

# Application of Innovative Technologies in The Training Of 3×3 Women's Basketball Players as A Factor in Enhancing the Effectiveness of The Training Process and Performance Monitoring

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## Abstract

The article examines the application of innovative technologies in the training process of 3×3 women's basketball players and their impact on training effectiveness and performance monitoring. The study was conducted using a questionnaire survey involving 40 respondents. It was established that technologies are used by all participants; however, their application is heterogeneous: 40% use them regularly, while 60% use them partially. The most commonly used technologies are fitness trackers (80%), which reflects a focus on load monitoring. The greatest impact of technologies is observed in improving training quality and motivation ( $M=4,2$ ), whereas their influence on the development of physical qualities and decision-making is assessed as moderate ( $M=3,6$ ). The main limitations are the lack of equipment (100%) and high cost (40%). At the same time, 80% of respondents are ready to implement technologies, and 100% emphasize the need for coach training. The obtained results confirm the importance of technologies and the necessity of their systematic integration into the training of 3×3 women's basketball players.

**Keywords:** 3×3 basketball, innovative technologies, training process, load monitoring, training effectiveness, sports analytics, athlete motivation.

## Introduction

3×3 basketball is characterized by a higher density of game actions compared to the traditional 5×5 format. In their studies, Paul G. Montgomery et al. [9] established that 3×3 players spend up to 75-80% of game time in high-intensity zones, and the frequency of offensive actions is higher than in 5×5, which requires more precise control of training load and recovery [2, 4, 6, 9].

Comparative data across different countries demonstrate differences in the level of training in modern technologies. In studies by Javier Espasa-Labrador et al. [5], it is shown that in professional leagues in Spain and the United States, more than 70% of teams use load monitoring systems (GPS, heart rate), whereas in university programs in Eastern European countries this figure is lower and ranges between 30-50%, which is associated with limitations in material and technical resources [3, 5, 13].

The use of wearable technologies makes it possible to record objective indicators of load, it has been established that the use of wearables increases the accuracy of training intensity assessment by 25-40% compared to subjective methods [10, 13]. In educational practice, differences are also observed at the level of specialist training. In the study by Carlos Rebelo et al. [11], it is shown that in coach education programs in Western European countries, digital technologies are integrated into curricula, whereas in a number of CIS countries training is episodic, which reduces the effectiveness of technology implementation in practice [1, 7, 11, 14].

The practice of training female athletes demonstrates a similar trend. In a number of educational programs at universities in Romania and Spain, video analysis is used in every training

session, allowing real-time correction of technique, whereas in local clubs in Eastern European countries its application is limited to periodic game analysis, which reduces the effectiveness of feedback. Data on exact implementation rates in these conditions remain limited.

The development of technologies is also associated with the emergence of new analytical tools. In the study by Zheng et al. [15], it is shown that marker less biomechanical analysis systems allow the assessment of movement parameters of 3×3 players with an accuracy of up to 90%. However, their use in practical training remains limited [8, 10, 15].

In real training practice, the most widely used solutions are accessible technologies. For example, in FIBA 3×3 Challenger clubs, heart rate monitors and simple GPS systems are predominantly used, whereas artificial intelligence technologies are mainly applied in analytical centers and are not integrated into everyday training processes.

Despite the growing number of studies, data on the specific use of innovative technologies in women's 3×3 basketball remain limited. There is a lack of sufficient research comparing the effectiveness of different types of technologies depending on their practical application, which necessitates the conduct of empirical studies in this field.

The present study is aimed at addressing this gap and analyzes the features of the application of innovative technologies in the training process of 3×3 women's basketball players, their impact on training effectiveness, and the existing limitations of their implementation.

**The aim of the study** - is to identify patterns in the application of innovative technologies in the training process of 3×3 women's basketball players, to assess their effectiveness, and to determine the limitations and prospects for their implementation within the system of sports training.

