applied sciences

MDPI

Article

Improving Effectiveness of Basketball Free Throws through the Implementation of Technologies in the Technical Training Process

Mircea Olteanu [1], Bogdan Marian Oancea [2] and Dana Badau [1,3,*]

[1] Interdisciplinary Doctoral School, Transilvania University of Brasov, 500036 Brasov, Romania
[2] Faculty of Physical Education and Mountain Sports, Transilvania University of Brasov, 500036 Brasov, Romania
[3] Petru Maior Faculty of Sciences and Letters, George Emil Palade University of Medicine, Pharmacy, Sciences and Technology, 540142 Targu Mures, Romania
* Correspondence: dana.badau@umfst.ro

Abstract: The aim of the study was to implement a specific training program to improve basketball free throws by using an innovative system called "system and technical device designed for motor learning process in the field of sports science and physical education with direct applicability in basketball specific training-free throw improvement", as well as to evaluate the level of free throw effectiveness. We also aimed to highlight the differences in progress between the experimental and control groups for three age categories U14, U16, and U18 male juniors. The system and the device for detecting the ideal trajectory of the ball were provided by a high-speed video camera which captured the images and projected them in real-time onto a projection surface that was placed in front of, or to the side of the athlete, depending on the subject's preference, provided that this projection surface is in the performer's field of vision. The research took place from 5 April to 10 July 2021 and phased as follows: initial testing, implementation of the experimental 12-week free-throw training program (one individualized training session per week lasting 120 min), and final testing. The study included 360 subjects aged 13–14 years, who were grouped according to gender and team sport played. The evaluation was done by three tests: the FRB test (standardized test), the Shoot-Run test, and the 10 experimental throws test. The results of the study in all three motor tests showed that by implementing the innovative system that was designed for motor learning, the effectiveness of free throw shooting improved significantly in the players of the experimental groups in all age groups (U14, U16, U18), thus evidencing a positive, upward dynamic in relation to the increasing age category. In all three motor tests, the progress of the experimental groups was superior to the control groups as a result of the implementation of the experimental exercise program using the innovative system and device that was designed to improve free throws. The results of the study highlighted the effectiveness and opportunity of the implementation of innovative technologies in the process of training and evaluation of basketball specific free throws.

Keywords: basketball; free throw; junior men; innovative system and device; technical training; motion analysis; technical effectiveness

check for updates

Citation: Olteanu, M.; Oancea, B.M.; Badau, D. Improving Effectiveness of Basketball Free Throws through the Implementation of Technologies in the Technical Training Process. *Appl. Sci.* **2023**, *13*, 2650. https://doi.org/10.3390/app13042650

Academic Editors: Rita M. Kiss and Alon Wolf

Received: 29 January 2023
Revised: 11 February 2023
Accepted: 16 February 2023
Published: 18 February 2023

1. Introduction

Basketball is a sports game with a wide variety of technical-tactical actions that contribute to the multilateral development of athletes in terms of motor, functional, technical, tactical, and psychological aspects [1–3]. The succession and complexity of the phases of the game of basketball stimulate the players' motor skills and creativity in terms of the manifestation of their physical, technical, and tactical potential [4–6]. The dynamism of the game of basketball is conditioned by the regulatory provisions, the creativity of the coaches, the dynamics of specific information technologies, as well as the scientific and modern approach to training methodology [7–9].

The performance level of basketball players is determined by the weight and quality of technical-tactical training along with physical, psychological, and theoretical training at all levels of training, but with greater weight at the junior level. The technical training of juniors must focus on increasing the level of technicality and effectiveness of technical procedures in relation to multilateral sports training [10,11]. Technical training must be carried out through a continuous and seasonal process on a scientific basis and in relation to current methodological and technological trends in sport. The process of technical training must stimulate players' continuous self-improvement and, in this respect, it must aim at the following aspects: it must be stimulating and challenging for the athlete, it must be carried out in the most varied conditions, it must create a concrete link between theory and practice, it must facilitate the transfer of technical skills to playing conditions, and it must provide corrective and real-time feedback [6,12,13].

