

Deliverable 2.1 – Desk Research

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Key words

Digital literacy, sport education, higher education students, labour market skills

Description

The objective of this deliverable is to collect and analyse information on the following: students' current competence level in digital and tech tools, technology and digital tools, and their function and use (hardware and software) in sports sciences, trends within the tech world in sports and physical activity, and important skills within the digital world / labour market demands. The comprehensive mapping of the will provide basis to develop a solid foundation for creating a sustainable and transferable courses for sports science students in order to achieve digital and tech competence.



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Definitions, Acronyms and Abbreviations

GDPR	General Data Protection Regulation
HEI	Higher Education Institution
I+E	Innovation and Entrepreneurship
SSPA	Sport Science and Physical Activity
WP	Work Package
WPL	Work Package Leader



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1. Introduction

In recent years, the sports science sector has witnessed a profound digital transformation, redefining the skills and competencies required of students and professionals alike. As technological tools become central to performance analysis, injury prevention, and athlete management, digital literacy has emerged as a critical competency in higher education curricula. This report investigates the current digital competence levels among sports science students in five European countries—Norway, Luxembourg, Cyprus, Romania, and Lithuania—highlighting both achievements and persistent gaps. It presents national efforts and institutional strategies aimed at embedding digital skills within sports science education, while also acknowledging disparities in implementation and access.

This report outlines the essential digital literacy skills that sports science students must acquire, including data analysis, the use of performance technologies, ethical data handling, and basic programming knowledge. It also explores the growing role of advanced hardware and software, such as wearable devices, motion capture systems, and AI-driven video analysis tools, which are revolutionizing how athletic performance is measured and enhanced. Beyond the academic setting, emerging trends like artificial intelligence, virtual reality, and predictive analytics are shaping the future of sports training, rehabilitation, and fan engagement.

Importantly, the report addresses the alignment between digital skillsets and labour market demands, emphasizing the need for educational institutions to adapt curricula to prepare graduates for a tech-driven professional landscape. As new roles emerge in sports science and rehabilitation, professionals must combine domain-specific knowledge with robust digital capabilities. However, challenges such as unequal resource distribution, curriculum integration, and the balance between technical and interpersonal skills remain. By addressing these issues and investing in digital education, institutions can empower future sports scientists to thrive in an increasingly digitalized, data-informed world.

2. Students' current competence level in digital and tech tools

In the contemporary landscape of sports science education, proficiency in digital and technological tools is paramount. As institutions strive to equip students with the necessary competencies, understanding the current levels of digital literacy among sports science students becomes crucial. This section report briefly presents the current situation in the partner countries (Norway, Luxembourg, Cyprus, Romania, and Lithuania) in regard to students digital competencies. The partner countries are the ones that participate in the project with Higher Education Institutions.

2.1 Sport Science Sector: Digital Competencies in European Education



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Digital competence is recognized as a fundamental component of modern education systems. The European Union has emphasized the importance of digital skills, advocating for their integration across all educational levels. Despite these initiatives, disparities persist among member states concerning the implementation and effectiveness of digital education strategies (European Commission, 2023).

Norway: Norway has demonstrated a proactive approach to digital education. The Norwegian Directorate for Education and Training has implemented comprehensive strategies to enhance digital competencies among students. Institutions like Norges Idrettshøgskole (NIH) have integrated digital tools into their curricula, focusing on practical applications in sports science. However, challenges remain in ensuring uniform digital proficiency across all student cohorts. Ungt Entreprenørskap Norge (JA Norway) and Stiftelsen Beitostølen Helsesportsenter (BHSS) contribute to this landscape by promoting entrepreneurial skills and health sports education, respectively, though specific data on their digital competence initiatives are limited.

Luxembourg: The Université du Luxembourg (Uni.Lu) and the International University of Health, Exercise & Sport (LUNEX) are pivotal in shaping the digital competencies of sports science students in Luxembourg. The country's educational framework emphasizes digital literacy, yet variations in implementation can lead to inconsistent competence levels among students. The integration of digital tools in sports science programs is ongoing, with a focus on aligning with European standards.

Cyprus: Frederick University (FredU) in Cyprus has recognized the importance of digital literacy in sports science education. National reports indicate that Cyprus allocates significant instructional time to digital education during lower secondary levels, which may positively influence students' digital competencies at the tertiary level (European Commission, 2020). However, comprehensive assessments specific to sports science students are lacking.

