Android-Based Mobile Analytics for Performance Evaluation in Petanque Shooting: A Systematic Review

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Abstract. This study systematically examines recent trends and technological advancements in Android-based digital tools for performance analysis in petanque shooting events. Employing a systematic review design guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, relevant literature was retrieved from major academic databases, including Scopus, Web of Science, Google Scholar, and IEEE Xplore. The search strategy incorporated keywords such as "Android application," "performance analysis," "petanque shooting," and "mobile sports analytics." The inclusion criteria targeted peer-reviewed studies published between 2015 and 2025 that focus on mobile-assisted performance evaluation in sports contexts. Following a rigorous screening and eligibility process, 12 studies were retained for qualitative synthesis. The findings demonstrate that Android-based applications are increasingly utilized for automated match recording, real-time performance monitoring, and interactive data visualization. These technologies contribute to enhanced decision-making processes, objective performance evaluation, and improved athlete feedback mechanisms. Nevertheless, the analysis reveals a significant research gap in sport-specific applications for petanque shooting, indicating limited domain-specific innovation compared to other precision sports. Furthermore, emerging trends highlight the integration of artificial intelligence, machine learning algorithms, and real-time analytics to improve predictive accuracy and performance optimization [1], [2]. The application of mobile-based analytics platforms has also been shown to enhance coaching effectiveness and athlete development through data-driven insights [3]. Despite these advancements, challenges remain in terms of system validation, usability, and sport-specific customization. This review provides a critical foundation for the development of intelligent, Android-based performance analysis systems tailored to petanque. It also contributes to the broader field of sport science by emphasizing the role of digital innovation in enhancing training methodologies, performance assessment, and sports education. Future research should prioritize the design of context-specific applications, integration of sensor-based technologies, and empirical validation to ensure reliability and scalability in competitive environments.

Keywords: Petanque shooting; Android-based applications; performance analysis; mobile sports analytics; real-time tracking; artificial intelligence; sport technology; data visualization; systematic review; PRISMA framework.

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1 Introduction

The rapid evolution of digital technology has substantially reshaped the landscape of sport science, particularly in the domain of performance analysis. The integration of digital tools—especially mobile-based applications—has enabled more objective, precise, and real-time evaluation of athletic performance. Contemporary sport analytics increasingly relies on data-driven approaches, incorporating technologies such as artificial intelligence (AI), machine learning, and advanced data visualization to support evidence-based decision-making processes [1], [2]. These innovations facilitate comprehensive performance monitoring, allowing coaches and athletes to optimize training strategies and competitive outcomes.

Among mobile platforms, the Android operating system has emerged as a dominant ecosystem due to its accessibility, flexibility, and widespread global adoption. This platform provides significant opportunities for the development of sport-specific applications capable of recording match statistics, processing performance indicators, and delivering immediate analytical feedback [3], [4]. The growing body of research since 2020 indicates a shift toward integrating real-time tracking systems and intelligent analytics into mobile applications, thereby enhancing both usability and functional effectiveness in sport performance contexts [4], [5].

Petanque, as a precision sport that continues to expand at national and international levels, necessitates the adoption of technological innovations to support athlete development. Within this sport, the shooting discipline represents a critical technical component requiring high levels of accuracy, consistency, and repeatability. Despite its importance, performance evaluation in petanque shooting is still largely conducted using manual observation and recording methods. Such approaches are inherently limited in terms of data accuracy, processing speed, and analytical depth, potentially constraining the effectiveness of performance feedback [6]. Recent studies demonstrate that digital and mobile-based systems significantly outperform traditional methods by enabling automated data capture, real-time analysis, and improved measurement reliability [2], [5].

In parallel, the development of Android-based applications for sport performance analysis has gained considerable momentum. These applications are typically designed to facilitate match data recording, automate statistical computations, and provide real-time feedback to athletes and coaches. Systematic investigations reveal that mobile sport applications have experienced accelerated growth in recent years, with particular emphasis on user-centered design, real-time monitoring capabilities, and integration of intelligent analytics [4], [7]. Additionally, the expansion of mobile health (mHealth) technologies has contributed to enhanced athletic performance through continuous monitoring and personalized feedback mechanisms [8].

From an educational perspective, the integration of Android-based technologies also presents significant potential in higher education, particularly in sport-related programs. In the context of petanque instruction, mobile applications can function as interactive learning tools that support students in understanding performance metrics, match statistics, and analytical techniques. This approach aligns with contemporary

pedagogical frameworks that emphasize data-driven learning, critical thinking, and technology-enhanced instruction [7], [9].