Free throws are an important element in the technical level of basketball players, and their success requires good concentration and good adaptation to the game conditions, as well as proper biomechanics of the execution of the two types of shots: overhand push shot and underhand loop shot [14–16]. Studies show that the effectiveness of free throws depends on the conditions of execution, so valid shots in training are clearly superior to that in an official game [11,17,18]. The success of a free throw is ensured by the coordination of specific movements in relation to the anthropometric aspects of the players, the posture during the throw, the trajectory of the throw, and the different levels of consistency between the angle of the joints involved in the movement and the speed of the throw [19–22]. Studies show that the effectiveness of free throws is dependent on the correctness of the throwing technique and the minimization of execution errors [23–25]. Specialists consider that the execution of free throws, specific to the game of basketball, is the only type of shot in which all the mathematical parameters of the shot are and remain constant throughout the execution (height from which the ball is thrown, speed at which the ball is thrown, maximum height of the ball in the air, angle at which the ball enters the basket, etc.), but also that these aspects are particular to the kinematics of each athlete, determined by the personal style (personal imprint) of each subject to execute it [26–28].

The analysis of how information technology can contribute to the improvement of the game of basketball in general, and free throws in particular, is a highly topical issue from both a practical and experimental scientific perspective. From the perspective of technical training, a relevant aspect is that the motor learning process of free throws is directly conditioned by real-time correction, especially in the initiation stage of the basketball game, thus increasing the chances of improving the execution technique and effectiveness of these finishing actions [29–32].

Experimental and scientific studies that address specific technical, tactical, physical, and effectiveness aspects of free throws are numerous, but the approaches that address the impact that information technology materialized by innovative devices has on the training process in order to correct the trajectory of shooting and implicitly increase the percentage of successful free throws are relatively few. For basketball in Romania, this is one of the first. The design and implementation of the device called "system and technical device intended for the motor learning process in the field of sports science and physical education with direct applicability in the training specific to the game of basketball—improvement of free throws" in the training process, especially for juniors, can bring an added value both in terms of methodologies of action, and especially the real-time correction of the execution and trajectory of the ball with a direct impact on the percentage of success of these individual actions of completion in the game of basketball and implicitly on the sporting success.

The general hypothesis of the research was based on the assumption that by implementing the innovative device that was designed and intended for the improvement of the free throw in the training program at the junior level and in the framework of an experimental training program, including specific exercises, can optimize the execution technique and effectiveness of free throws in the game of basketball. The specific hypotheses of the final research started from the assumptions that:

- by implementing the innovative device for motor learning, the effectiveness of free throw shooting will be improved in the U14, U16, and U18 men's junior groups;
- comparative analysis of the three age groups of junior males will show a positive impact in the effectiveness and progress of the experimental groups compared to the control groups as a result of the implementation of the innovative free throw improvement device.

2. Materials and Methods

2.1. Participants

The research included active basketball athletes that were entered in the national junior men's competitive system—National Junior Championships, categories: U14, U16, and U18. The research included 3 experimental samples (GE) and 3 control samples (GC) with identical structure: U18 consisting of 16 athletes, U16 consisting of 16 athletes, and U14 including 14 athletes. The athlete samples participated in the entire final experimental program in which we followed the implementation of the innovative free-throw improvement device and also performed the complete initial and final tests, including the motor tests (FRB Test, Shoot-Run Test, Experimental 10-Throw Test). The athlete inclusion criteria were good health, active registered athletes, minimum 3–5 years sports experience, no injuries in the last 6 months, complete completion of the training program, and specific tests of the final research.

2.2. Testing Procedure

There were three motor tests that were applied in the research itself: the FRB test (standardized test), the Shoot-Run test, and the 10 experimental throws test.

The FRB Test is a standardized test consisting of 12 free throws at the basketball hoop.