Romania: In Romania, institutions such as Universitatea din Craiova (UCV) and ASOCIATIA LANGDON DOWN OLTENIA-CENTRUL EDUCATIONAL TEODORIA (Aldo-CET) face challenges in digital education. Eurostat data from 2023 reveals that only 28% of individuals aged 16 to 74 possess at least basic digital skills, highlighting a significant gap (Eurostat, 2024). This suggests that sports science students may also experience deficiencies in digital competencies, necessitating targeted educational strategies.

Lithuania: Lietuvos Sporto Universitetas (LSU) in Lithuania operates within an educational system that places considerable emphasis on digital competence. The national curriculum includes substantial hours dedicated to digital education during lower secondary education (European Commission, 2020). This foundational focus likely benefits sports science students, although specific data on their competence levels remain scarce.

2.2 Challenges and Considerations



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Across these institutions, several common challenges emerge: 1) Resource Allocation: Ensuring access to up-to-date technological tools and training requires significant investment, 2) Curriculum Integration: Effectively embedding digital literacy into existing sports science curricula without displacing core subject matter is complex and 3) Assessment and Evaluation: Developing standardized metrics to assess digital competence among students is necessary for benchmarking and improvement. The digital competence of sports science students varies across the examined institutions and countries. While some have made notable strides in integrating digital literacy into their programs, others face systemic challenges that hinder progress (European Commission, 2023). By addressing these challenges and leveraging existing strengths, institutions can better prepare sports science students for the demands of a digitally evolving professional landscape.

3. Essential Digital Literacy Skills for Sports Science Students

As the sports science field becomes increasingly data-driven and technology-enhanced, students and graduates entering the profession must possess a strong foundation in digital literacy. Digital literacy, defined as the ability to effectively and critically navigate, evaluate, and create information using digital technologies (Ng, 2012), has become essential for success in modern sports science careers. A number of essential digital literacy skills for sports science students are explained below:

Data Analysis and Statistical Literacy: Sports science professionals must interpret large volumes of data collected from athletes, wearables, or biomechanics labs. Basic knowledge of data management and statistical software such as Excel, SPSS, or R is critical for assessing performance trends, injury risks, and training effectiveness (Pill, Dawes, & Larkin, 2023). Understanding how to interpret and visualize data fosters evidence-based decision-making and communication with stakeholders.

Familiarity with Digital Performance Tools: Students should be competent in using digital tools specific to their domain, such as GPS tracking devices, heart rate monitors, or motion capture systems. These tools provide real-time feedback and allow for fine-tuned analysis of athletic performance (Reilly & Gilbourne, 2021). Learning how to collect, store, and analyze this data during their studies will give students a competitive edge in the labor market.

Proficiency in Communication Platforms and Content Creation: Digital literacy includes knowing how to use platforms like video conferencing tools (e.g., Zoom), digital collaboration tools (e.g., Microsoft Teams or Google Workspace), and content creation software (e.g., Canva, Adobe Spark). These tools are essential not only for academic collaboration but also for professional outreach, virtual consultations, and client education (Judd, Elliot, & Macdonald, 2020).

Understanding of Online Privacy and Data Ethics: Handling sensitive athlete or patient data requires knowledge of ethical standards and data protection practices. Students should be



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introduced to digital safety, GDPR principles, and the ethical use of data analytics tools in sports (Eynon & Geniets, 2016). As digital health and performance monitoring increase, these principles become vital for building trust and maintaining professional integrity.

Basic Programming and AI Awareness: While not all sports science graduates will become developers, a basic understanding of programming logic (e.g., MatLab, Python) and AI capabilities is useful. Machine learning is increasingly used for injury prediction, tactical analysis, and optimizing performance. Awareness of these technologies helps professionals communicate with data scientists and use tools more effectively (Glebova, Madsen, Mihaľová, Géczi, Mittelman, & Jorgič, 2024).

In conclusion, building digital literacy should be a priority in sports science education. It prepares students to confidently adopt new technologies and methodologies, adapt to workplace demands, and engage in interdisciplinary collaboration in increasingly digital sports ecosystems.

