I can implement new techniques in hours rather than the days or weeks it would have taken previously. Most importantly, since they handle intricate details, I can maintain the big-picture view and focus on what truly matters for my research.

Vignette from Dr Clare Strongman: Within my own research into physical activity and disability, I use LLMs to provide an overview of current research within an area to identify gaps and potential topics to develop further. The content generated by generative AI tools provides a fast and effective way to scope research areas and also identify grey literature that can be used to inform and develop new project ideas. Using LLMs to summarise interview data can also provide some initial familiarisation with qualitative data as a form of content analysis, which is useful to use with colleagues who may not be familiar with reflexive thematic analysis and the processes involved.

I am also currently involved with a project that uses creative methods to explore students' experiences and views on the use of AI in assessment, in particular LLMs such as ChatGPT. By using methods where students do not feel that they are being judged on their responses, we hope to investigate how students' perceptions of the use and usefulness of large language models change as the students transition into higher education, and to reach a more nuanced understanding of how students approach assessment and use technology in their studying.

5 CASES Values and Ethical Considerations in AI Use

Human Responsibility

Whilst AI may be able to help us think through ethical decisions, it can't be trusted to be ethical, fair or to understand professional values. Decisions that have an ethical dimension are a human responsibility that should not be delegated to AI, no matter its computational speed or level of 'intelligence'. Ethical issues related to AI should be addressed by people, preferably collectively, in, for example, a formal Ethics Committee.

Readers may find the Data Ethics Framework a helpful resource to guide the appropriate and responsible use of data. The framework foregrounds three overarching principles; transparency, accountability and fairness. If a Sport and Exercise Scientist uses AI to draft a document or for any other purpose, they should be transparent about its use and accountable for its content.

Alignment of AI Applications with Professional Values

In their use of AI, Sport and Exercise Scientists should be guided by the CASES values, commitments and behaviours.

Figure 1: The CASES Values, Commitments and Behaviours

Full details of these values, commitments and behaviours can be found here.

Ethical Issues Raised by AI in SES

The table below raises some of the issues linked to the use of AI in SES.

Table 7: Issues Raised by AI in SES

Ethical Issue	Summary	Hypothetical Examples in SES
Accountability	Responsibility for the development of AI models or algorithms should be established so they are accountable for its outcomes and impacts	If an exercise training AI tool prescribes the wrong frequency, intensity and duration of exercise to a cardiac patient, who is responsible and will be held to account?
AI data privacy	Safeguarding personal data against unauthorised access or misuse	Sensitive GPS and heart-rate data from elite runners accidently leaked after an error, giving an advantage to competitors
Consent	Ensuring individuals give informed, voluntary permission for data use	Collecting motion-capture data from youth football players without clear parental / guardian consent
Algorithmic bias	When models produce unfair or inaccurate outputs due to skewed training data	An injury-risk algorithm trained primarily on male rugby players underestimates risk in female players
System accessibility	Making sure AI tools are functional regardless of users' abilities or resources	A biomechanics-analysis platform that requires expensive sensors, excluding community club coaches
Data representativeness	Ensuring datasets reflect the diversity of the target population	VO_2max normative curves based on Western endurance athletes, failing to generalise beyond this population

Bias ranks among AI's most urgent ethical challenges. Addressing it requires a coordinated, end-to-end strategy spanning data collection, model development, deployment and governance. A critical step is ensuring real-world representativeness by gathering data that captures the full spectrum of SES contexts. For example, in SES research, studies should recruit participants across races, ages, genders, performance levels, body types, sports and cultures to avoid bias and ensure a broadly generalisable model.

There are concerns regarding data protection when uploading patient or client personal information to AI platforms. It is essential to understand which AI systems retain and use uploaded data, as well as how such data use can be limited or deactivated when possible. Institutions may also wish to consider the use of other strategies to restrict AI access to sensitive information – such as the use of secure digital 'sandboxes'. Implementing such measures may require additional investment from organisations to safeguard data security and maintain intellectual property rights.

To ensure everyone can benefit from AI systems, they should be truly multilingual – equally fluent in Mandarin, Arabic, Swahili, and every other language – rather than being optimised solely for English proficiency.

When considering the ethics of AI, it is important to think about the large energy consumption of these systems and their impact on the environment. Concerns about sustainability issues have resulted in research and frameworks that seek to address these challenges[48].