The test consists of a running movement from the baseline to the center line continuing to the free throw line where a series of free throws are made, as follows: 3-2-1 then run to the baseline and restart the second series of 3-2-1 throws; in the same conditions, one test is made. The number of baskets scored from the total of 12 free throws is counted. This test is conducted in the battery of tests and control rules specific to the Romanian Basketball Federation [33].

The Shoot-Run test (personal contribution) was where 15 throws from the free-throw line combined with athletic drills were performed once: 5 throws—sprint to the opposite baseline, return to the free-throw line; 5 throws—sprint to the opposite baseline, return to the free-throw line; 5 throws—sprint to the opposite baseline, return to the free-throw line. The free throw will be made with a basketball (Molten brand), regulation 7 in mens, and the time for each free throw is similar to the regulation 5 s.

The 10 experimental shots test (personal contribution) consisted of making a set of 10 free throws from the foul line of the basketball court after having previously made 10 free throws using the "Technical system and device for motor learning process in the field of sports science and physical education with direct applicability in basketball specific training—perfecting the free throw". The aim of this test is to show the effectiveness of the implementation of the free throw improvement system in real-time. Between the series of 10 free throws using the innovative device and the series of 10 experimental shots, there was a 3-min break for rest and mental relaxation. The number of successes out of the total of 10 free throws made, one series of throws, was quantified.

2.3. Research Design and Training Procedure

The research was structured as follows: initial testing (IT) that was carried out 10–15 April 2021, application of the experimental program that was carried out between 20 April and 3 July 2021, and final testing which was applied 5–10 July 2021. The experimental intervention program was carried out only on experimental, male samples from the age groups U14, U16, and U18. The experimental program included 12 training sessions in which the innovative device was used to perfect free throws. The training sessions took place on Tuesdays of each week of the final program. The duration of the workouts was 120 min and the theme and objective of the workout was to perfect free throws. The minimum number of free throws using the "System and technical device for motor learning process in the field of sport science and physical education with direct applicability in basketball specific training—perfecting free throws" was a minimum of 60 executions per athlete. The control groups performed the classic basketball-specific training program.

Participation in the present study was voluntary based on the informed consent of the participants, respecting the principles of the Declaration of Helsinki. This research was approval no. 78, date 1 October 2018 by the Reviewers Committee of Interdisciplinary Doctoral School, University Transilvania of Brasov, Romania.

2.4. Description of the Technology

The innovative elements of the research concern a motor learning device characteristic of the sports training process (free throw shooting in basketball) which displays the trajectory of the ball towards the basket during the flight phase in real-time, on a projection plane on which the optimal trajectory is graphically indicated, called "System and technical device intended for the motor learning process in the field of sports science and physical education with direct applicability in training specific to the game of basketball-improvement of free throw shooting"—registration at the State Office for Inventions and Trademarks (OSIM) no. R020221000022820210506. The innovative device was designed by Oancea Bogdan, Serban Ionel, and Olteanu Mircea from Transilvania University of Brasov. The problem that the invention solves is part of the motor learning process of skills, conditioned reflexes, automatisms, and dynamic stereotypes that are characteristic of the sports training process specific to the game of basketball. This is done by correlating kinesthetic information with visual information in the case of free throws. Specialists in the field have determined the free throw trajectory using mathematical formulae, but never a device that is specifically designed for this purpose.

The solution underlying the design of this device is that the human neuro-muscular system will respond positively to an increase in the specific capacity to acquire specific motor automatisms by corroborating information specific to the visual system. Thus, it is based on the idea that the display on a real-time projection surface of the trajectory of the basketball overlayed on the ideal (customised) one, leads to the streamlining of the motor learning process in the case of free throws in basketball. The technical solution that was identified consists of displaying the trajectory of the ball towards the basket in real-time, overlayed on the projection surface where the optimal customized trajectory determined from the kinematic and mathematical analysis of the subject's successful positive shots is displayed. The solution that was found concerns:

- the possibility of determining the ideal trajectory of the ball by video recording and kinematic analysis, counting and analyzing only successful shots;
- presenting the ideal trajectory (in a particular way) on a projection surface by highlighting it with a writing tool: marker, colored pencil, etc.;
- real-time transmission on the same projection surface of the free throw in the basketball game, using the same measurement scale;
- real-time analysis of any differences in trajectories (the ideal, constant trajectory displayed on the projection surface and that which is determined by the technical execution of the sports training process);
- the ability to replay and store the execution kinematically for analysis;

- the possibility of correcting the technical execution by adapting to the existing visual stimulus (graphic presence of the ideal trajectory).