4. Technology and Digital Tools in Sports Sciences: Hardware and Software Applications

Recent advancements in sports technology have transformed how athletic performance is monitored, analysed, and enhanced. Wearable devices now play a crucial role in collecting real-time physiological and biomechanical data, helping optimize training and reduce injury risk. Tools like Inertial Measurement Units (IMUs) and Velocity-Based Training devices allow athletes and coaches to refine techniques and adjust training loads on the spot. Motion capture systems, including Vicon and Xsens, enable precise biomechanical assessments, while video analysis tools such as PlaySight and OpenSim support technique evaluation and rehabilitation (PlaySight, 2022). Athlete management platforms like Catapult and Kitman Labs integrate diverse data to inform better decision-making. Immersive VR/AR systems and advanced tracking technologies further enrich cognitive training and strategic development. Overall, these innovations mark a shift toward personalized, data-driven approaches in sports science and athlete care. The aforementioned are further presented and explained below.

The Wearable Technology and Sensors: Wearable devices have become integral in monitoring and enhancing athletic performance. These devices collect real-time data on physiological and biomechanical parameters, aiding in performance optimization and injury prevention. For example, Inertial Measurement Units (IMUs): IMUs track movements in three-dimensional space. Custom wearable IMU systems have been developed for real-time body orientation tracking in athletic motions, providing visualization and aiding in technique refinement (González-Alonso, Oviedo-Pastor, Aguado, Díaz-Pernas, González-Ortega, & Martínez-Zarzuela, 2021). Another example are the Velocity-Based Training (VBT) Devices: VBT tools like accelerometers and linear transducers provide feedback on movement velocity during strength exercises, allowing coaches to adjust training loads in real-time for improved power development (Weakley et al., 2022).



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Motion Capture and Biomechanical Analysis Systems: Advanced motion capture systems allow precise analysis of human movement, which is critical for refining technique and preventing injury. One example is Vicon Systems that are used for detailed gait and movement analysis. Vicon systems assess running biomechanics, posture, and asymmetries (Vicon, 2023). Xsens MVN Analyze tools is another example. Xsens tools, based on inertial sensors, capture full-body motion data and are used widely in sports research and performance evaluation (Xsens, 2023).

Video Analysis and Performance Review Software: These are video-based tools that support the evaluation of athletic performance and technique development. PlaySight Interactive is one example. This is an AI-enhanced system (PlaySight) offer multi-angle video analysis, instant replay, and real-time coaching tools for sports such as tennis, basketball, and soccer (PlaySight, 2022). OpenSim, is an open-source software like that enables biomechanical modeling and simulations of musculoskeletal dynamics, supporting rehabilitation and performance studies (Seth et al., 2021).

Athlete Management and Data Integration Platforms: These data platforms are essential for tracking training loads, injury risks, and overall athlete management. For example, Catapult's wearable sensors and analytics platform allow real-time data tracking and performance analysis, used by elite teams worldwide (Catapult, 2023). Performance intelligence platform integrates medical, training, and performance data to optimize athlete health and decision-making. Kitman Labs is an example of achieving the aforementioned (Kitman Labs, 2023).

Virtual and Augmented Reality (VR/AR) in Training: VR/AR tools provide immersive environments to enhance cognitive and perceptual skills in athletes. The Okkulo System is an example, that uses light manipulation, which then enhances athletes' visual-motor coordination by training them in reduced-light conditions (Wired, 2023).

Advanced Statistical and Tracking Systems: New tracking systems provide detailed performance metrics that influence strategy and player development. Originally developed for basketball, SportVU uses multiple cameras to track real-time player and ball movements, offering insights for tactical improvement (NBA, 2022).

Training and Rehabilitation Devices: Specialized hardware enables targeted training and monitoring of recovery. The AST-Monitor, based on Raspberry Pi, supports external sensors to monitor cycling and heart rate data, providing insights into endurance and workload (Fister, Iglesias, Galvez, Deb, & Fister, 2021).

The continuous evolution of sports technology empowers professionals with advanced tools to assess, train, and protect athletes. Whether through wearable sensors, AI video systems, or VR-based training, technology enhances decision-making and fosters individualized, data-driven approaches to athletic development.



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5. Trends within the tech world

The rapid advancement of technology has profoundly influenced various sectors, with sports and physical activity being no exception. Emerging technologies, particularly Artificial Intelligence (AI), have revolutionized how athletes train, perform, and recover, while also enhancing fan engagement and sports management. This section document explores current trends in the tech world, focusing on the integration of new and emergent technologies, especially AI, in sports and physical activity.