To achieve this aim, the following **objectives** were defined:

1. To analyze the level of use of innovative technologies in the training process of 3×3 women's basketball players.
2. To identify the most commonly used types of technologies and the frequency of their application in the practice of athlete training.
3. To assess the impact of innovative technologies on key components of the training process (training quality, individualization, development of physical qualities, motivation, and decision-making).
4. To examine the features of technology application in the system of monitoring and control of training load, as well as their use for adjusting the training process.
5. To determine promising directions for the development of technologies and the level of readiness of specialists for their further implementation.

**The research hypothesis** assumes that innovative technologies are a significant factor in enhancing the effectiveness of the training process in 3×3 basketball, while the degree of their impact varies depending on the area of training (physical, tactical, motivational) and the level of their integration into training practice.

## Materials and Methods

The present study was descriptive in nature and aimed to examine the application of innovative technologies in the training process of 3×3 women's basketball players, as well as to assess their impact on training effectiveness and performance monitoring. Data collection was carried out using a structured questionnaire specifically developed for the purposes of this study.

A total of 40 respondents participated in the study, including coaches, athletes, and physical education teachers involved in 3×3 basketball. The selection of respondents was characterized by a relatively high level of professional experience, with the majority of participants having more than 10 years of experience in basketball, which enhances the reliability and practical significance of the obtained results.

Data collection was conducted over a six-week period, from early January to mid-February 2026. The survey was administered online using the Google Forms platform, which ensured accessibility, anonymity, and efficiency in data processing. Participation in the study was voluntary, and all respondents were informed about the purpose of the research prior to completing the questionnaire.

A researcher-developed questionnaire consisting of 22 items was used for data collection, aimed at examining the application of innovative technologies in the training process of 3×3 women's basketball players.

The questionnaire began with items designed to characterize the respondents, including gender, age, professional role, years of experience in basketball, as well as the level of athletes with whom they work.

Subsequently, the questionnaire was structured into thematic blocks.

**The first block** was aimed at identifying the features of the use of innovative technologies and included questions reflecting their application, the types of technologies used (fitness trackers, video analysis, mobile applications, online platforms, analytical software), as well as the frequency of their use in the training process.

**The second block** focused on evaluating the effectiveness of technologies and included statements assessed on a five-point Likert scale ranging from 1 - "strongly disagree" to 5 - "strongly agree." This block made it possible to determine the impact of technologies on training quality, individualization of training, development of physical qualities, motivation of athletes, and decision-making in 3×3 basketball.

**The third block** was aimed at examining the monitoring of the training process and included questions related to the use of technologies for load control, the list of monitored indicators (heart rate, distance, speed, level of fatigue and recovery, technical indicators), as well as the use of the obtained data for adjusting training sessions.

**The fourth block** included questions aimed at identifying the main barriers to the implementation of technologies, such as lack of equipment, high cost, complexity of use, and other limitations, as well as assessing the need for coach education in the field of modern technology application.

**The fifth block** was devoted to development prospects and included questions aimed at assessing the necessity of using technologies in 3×3 basketball, identifying the most promising areas (biomechanical analysis, video analytics, wearable devices, etc.), as well as the readiness of respondents to implement new technologies in the future.

Such a structure of the questionnaire made it possible to comprehensively cover the key aspects of the use of innovative technologies in the training process and to ensure the completeness of the analysis of the obtained data.

Data processing was carried out using descriptive statistical methods. For categorical variables, absolute and relative indicators (%) were calculated, and for Likert scale data, mean values (M) were determined. The results are presented in the form of tables, graphical materials, as well as comparative analysis, taking into account the professional role and level of experience of the respondents.

During the study, all ethical principles were observed. Participation of respondents was voluntary and anonymous, and no personal data were collected, which ensured the confidentiality of the obtained information.

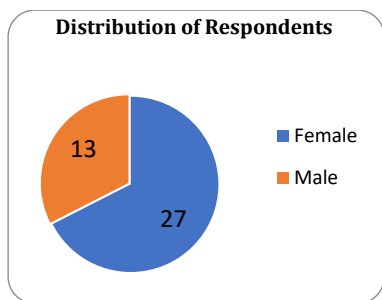
## Results

The obtained results make it possible to identify key patterns in the use of innovative technologies in the training of 3×3 women's basketball players and to assess their contribution to the optimization of the training process. The analysis of the data revealed clear trends in the evaluation of technology effectiveness, the features of their application, as well as differences in perception depending on the professional role and level of experience of the respondents, which is of significant importance for improving the system of sports training.