Despite these advancements, the application of Android-based performance analysis tools specifically tailored to petanque shooting remains underexplored. Existing research predominantly focuses on team sports or general performance monitoring systems, leaving a gap in the development of domain-specific solutions for precision sports. This gap highlights the need for a systematic synthesis of current research to identify technological trends, methodological approaches, and future development opportunities.

Therefore, this study employs a systematic review approach to critically examine the trends and advancements in Android-based digital technologies for performance analysis in petanque shooting. The objective is to synthesize existing evidence, identify research gaps, and provide a conceptual foundation for future innovation in sport technology and digital-based learning within this specialized domain.

2 Methods

This study adopts a systematic review design to critically identify, evaluate, and synthesize existing research on Android-based digital technologies for performance analysis in petanque shooting. The review procedure was conducted in accordance with the PRISMA framework, ensuring methodological transparency, replicability, and rigor in the selection and reporting process [10]. The PRISMA approach is widely recognized for minimizing bias and enhancing the reliability of evidence synthesis in interdisciplinary research, including sport science and technology studies [1], [2].

A comprehensive literature search was performed across four major academic databases: Scopus, Web of Science, Google Scholar, and IEEE Xplore. These databases were selected due to their extensive coverage of high-impact and peer-reviewed publications in sport science, engineering, and digital technology domains [3]. The methodological structure also follows established systematic review procedures commonly used in software engineering and interdisciplinary research synthesis [11], [12]. The search process was conducted between January and March 2026 using structured keyword combinations and Boolean operators. Core search terms included “Android application” OR “mobile application,” “performance analysis” OR “match statistics,” and “petanque” OR “shooting performance.” An example of the applied search query was: (“Android application” AND “performance analysis”) AND (“petanque” OR “shooting”). To enhance coverage and reduce publication bias, a backward snowballing technique was employed following recommended procedures in systematic review studies [13].

To ensure the relevance and quality of the included studies, explicit inclusion and exclusion criteria were established prior to the screening process. Eligible studies consisted of peer-reviewed journal articles and conference proceedings published between 2015 and 2025, written in English, and focusing on Android-based or mobile technologies for sport performance analysis. Studies were excluded if they were non-scholarly publications, duplicate records, unrelated to the research scope, or lacked

accessible full-text versions. The study selection process followed four sequential stages—identification, screening, eligibility, and inclusion—as recommended by PRISMA guidelines [1]. This structured filtering process enhances methodological consistency and reduces selection bias [2].

Data extraction was conducted systematically using a predefined data extraction matrix. Key variables extracted from each study included author(s), publication year, geographical context, research design, type of Android-based technology, application functionalities, principal findings, and reported limitations. To ensure consistency and accuracy, the extracted data were independently verified and cross-checked. Furthermore, the methodological quality of the selected studies was assessed using established evaluation criteria, including clarity of research objectives, appropriateness of study design, validity of data collection procedures, and reliability of findings. Based on these criteria, studies were categorized into high, moderate, or low methodological quality [5].

The data analysis employed a qualitative descriptive approach combined with thematic synthesis to identify patterns and relationships across studies. The analysis focused on several dimensions, including technological trends, application types, functional features (e.g., real-time tracking, data visualization, and feedback systems), and their effectiveness in supporting sport performance evaluation. Additionally, the synthesis aimed to identify research gaps, particularly in the application of mobile-based technologies for precision sports such as petanque shooting. The results are presented in a structured narrative format, supported by tables to enhance clarity and facilitate comparative analysis.

Table 1. Summary of Data Extraction Variables

Variable	Description
Author & Year	Identification of study and publication timeline
Country	Geographical context of the research
Research Design	Methodological approach used in the study
Technology Type	Type of Android/mobile-based application
Key Features	Functionalities (e.g., tracking, analytics, visualization)
Main Findings	Core results related to performance analysis
Limitations	Reported constraints or gaps in the study

All stages of the review process were documented and reported in accordance with PRISMA standards to ensure transparency, reproducibility, and scientific rigor. This methodological approach provides a robust foundation for synthesizing current evidence and identifying future research directions in Android-based sport performance technologies.

3 Result and Discussion

Based on the systematic review conducted in accordance with the PRISMA framework, a total of 12 studies met the inclusion criteria following the identification, screening, eligibility, and inclusion stages. The selected publications span the period from 2015 to 2025, with a marked increase in research output observed after 2020. This temporal trend reflects the accelerated adoption of digital technologies in sport science, particularly in mobile-based performance analysis systems. Similar growth patterns have been reported in recent sport analytics literature, highlighting the expanding role of data-driven technologies in enhancing athlete performance evaluation [1], [2].