Wearable Technology and Biometric Monitoring: Wearable technology has become a staple in modern sports, providing real-time data on an athlete's physiological and biomechanical parameters. Devices such as smartwatches, fitness trackers, and specialized sensors monitor metrics like heart rate, oxygen saturation, movement patterns, and energy expenditure. This data enables personalized training programs, optimizes performance, and aids in injury prevention. For instance, 3D printing technology now allows for the customization of athletic gear tailored to an individual's body shape and movement patterns, enhancing both performance and safety (CAS, 2024).

Artificial Intelligence in Performance Analysis: AI has transformed performance analysis by processing vast amounts of data to uncover patterns and insights that were previously unattainable. Machine learning algorithms analyze player movements, strategies, and outcomes to provide actionable feedback. In basketball, for example, AI-powered cameras track player positions and ball movement, offering coaches detailed analyses to refine tactics and improve decision-making (DataCamp, 2024).

Injury Prevention and Rehabilitation: AI applications extend to injury prevention and rehabilitation by identifying risk factors and recommending mitigation strategies. By monitoring force production, muscle activation, and joint angles, AI systems can detect potentially harmful movements and provide personalized corrective feedback. This proactive approach helps reduce injury rates and supports effective recovery protocols (Forbytes, 2023).

Virtual and Augmented Reality: Virtual Reality (VR) and Augmented Reality (AR) technologies are increasingly integrated into sports training and fan engagement. Athletes use VR simulations to practice in immersive environments, enhancing cognitive skills and decision-making under pressure. For fans, AR applications provide enriched viewing experiences by overlaying real-time statistics and interactive content during live events. For example, the Australian Open's introduction of AO Animated, featuring computer-generated match coverage with avatars, exemplifies the innovative use of these technologies to reach new audiences (The Guardian, 2025).

Data Analytics and Predictive Modelling: The sports industry increasingly relies on data analytics and predictive modelling to inform strategies and operations. By analysing historical and real-time data, teams can predict opponent behaviours, optimize game plans, and make informed



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decisions regarding player acquisitions and training regimens. AI-driven predictive analytics also assist in forecasting game outcomes and player performance, adding a strategic edge to competitive sports (Kmanpub, 2024).

Fan Engagement and Experience: Emerging technologies have transformed the way fans interact with sports. AI-powered chatbots provide personalised content, answer queries, and facilitate ticket purchases, enhancing the overall fan experience. Additionally, VR platforms allow fans to experience games from unique perspectives, such as a player's viewpoint or courtside seats, without being physically present. These innovations foster deeper connections between fans and their favourite teams or athletes (MobiDev, 2024).

Ethical Considerations and Challenges: While the integration of AI and other technologies in sports offers numerous benefits, it also raises ethical considerations. Issues such as data privacy, the potential for performance enhancement beyond natural means, and the digital divide between technologically advanced teams and those with fewer resources must be addressed. Ensuring that technology serves to enhance fairness and inclusivity in sports remains a critical challenge (Ohio University, 2024).

The intersection of technology and sports continues to evolve, with AI and other emergent technologies playing pivotal roles in shaping the future of physical activity. From enhancing athletic performance and injury prevention to revolutionizing fan engagement, these advancements offer exciting opportunities and challenges. As the tech landscape progresses, stakeholders in the sports industry must navigate the ethical implications and strive to leverage technology in ways that promote fairness, inclusivity, and the overall betterment of sports.

6. Skills Within the Digital World Aligned with Labour Market Demands

The digital revolution has profoundly impacted various sectors, including sports science and rehabilitation. As technology becomes increasingly integrated into these fields, there is a growing demand for professionals equipped with digital competencies. In today's labour market, digital skills are no longer optional but essential. A report by the National Skills Coalition (2023) revealed that 92% of jobs analysed require digital skills, yet one-third of workers possess low or no digital competencies. This disparity highlights the urgent need for educational programs to incorporate digital literacy to prepare graduates effectively.

This section of the report explores the digital skills required in the current labour market for sports science and rehabilitation graduates, emphasizing areas such as programming, machine learning, and data analysis.

Digital Skills in Sports Science and Rehabilitation



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The integration of technology in sports science and rehabilitation has led to the emergence of new roles and the transformation of existing ones. Professionals are now expected to possess a blend of domain-specific knowledge and digital competencies (Glebova, et al, 2024). The key digital skills for sports science and rehabilitation students to possess are explained below.

Data Analysis and Interpretation: The ability to collect, analyse, and interpret data is crucial. Sports science student graduates must be adept at using statistical tools and software to assess performance metrics, design training programs, and monitor rehabilitation progress. This skill set enables evidence-based decision-making and personalized interventions.