Recommended Reading on AI, Ethics and Bias

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6 Conclusion

Challenges

SES faces several challenges if it is to ensure that AI has a positive impact on the profession. These include, but are not limited to the following:

- Preparing the next generation of professional and early career scientists for a future world of work shaped by AI. For example, how should AI be embedded in our undergraduate curricula?
- Providing lifelong learning, training and development opportunities to ensure that Sport and Exercise Scientists at all career stages can use AI appropriately.
- Establishing what best practice in SES looks like in the use of AI. For instance, how can accreditation criteria be adapted to effectively capture the skills required to use AI appropriately?
- Thinking about and preparing for other technological developments that will emerge because of, or alongside, AI. For example, how will developments in areas such as quantum computing and robotics change the profession?

Human Intelligence

The development of LLMs over the last 18 months has been rapid. They are far more capable and reliable than they were in the early days. Current 'reasoning' models give comprehensive, hard-to-fault answers, and they promise much more. There have also been big advancements in text-to-image and text-to-video generation, producing outputs of remarkable realism. As this resource demonstrates, several AI systems have much to offer SES.

However, fundamental problems remain, including:

- hallucinations, which, whilst becoming less prevalent, still occur
- the lack of common sense from LLMs
- the absence of genuine abstract reasoning and understanding
- the poor handling of situations outside of their training data.

At the time of writing, AI has not developed internal models of the real world. At heart, they remain models of language.

Although AI is beginning to outperform human experts in narrowly defined benchmark tests[49], in broader real-world assessments, the models still lack average human capabilities[50]. Current LLM architectures cannot rival human reasoning or the other distinctive qualities of our species.

AI is a tool to be used by human Sport and Exercise Scientists to improve the human condition by:

- improving public health
- enhancing the enjoyment of sport
- adding to the sum of human knowledge.

Whilst AI systems excel at tasks like data analysis, it is incumbent upon human Sport and Exercise Scientists to oversee these processes and ensure they genuinely meet the needs of the individuals, communities and societies involved. This may mean that in the future, Sport and Exercise Scientists will need more training in ethics and how to assess what is in the best interests of their clients. A practical step that Sport and Exercise Scientists can take to ensure AI improves the human condition is to address algorithmic bias in their research, such as by recruiting participants not currently represented within the literature.

Whilst this resource has directed readers to AI systems that can do some things better than humans, it is important to identify those things which humans do best. Table 8 presents some of these things with reference to SES. By identifying human excellence, it is possible to highlight how Sport and Exercise Scientists can best use, or partner with, AI to maximise its benefits and mitigate its risks. By recognising what humans do best, and working together with AI on what it does best, we could have a transformational impact on sport, exercise and science.

Table 8: Human Excellence

Human Domains of Excellence	Application to SES
Creativity and innovation: Acts of imagination, leaps of faith, 'irrational thinking', counterintuitive thought, inspirational moments, and going beyond algorithmic pattern recognition	Developing new ways for people and communities to 'recreate' through sport and physical activity. The creation of new games and ways for people to collaborate and compete through human movement
Empathy and emotional intelligence: Understanding, communicating and relating to other people as they experience an embodied existence	Relating to and being with people as they go through intense experiences, and recognising individual differences in how people respond in such circumstances. For example, in sport, in the hours before an Olympic final. In exercise, during the first exercise rehabilitation session after a heart attack
Ethical judgement and moral reasoning: Only humans can make ethical judgements, be held accountable for them and live with the consequences	Advising an athlete when AI has suggested a match tactic that, whilst maximising their chances of winning, is against the 'spirit of the game'
Contextual understanding and common sense: Not all understanding is objectively quantifiable nor gained through the scientific method and easily communicable. Some knowledge is subjective, gained through experience and difficult to share verbally	Sometimes, the best thing a Sport and Exercise Scientist can do is to do nothing, to remain silent but share the moment and to communicate non-verbally. Such circumstances may occur after an athlete has lost a race or a patient has been given a challenging diagnosis
Strategic vision and big-picture thinking: Humans have the ability and responsibility to define clear, long-term directions for projects and organisations, and to allocate resources to achieve these ends. To do this they need to step out of detailed day-to-day operations to envision the future they want to create	Human Sport and Exercise Scientists need to show leadership and ownership of the projects they work on. For example, if funding is available to resource a community activity programme, they need to decide which groups it should target, what success looks like, and the types of activities it should include

Whilst acknowledging the transformative power of AI, we need to take care not to anthropomorphise these systems and to recognise the importance of human intelligence, emotions and values.

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10 Legal Statement

Please note that this resource is for guidance only. Further independent legal guidance should always be sought if necessary. AI is constantly changing and there are changes and updates almost daily which should be monitored and acted upon by all Sport and Exercise Scientists.

Links and references are provided to support further exploration. As external systems evolve, accuracy and availability may change. Readers should confirm details independently and apply professional judgment when using these resources.

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