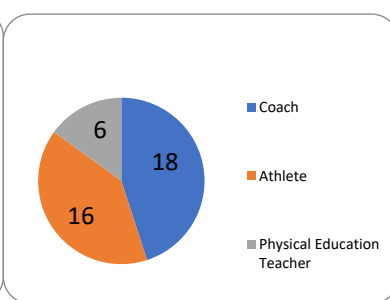
At the initial stage of the analysis, the gender structure of the respondent sample was examined, which makes it possible to characterize the composition of the study participants. The corresponding data are presented in **Fig. 1**. To characterize the professional structure of the sample, an analysis of the

distribution of respondents by role was conducted. The obtained data are presented in **Fig. 2**. To assess the level of professional experience of the study participants, an analysis of the

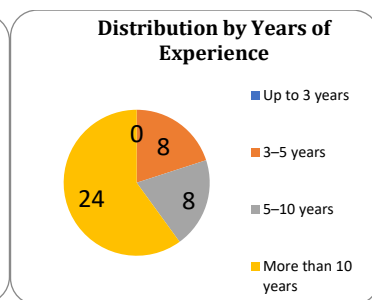
distribution of respondents by years of experience in basketball was carried out. The obtained data are presented in **Fig. 3**.



**Fig 1:** Gender Distribution of Respondents



**Fig 2:** Distribution of Respondents by Role



**Fig 3:** Distribution of Respondents of Years of Experience

A total of 40 respondents participated in the study, of whom 67,5% were female and 32,5% were male, which indicates the predominance of a female sample.

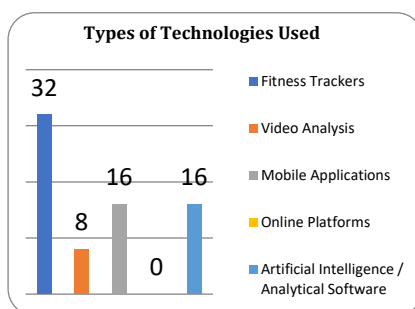
respondents have 5 to 10 years of experience, and another 20% (n=8) have 3 to 5 years of experience. No respondents with less than 3 years of experience were identified in the sample (**Fig. 3**).

The analysis of the distribution of respondents by professional role showed that the largest proportion consisted of coaches (45%) and athletes (40%), whereas physical education teachers were represented to a lesser extent (15%).

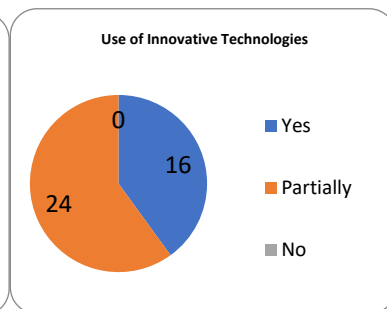
Thus, the sample is characterized by a predominance of experienced specialists, which increases the reliability and practical significance of the obtained results.

The examination of data on years of experience made it possible to establish that the majority of respondents have substantial experience in basketball. Thus, 60% (n=24) have more than 10 years of experience, which indicates a high level of qualification among the study participants. At the same time, 20% (n=8) of

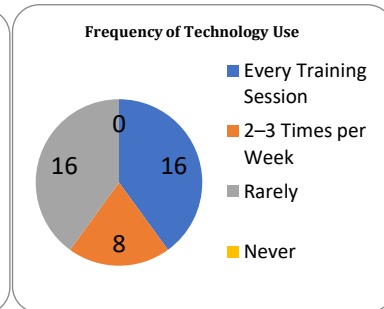
Within the first block of the study, a comprehensive analysis of the use of innovative technologies in the training process of 3×3 women’s basketball players were conducted, including the degree of their implementation, the types of technologies used, and the frequency of their application. The obtained results are presented in **Fig. 4, 5 and 6**.