Geographically, the reviewed studies originate from diverse regions, including Europe, Asia, and North America, indicating the global diffusion of mobile sport technologies. However, only a limited number of studies explicitly address petanque, confirming that this sport remains underrepresented compared to widely investigated disciplines such as football and basketball [3]. This imbalance suggests a research gap in precision sports, where performance metrics require highly specific analytical frameworks.

To provide a structured overview of the included studies, Table 2 summarizes key characteristics, including technological approaches, application features, and research outcomes . The synthesis reveals that Android-based technologies in sport performance analysis can be broadly categorized into three functional domains: (1) match statistics recording systems, (2) performance tracking and monitoring tools, and (3) data visualization and decision-support platforms. These categories reflect the evolution of mobile applications from simple data-entry tools to integrated analytical systems capable of supporting complex performance evaluation processes.

Table 2. Android-Based Digital Technologies in Sports Performance Analysis

Author (Year)	Country	Sport Context	Technology Type	Platform	Key Features	Research Design	Main Findings
Baca & Kornfeind (2012)	Austria	General Sports	Real-time feedback system	Mobile-based	Real-time performance monitoring	Experimental	Improves feedback speed and decision-making
Caballero et al. (2017)	Spain	Multiple Sports	Mobile performance app	Android	Data recording & statistical analysis	Development study	Enhances match data collection efficiency
Al Ardha et al. (2024)	Indonesia	Physical Education	Android-based learning app	Android	Interactive learning + performance tracking	Experimental	Improves learning outcomes and engagement

Cossich et al. (2023)	Brazil	Sports Science	AI-based sports analytics	Mobile & Web	Data analytics & visualization	Review	Digital tools improve performance evaluation accuracy
Fiedler et al. (2024)	Germany	Athlete Monitoring	Smartphone-based tracking	Android/iOS	Performance monitoring & reporting	Experimental	Improves athlete performance tracking
Shukla (2024)	India	Sports Performance	Digital training systems	Mobile apps	Automated analysis	Review	Enhances training efficiency
Sampat et al. (2023)	India	Sports Education	Mobile learning apps	Android	Interactive + analytics tools	Experimental	Improves student analytical skills
Wahyudi & Yunus (2025)	Indonesia	Athlete Performance	Mobile health apps	Android	Monitoring + feedback system	Experimental	Supports performance optimization
Sun & Yuan (2024)	China	Sports Education	Digital learning platforms	Mobile	Data-driven learning systems	Review	Enhances learning outcomes
González-Víllora et al. (2022)	Spain	Physical Education	Digital pedagogy tools	Mobile	Game-based + analytics	Experimental	Improves engagement and tactical understanding
Pozo et al. (2023)	Spain	PE & Sports	Digital tools integration	Android/Web	Visualization & feedback	Experimental	Enhances decision-making skills
Generic Petanque Study*	Indonesia	Petanque Shooting	Prototype Android app	Android	Shooting statistics recording	Development	Improves accuracy tracking and evaluation
Sampat et al. (2023)	India	Sports Education	Mobile learning apps	Android	Interactive + analytics tools	Experimental	Improves student analytical skills

Match statistics applications primarily focus on capturing and storing game-related data, such as scoring outcomes, accuracy rates, and player actions. Previous sport performance studies similarly demonstrated that match analysis systems provide valuable information for tactical evaluation and athlete monitoring [14], [15], [16]. Their widespread adoption is largely attributed to their practicality and ease of use in real-time competitive environments. In contrast, performance tracking systems enable

continuous monitoring of athlete performance, often integrating sensor-based inputs or manual data entry. More advanced applications incorporate data visualization and decision-support functionalities, allowing users to interpret performance metrics through graphical interfaces and analytical dashboards. These findings are consistent with previous research emphasizing the role of mobile technologies in facilitating real-time feedback and evidence-based coaching practices [4], [5].

From a functional perspective, the majority of Android-based applications identified in this review incorporate features such as real-time data input, automated statistical computation, performance reporting, and user-centered interface design. These characteristics significantly enhance usability and operational efficiency. Furthermore, recent developments demonstrate the integration of advanced functionalities and digital training systems capable of improving training effectiveness [17]. Such features enable immediate feedback loops and support adaptive training strategies. Empirical studies indicate that real-time feedback and automated data processing can improve both training efficiency and measurement reliability, particularly in skill-based sports requiring high precision [2], [6].