The proposed invention has the following advantages: large area of applicability, time saving in the motor learning process, possibility to present the trajectory in slow-motion or repeat video, ease of use, low cost, and projection to scale, depending on the space that is available and/or the subject's preference. The system and the device detecting the ideal trajectory of the ball are provided by a 100 Hz high-speed video camera which captures the images and projects them in real-time onto a projection surface that is placed in front of or to the side of the athlete, depending on the subject's preference, provided that this projection surface is in the performer's field of vision. System materials: HDMI-HDMI cable, Go Pro Hero 8 camera, tripod, 25 m extension cord, HP laptop, video projector, and a power cable. The Go Pro Hero 8 camera has the following specifications: 12 mpx sensor resolution; 2 inch screen size; HD, Full HD, and UHD 4K video resolution; 60 FPS resolution; as well as Wi-Fi and Bluetooth connectivity. Determining the ideal trajectory consists of video recording the subject's successful throws (5–10 executions), analyzing their kinematics, determining the optimal trajectory by replaying or possibly overlapping them, and projecting/presenting the trajectory on a projection surface. The presentation of the optimal trajectory will be done with the help of a writing instrument, preferably a marker or colored pencil, provided that the markings on the projection surface (usually paper) are visible and in chromatic contrast (Figures 1 and 2).

The novelty of this device for the game of basketball consists of the real-time presentation of the trajectory of the ball to the basket in the case of free throws, superimposed on the customized optimal trajectory, thus positively influencing the formation of the dynamic stereotype specific to the technical process.

How to execute the subject: the subject is set at a distance of 4.57 m from the edge of the board where the free-throw line is located. The height of the panel is at a distance of 3.05 m from the floor of the hall. The camera is positioned to the side of the subject at a distance of 3.50 m from the first leg and 4.00 m from the second leg of the panel baseline. The camera is 3.40 m from the side-line of the 3-s box. The projector is placed 50 cm from the baseline of the panel, below the projection of the lower edge of the panel. The image is transposed in real-time onto a projection panel, which is placed on the wall below the basketball hoop, respecting the size of the panel (h − 1.05 m × W − 1.80 m) (Figure 1). The original note of the invention is provided by the presence of the visual stimulus in the training process, a stimulus which confers and imposes on the performer the optimal execution pattern of the technical process (Figure 2).

2.5. Statistical Analysis

In order to identify the dynamics of the results and the differences between the initial and final tests, we used the statistical method using SPSS-IMB 24 software. In the present study, in which we followed the impact of the implementation of an innovative technological device on the improvement process and the effectiveness of free throws, we considered the following statistical-mathematical parameters: arithmetic mean of the scores (X); standard deviation (SD); variation, median, Skewness parameter, difference of scores between tests (ΔX); Student's t-test (t); confidence interval (95% CI) including two levels of appreciation, low (lower) and high (upper); effectiveness (%) which was measured in percentages represents the ratio of the number of successes to the total number of free throws made; progress (%) which was the percentage difference between the efficiencies recorded in the final test compared to the initial test; and p, the probability level. The mean difference between the three independent age groups was analyzed using analysis of variance (ANOVA) with the mean square, F-test (F), and degrees of freedom (df). For the research, we chose a statistical probability level of $p < 0.05$.