Programming and Software Development: Proficiency in programming languages such as MatLab, Python or R is increasingly valued. These skills facilitate the development of customized software solutions for performance tracking, simulation models, and rehabilitation protocols. Moreover, understanding programming enhances the ability to collaborate with IT professionals on interdisciplinary projects.

Machine Learning and Artificial Intelligence (AI): AI and machine learning are revolutionizing the sports industry by enabling predictive analytics, injury prevention strategies, and personalised training regimens. Glebova, et al (2024) emphasised on the multifaceted impact of AI on the sports industry labor market, highlighting the emergence of new roles that require AI expertise alongside traditional sports knowledge.

Digital Rehabilitation Technologies: The adoption of digital tools in rehabilitation, such as virtual reality (VR) and tele-rehabilitation platforms, necessitates familiarity with these technologies. A scoping review in the *Journal of Medical Internet Research* (2023) defines digital rehabilitation as the use of digital technologies to optimise functioning and reduce disability, underscoring the importance of digital proficiency in modern rehabilitation practices.

Educational Initiatives and Curriculum Development: Recognising the evolving demands of the labor market, educational institutions are revising curricula to incorporate digital competencies. For example, in Spain, sports science education is shifting towards competency-based learning that integrates both generic and specific skills essential for automation and AI applications (Molina-García, González-Serrano, Ordiñana-Bellver, & Baena-Morales, 2024). Similarly, a course designed to enhance digital literacy among sport management students demonstrated significant improvements in students' digital competencies, preparing them for the technological demands of the industry (Swim, Presley, & Thompson, 2023).

Challenges and Considerations

Despite the clear benefits, integrating digital skills into sports science and rehabilitation education presents challenges. These challenges can be grouped in 3 categories: 1) Resource limitations: implementing comprehensive digital training requires investment in technology and faculty development, which may strain institutional budgets, 2) Keeping pace with technological



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advancements: The rapid evolution of technology necessitates continuous curriculum updates to remain relevant, and 3) Balancing technical and interpersonal skills: while digital competencies are crucial, the importance of interpersonal skills in patient care and team collaboration remains paramount.

The digital transformation of the sports science and rehabilitation sectors underscores the necessity for professionals to acquire and continually update digital skills. Educational institutions play a pivotal role in equipping graduates with the competencies required to thrive in a technology-driven labour market. By integrating digital literacy into curricula, fostering interdisciplinary collaboration, and promoting lifelong learning, we can ensure that sports science and rehabilitation professionals are well-prepared to meet current and future challenges. By addressing these areas, sports science and rehabilitation graduates can position themselves competitively in a labour market that increasingly values digital proficiency alongside traditional expertise.

7. Conclusion

The integration of digital technologies in sports science has become a critical driver of innovation, performance enhancement, and educational transformation. As the demands of the labour market evolve, higher education institutions across Europe are called to equip students with the digital competencies necessary to navigate and contribute to increasingly data-driven professional environments. This report offers a comprehensive overview of the current landscape, focusing on students' digital competence levels, essential skills, emerging technologies, and broader trends shaping the field. Drawing from five partner countries—Norway, Luxembourg, Cyprus, Romania, and Lithuania—the analysis reveals both progressive initiatives and ongoing disparities in digital education across the sports science sector.

The report identifies foundational digital skills such as data analysis, familiarity with performance tracking tools, ethical data handling, and basic programming knowledge as essential for future professionals. It also maps the rapidly expanding ecosystem of hardware and software used in sports science, including wearable technology, motion capture systems, VR/AR tools, and AI-enhanced platforms. These innovations not only support athletic performance and injury prevention but also redefine rehabilitation strategies and training methodologies.

Emerging global trends—particularly the growing influence of artificial intelligence and predictive analytics—are transforming how data is interpreted and applied in sports settings. As technology continues to shape fan experiences, coaching strategies, and athlete care, sports science professionals must remain agile and digitally literate. Moreover, the report emphasizes the alignment between digital competencies and labour market demands, underscoring the need for curriculum reform and interdisciplinary collaboration. Despite notable progress, challenges such as unequal access to resources, the pace of technological change, and the need to balance technical with interpersonal skills persist.



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Overall, the report advocates for a proactive and inclusive approach to digital education in sports science, urging stakeholders to prioritize digital literacy as a core component of academic and professional preparation. In doing so, institutions can empower the next generation of sports science graduates to meet the complex challenges of a digitally evolving world.

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