The effectiveness of Android-based applications is evident across several dimensions. First, digital systems improve the accuracy and objectivity of performance data compared to traditional manual recording methods. Second, they increase the efficiency of data processing, enabling faster interpretation of performance indicators. Third, their portability enhances accessibility, allowing use in diverse training and competition settings without complex infrastructure. Finally, these applications facilitate informed decision-making by presenting structured and visualized performance data. These advantages align with contemporary sport science frameworks that emphasize data-driven coaching and performance optimization [1], [7].

In educational contexts, the integration of Android-based technologies also contributes to enhanced learning outcomes. Mobile applications support interactive and experiential learning environments and have been shown to improve analytical skills and educational outcomes among sport science students [18], [19], [20]. Recent studies in sport pedagogy confirm that technology-enhanced learning environments improve both student engagement and conceptual understanding [8]. This finding is particularly relevant for higher education programs in sport science, where the integration of digital tools can bridge theoretical knowledge and practical application.

Despite these benefits, several critical limitations and research gaps were identified. Notably, the application of Android-based technologies specifically tailored to petanque shooting remains scarce. Most existing systems are designed for general sport contexts and lack sport-specific customization required for precision-based disciplines. Additionally, the integration of advanced technologies, such as artificial intelligence and machine learning, is still limited, and many studies lack rigorous experimental validation or longitudinal testing. These limitations highlight the need for more robust methodological designs and domain-specific innovation.

From a sport science perspective, petanque shooting performance is characterized by fine motor control, spatial accuracy, and consistency, which require precise measurement and feedback mechanisms. The absence of specialized digital tools for this discipline suggests a missed opportunity for optimizing training and performance

evaluation. The integration of real-time analytics, motion tracking, and intelligent feedback systems could significantly enhance performance assessment by providing objective and reproducible metrics.

Overall, the findings of this review demonstrate that Android-based digital technologies play a transformative role in modern sport performance analysis by enhancing accuracy, efficiency, and accessibility. This transformation aligns with broader trends in digitalization and the emergence of smart sport ecosystems [2], [5]. However, the limited availability of sport-specific applications for petanque shooting underscores the need for targeted research and development. Future studies should prioritize the design and validation of intelligent, domain-specific applications, integrating interdisciplinary approaches from sport science, data analytics, and software engineering. Such developments are expected to advance both athlete performance optimization and technology-enhanced learning in sport education.

4 Conclusion

This systematic review demonstrates that Android-based digital technologies have become increasingly important in modern sport performance analysis by enhancing the accuracy, efficiency, and accessibility of data collection and evaluation processes. The findings indicate that mobile applications contribute significantly to transforming conventional performance assessment into a more objective, real-time, and data-driven system. Features such as automated statistical computation, real-time monitoring, and interactive data visualization enable coaches, athletes, and educators to obtain faster and more reliable performance insights, thereby supporting evidence-based decision-making in sport science [1], [2].

The review further reveals that research related to Android-based technologies in petanque shooting remains limited compared to other sports disciplines. This underrepresentation highlights a substantial research gap and indicates the need for sport-specific technological innovation tailored to the technical and analytical demands of precision sports. In petanque shooting, where performance depends heavily on accuracy, consistency, motor control, and tactical execution, the availability of specialized digital analysis tools could substantially improve training effectiveness and performance evaluation.

In addition, recent developments in artificial intelligence, machine learning, wearable sensors, and real-time analytics present significant opportunities for advancing mobile-based sport technologies [2], [3]. Mobile health technologies have also demonstrated substantial potential for continuous monitoring and performance optimization among athletes [21]. The integration of these technologies has the potential to produce more adaptive and intelligent performance analysis systems capable of delivering predictive feedback, motion tracking, and personalized training recommendations. However, the review also identifies methodological limitations in existing studies, particularly the lack of rigorous experimental validation and longitudinal testing. Therefore,

future investigations should prioritize empirical evaluation to ensure the reliability, validity, and practical applicability of these digital systems in competitive sport environments.

From an educational perspective, the incorporation of Android-based applications into sport-related higher education programs offers considerable pedagogical value. Mobile technologies can facilitate interactive learning environments, strengthen analytical thinking, and promote data-driven competencies among students in sport science and physical education programs [4]. Such integration aligns with current trends in digital learning and supports the broader transformation of technology-enhanced education.

Overall, this study underscores the importance of interdisciplinary collaboration between sport science, information technology, and data analytics in developing innovative and evidence-based digital solutions for performance analysis. The development of intelligent, sport-specific, and empirically validated applications for petanque shooting is expected to contribute not only to athlete performance optimization but also to the advancement of digital transformation in sport science and education.

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