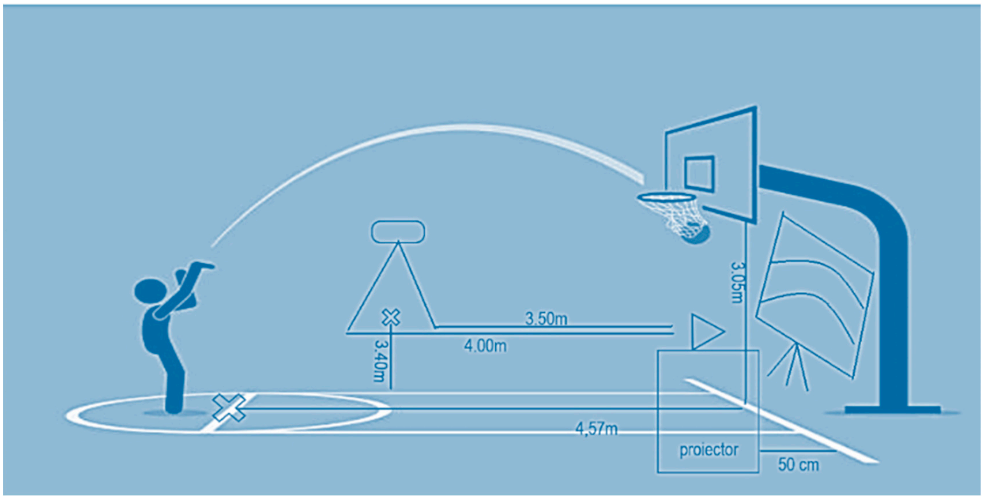

Figure 1. Representation of distances for the free throw improvement system.

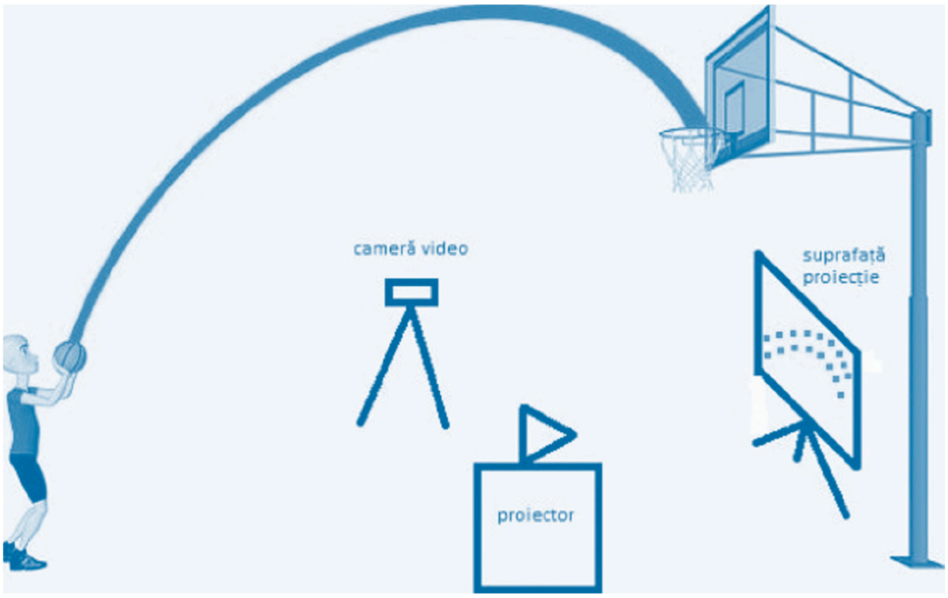

Figure 2. Superimposition of the execution trajectory on the ideal one.

3. Results

Tables 1–6 show the most relevant results of the experimental and control groups for the three age categories, U14, U16, and U18.