**Fig 4:** Use of Innovative Technologies



**Fig 4:** Use of Innovative Technologies in the Training Process

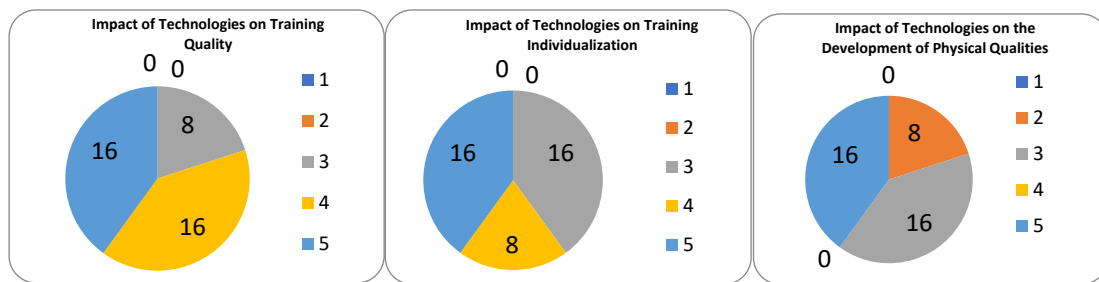


**Fig 5:** Frequency of Technology Use in the Training Process

The survey results showed that all respondents use innovative technologies in the training process to some extent. However, the majority apply them partially (60%), while 40% of participants reported regular use. It is observed that the types of technologies used indicate the predominance of fitness trackers (80%), which points to the active use of tools for monitoring physical load. Mobile applications and analytical systems are used in 40% of cases, whereas video analysis is applied less frequently (20%), and the use of online platforms was not recorded in the sample.

For the second block of the study, an assessment was conducted of the impact of innovative technologies on key components of the training process of 3×3 women’s basketball players, including training quality, individualization of preparation, development of physical qualities, motivation, and decision-making. The results are presented in **Fig. 7, 8, 9, 10 and 11**.

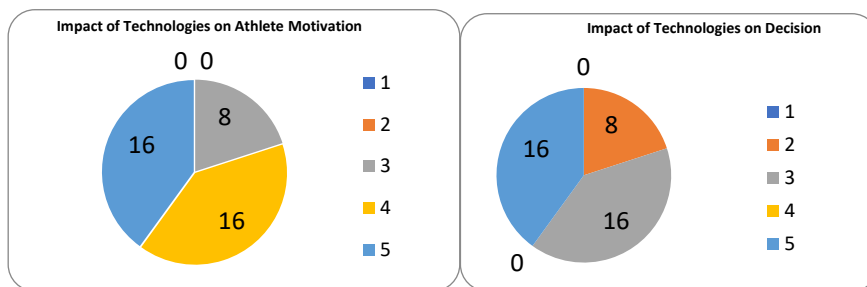
In terms of frequency of use, it was established that 40% of respondents apply technologies in every training session, another 40% use them occasionally, and only 20% use technologies 2-3 times per week. The absence of “never” responses confirms that technologies are integrated into the training process of all participants; however, the degree of their use remains heterogeneous.



*Fig 7: Respondents' Assessment of the Impact of Innovative Technologies on Training Quality*

*Fig 8: Assessment of the Impact of Technologies on the Individualization of Athlete Training*

*Fig 9: Assessment of the Impact of Technologies on the Development of Athletes' Physical Qualities*



*Fig. 10: Assessment of the Impact of Innovative Technologies on Athlete Motivation*

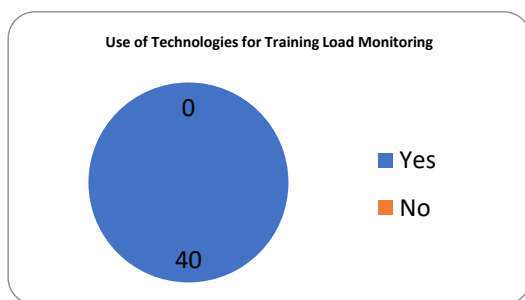
*Fig. 11: Impact of Technologies on Decision-Making in 3×3 Basketball*

It became evident that all respondents use innovative technologies in the training process to some extent. Mobile applications and analytical systems are used in 40% of cases, whereas video analysis is applied less frequently (20%), and the use of online platforms was not recorded in the sample.

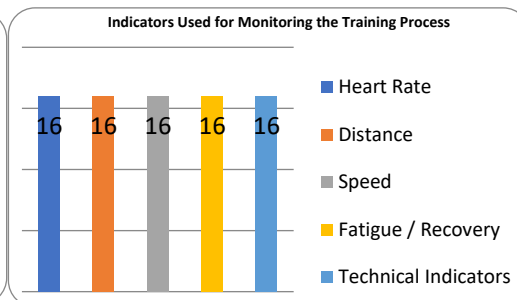
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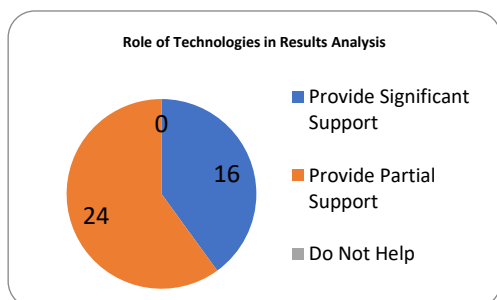
In the third block of the study, an analysis was conducted of the use of innovative technologies in the system of monitoring and control of the training process of 3×3 women’s basketball players, including the features of tracking indicators, analysis of results, and the application of the obtained data for adjusting training sessions. The summarized results are presented in **Fig. 12, 13, 14 and 15.**



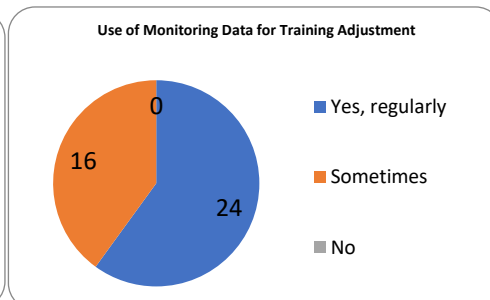
*Fig. 12: Respondents' Opinions on the Question: “Do You Use Technologies for Load Monitoring?”*



*Fig. 13: Respondents' Answers to the Question: “Which Indicators Do You Monitor?”*



*Fig. 14: Respondents' Opinions on the Question: “To What Extent Do Technologies Help You in Results Analysis?”*



*Fig. 15: Respondents' Opinions on the Question: “Do You Use Monitoring Data to Adjust Training?”*

The data presented in **Fig. 12** show that all respondents (100%) use technologies for monitoring training load, which indicates the full integration of digital tools into the monitoring system.

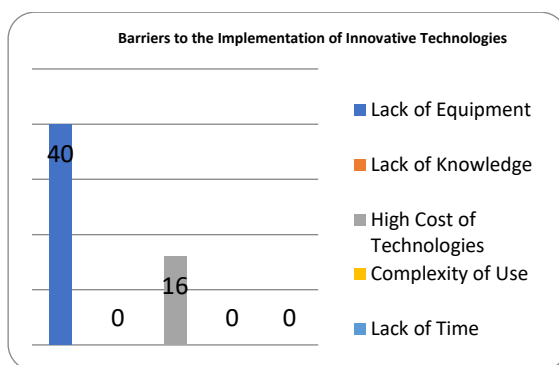
As shown in **Fig. 13**, monitoring is carried out based on a set of indicators: heart rate, distance, speed, recovery indicators, and technical characteristics are used equally (40% each), which indicates a multidimensional approach to the evaluation of the training process.

According to the data in **Fig. 14**, technologies provide noticeable support in the analysis of results: 40% of respondents assess their contribution as significant, while 60% note only partial effectiveness, which reflects the limited analytical use of technologies.

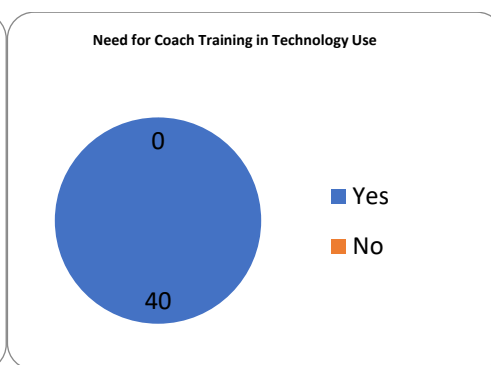
**Fig. 15** shows that the majority of participants (60%) regularly use monitoring data to adjust the training process, while 40% do so occasionally, which indicates a relatively high level of practical application of the obtained information.

Overall, the presented results confirm that technologies are actively used in the system of training control; however, the degree of their analytical and managerial application remains heterogeneous.

To identify the factors limiting the wider implementation of innovative technologies, an analysis of existing challenges and constraints in the training practice of 3×3 women’s basketball players was conducted. The results are presented in **Fig. 16 and 17**.



**Fig. 16:** Respondents’ Answers to the Question: “What Difficulties Do You Encounter?”



**Fig. 17:** Respondents’ Answers to the Question: “Do You Think Coaches Should Receive Training in the Use of Technologies?”

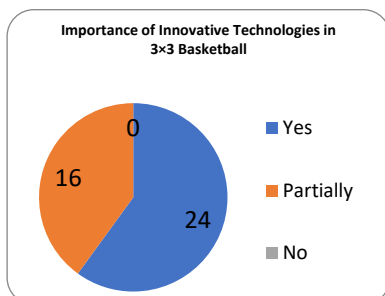
The results of the study indicate that the key barrier to the implementation of innovative technologies is the lack of equipment, as reported by all respondents (100%). A significant proportion of participants (40%) also identified the high cost of technologies as a limiting factor.

At the same time, such issues as lack of knowledge, complexity of use, and lack of time were not identified in the sample. This indicates that the main barrier is related to material and technical resources rather than the level of competence of specialists.

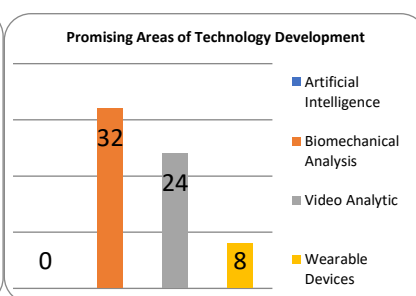
In response to the question, “Do you think that coaches should receive training in the use of technologies?”, all participants

(100%) answered “YES.” This indicates the high importance of digital competencies in professional activity and the need for systematic training of specialists for the effective implementation of innovative technologies in the training process.

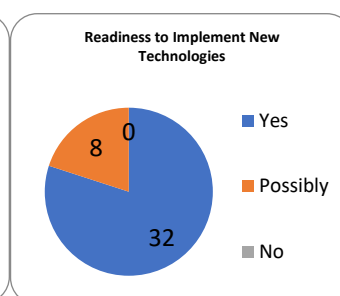
The final stage of the study was aimed at determining the significance of innovative technologies in 3×3 basketball and identifying prospects for their further development. Particular attention was paid to assessing the readiness of specialists to implement modern technological solutions. The data are presented in **Fig. 18, 19 and 20**.



**Fig. 18:** Assessment of the Necessity of Using Innovative Technologies



**Fig. 19:** Promising Areas for the Use of Technologies in Athlete Training



**Fig. 20:** Readiness to Implement Innovative Technologies in the Future

**Fig. 18, 19, and 20** show that the majority of respondents (60%) consider the use of innovative technologies to be a necessary element of the training process. At the same time, 40% of participants assess their necessity as partial, which may indicate differences in the level of technology implementation and the conditions of their application.

The absence of negative responses confirms the general recognition of the importance of technologies and their significant role in modern 3×3 basketball.

The most promising direction, according to respondents, is biomechanical analysis (80%), which indicates the high importance of precise assessment of movement actions in the

training process. Video analytics also plays a significant role (60%), as it allows the analysis of game situations and technical-tactical actions. Wearable devices are used to a lesser extent (20%), while artificial intelligence technologies are not represented in the sample.

This indicates that priority is given to already mastered and accessible technologies, whereas more complex digital solutions require further implementation.

As for the level of readiness to implement innovative technologies, the vast majority of respondents (80%) expressed full readiness to use them in the future.

For a more detailed assessment of the impact of innovative technologies on various aspects of the training process, an analysis of mean values of indicators based on the Likert scale was conducted.

The obtained results make it possible to quantitatively determine the degree of influence of technologies on key components of athlete preparation, including training quality, individualization, development of physical qualities, motivation, and decision-making. The data are presented in **Tab. 1**.

**Table 1:** Mean Values of Indicators Based on the Likert Scale.

Indicator	Mean Value (M)	Interpretation
Training Quality	4,2	High Impact
Training Individualization	4,0	Moderately High
Development of Physical Qualities	3,6	Moderate
Athlete Motivation	4,2	High Impact
Decision-Making	3,6	Moderate

The analysis of mean values based on the Likert scale showed that innovative technologies have the greatest impact on training quality (M=4,2) and athlete motivation (M=4,2), which indicates a high level of their effectiveness in these aspects.

The impact of technologies on the individualization of training is assessed slightly lower (M=4,0); however, this indicator still remains at a relatively high level. At the same time, the influence of technologies on the development of physical qualities

(M=3,6) and decision-making (M=3,6) is evaluated as moderate, which indicates the need for more effective implementation of technologies in these areas.

To identify differences in the use of innovative technologies in the training process, a comparative analysis was conducted depending on the professional role of the respondents, presented in **Tab. 2**.

**Table 2:** Comparison of technology use.

Indicator	Coaches	Athletes
Frequency of use	Regular	Occasional
Purpose of use	Control and Analysis	Motivation
Effectiveness rating	High (4-5)	Moderate (3-4)
Use of data	Systematic	Partial
Main challenges	Equipment, cost	Limited Access
Attitude to training	Full support	Support

The comparison of the data shows that the nature of interaction with innovative technologies is determined by the functional role of participants in the training process. The use of digital tools in the activities of coaches is managerial and analytical in nature, whereas for athletes it is primarily associated with the perception of the training process and personal engagement.

The identified differentiation indicates differences in the depth of involvement in working with data: some participants are focused on interpretation and decision-making, while others are oriented toward receiving feedback. This reflects not only the specifics of professional tasks but also the level of access to analytical tools.

Thus, the differences between the groups indicate the need for a more integrated approach to the use of technologies, in which athletes are also involved in the processes of analysis and understanding of training indicators.

**Discussion**

The obtained results indicate a stable integration of innovative technologies into the training process of 3×3 women’s basketball players; however, the nature of their use is

determined not so much by the availability of tools as by the degree of their methodological integration. The observed heterogeneity of application reflects differences in professional experience and organizational conditions, which form different models of interaction with digital tools.

The structure of the technologies used demonstrates a clear orientation toward monitoring training load and controlling the functional state of athletes. This orientation is consistent with contemporary studies, which show that in team sports, including basketball, priority is given to technologies for assessing internal and external load [5, 10]. This explains why analytical and cognitive aspects of training remain less covered.

The more pronounced influence of technologies on organizational and motivational components of training compared to physical and game-related characteristics is associated with the different nature of these indicators. Technologies provide rapid feedback and visualization, which directly affect the perception of the training process, whereas the development of physical qualities and decision-making requires prolonged and targeted pedagogical intervention. In the studies by Gil-Arias et al. [7], it is shown that improvements in decision-

making are possible only when technologies are integrated into the structure of training tasks, which confirms the dependence of their effectiveness on the mode of application.

The differences between coaches and athletes reflect the functional specificity of their roles in the training process. Coaches act as subjects of management and data interpretation, whereas athletes are primarily users of these tools. According to the findings of Rebelo et al. [11], the effectiveness of technology use is directly related to the level of analytical competence of specialists, which explains the more systematic nature of their application in coaching practice.

The limitations in the implementation of technologies are mainly conditioned by external factors related to material and technical resources. This finding confirms trends identified in previous research, where access to equipment is considered one of the key barriers to the digitalization of sports training. At the same time, the absence of pronounced cognitive limitations among specialists indicates the presence of potential for further expansion of technology use.

Interest in biomechanical analysis and video analytics indicates a shift toward tools that provide a deeper understanding of motor activity. According to Zheng et al. [15], modern motion analysis systems demonstrate high accuracy; however, their implementation in practice requires adaptation to training conditions, which explains their limited spreading.

Overall, the obtained data suggest that innovative technologies have significant potential for optimizing the training of 3×3 women's basketball players; however, their effectiveness is determined by the level of systematic use, integration into training methodology, and the readiness of specialists to engage in analytical work with data. The identified discrepancy between the high level of recognition of the importance of technologies and the limitations of their practical application highlights the need to develop methodological approaches for their comprehensive implementation.

### Conclusions

1. It was established that innovative technologies have become an integral part of the training process in 3×3 basketball; however, their application is predominantly non-systematic and depends on the conditions and experience of specialists.
2. In the structure of the tools used, technologies aimed at monitoring training load and objectifying the training process predominate, reflecting the practical orientation of specialists toward controlling physiological and functional indicators.
3. The greatest effectiveness of innovative technologies is observed in improving the quality of the training process and athlete motivation, whereas their influence on the development of physical qualities and game-related

decisions is less pronounced and requires more targeted methodological application.

4. Technologies are actively used in the system of control and management of training load; however, their analytical potential is not fully realized, which indicates the need for deeper integration of digital tools into the process of training decision-making.
5. The main limiting factor in the implementation of innovative technologies is related to material and technical conditions, while the level of professional readiness of specialists allows for the effective adoption and use of modern digital solutions.
6. A high level of readiness of specialists for further integration of technologies into the training process was identified, which, in combination with the need for additional training, indicates the necessity of systematic development of digital competencies in the field of sports training.

### Bibliography

1. Aiken, C. A., et al. Video Feedback in Basketball Learning. 2012.
2. Bompa, T. O., & Buzzichelli, C. Periodization: Theory and methodology of training (6th ed.). Human Kinetics. 2018. ISBN: 978-1492544807
3. Ciorba, C. Teoria și metodologia antrenamentului sportiv. Chișinău: USEFS. 2018.
4. Dusan Cabarkapa et al. Physical and Performance Characteristics of 3×3 Basketball Players. 2023.
5. Espasa-Labrador, J., et al. Monitoring Internal Load in Women's Basketball. 2023.
6. Figueira, B., et al. Physiological Responses and Technical-Tactical Performance of Youth Basketball Players: A Brief Comparison between 3x3 and 5x5 Basketball. 2022. J Sports Sci Med.
7. Gil-Arias, A., et al. Decision Training in Basketball. 2019.
8. He, X., & Wei, L. Real-time feedback enhances motor learning and motivation in youth team sports through augmented reality tools. 2025. Frontiers in Psychology. ISBN: 978-9975-131-84-1
9. Montgomery, P. G., et al. Inertial Movement and Physiological Demands in 3×3 Basketball. 2018.
10. Power, C. J., et al. External and Internal Load Variables Encountered During Training and Games in Female Basketball: A Systematic Review. 2022.
11. Rebelo, C., et al. Wearable Technologies in Sport. 2023.
12. Ricardo Duarte et al. Ecological Dynamics and Decision-Making in Team Sports. 2019.
13. Ripanti, F. Review on wearable and portable sensors for recording of cardiac signals while practicing sport. Università Politecnica delle Marche. 2022.
14. Sam Robertson et al. Data Analytics in Team Sports: Applications and Challenges. 2020. Zheng, W., et al. Motion Capture in 3x3 Basketball. 2025.

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