Analysis of the results of the FRB test (Table 1) shows that all the male experimental groups had higher arithmetic means in the final tests compared to the initial ones. The variance values ranged from 0.346 to 0.713, reflecting a normal spread of results. The skewness parameter values ranged from 0.440 to 0.995 reflecting a normal distribution of the data. The median of the male experimental groups ranged from 3.50 to 6 points. The arithmetic means on the FRB standardized test at all the initial and final tests for all male experimental samples in the categories: U14, U16, and U18 fell between the upper and lower 95% CI limits, which validates the mean test results. Analysis of the results that were recorded in the Student's statistical test shows that the results for all three male experimental groups were statistically significant, with significance threshold values lower than the 0.05 cut-off values. In this standardized FRB free throw assessment test, between the initial and the final test in the U18 category, the group improved its results by 1.071 points, representing a progress of 8.93%; between the initial and the final test in the U16 category, the group improved its results by 0.750 points, representing a progress of

6.25%; and between the initial and the final test in the U14 category, the group improved its results by 0.562 points, representing a progress of 4.68% (Table 1). In the FRB test, the effectiveness that was recorded by the male experimental teams in all age categories were higher in the final tests compared to the initial tests. The highest progress was recorded by the male experimental group in the U18 category and the lowest by the U14, which was determined by the level of athletic training, athletic experience, and the peculiarities of age and physical development.

For the male control groups, in this standardized FRB free throw evaluation test, the results in the final tests were better than in the initial tests. Thus, between the initial and final tests in the U18 category, the group improved its results by 0.642 points, representing a 5.35% improvement; between the initial and the final test in the U16 category, the group improved its results by 0.312 points, representing an improvement of 2.60%; and between the initial and the final test in the U14 category, the group improved its results by 0.125 points, representing an improvement of 1.04%. The differences in the arithmetic means between the final and the initial tests recorded by the male control group in the FRB Test were only partially significant for the U18 sample, otherwise in the other two groups U16 and U14 the athletes' performance in making free throws did not improve significantly. The variance values ranged between 0.264 and 0.841, the spread of the results being normal. The median of the male control groups ranged between 4 and 5.50 points. The values of the statistical parameter Skewness ranged from −0.542 to 1.174, reflecting a relatively normal distribution of the data (Table 1).

Table 1. Descriptive statistics for the FRB test for the experimental and control male groups U14, U16, and U18.

Age Category	Group	Tests	Mean	Standard Deviation	Effectiveness	ΔX Tf-Ti	Progress	*p*-Value	95% CI	
									Upper	Lower
U18	Experimental	Ti	5.071	0.997	42.26%	1.071	8.93%	0.008	1.804	0.338
		Tf	6.142	0.662	51.18%					
	Control	Ti	4.928	0.916	41.07%	0.642	5.35%	0.033	1.224	0.060
		Tf	5.571	0.513	46.43%					
U16	Experimental	Ti	4.312	0.946	35.93%	0.750	6.25%	0.006	1.246	0.253
		Tf	5.062	0.928	42.18%					
	Control	Ti	4.187	0.910	34.89%	0.312	2.60%	0.264	0.887	0.262
		Tf	4.500	0.730	37.50%					
U14	Experimental	Ti	3.500	0.816	29.17%	0.562	4.68%	0.045	1.111	0.013
		Tf	4.062	0.853	33.85%					
	Control	Ti	3.562	0.727	29.68%	0.125	1.04%	0.609	0.635	0.385
		Tf	3.687	0.704	30.73%					

ΔX—difference of averages, *p*—level of probability, CI—confidence interval, U—under-age, Ti—initial test, Tf—final test.

Table 2. ANOVA variance analysis between U14, U16, and U18 for the FRB Test.

Age Category	Groups	Mean	Mean Square	F (df)	*p*-Value
U18	Difference between groups E-C, Ti	0.143	16.162	23.487 (2)	0.000
U16		0.125			
U14		−0.062			
U18	Difference between groups E-C, Tf	0.571	9.252	10.939 (2)	0.000
U16		0.562			
U14		0.375			

E—experimental group, C—control group, U—under-age, Ti—initial test, Tf—final test, Ti—initial test, F—F test, df- degree of freedom *p*—level of probability of F.

Table 3. Descriptive statistics for the Shoot-Run Test for the experimental and control male groups U14, U16, and U18.

Age Category	Group	Tests	Mean	Standard Deviation	Effectiveness	ΔX Tf-Ti	Progress	*p*-Value	95% CI	
									Upper	Lower
U18	Experimental	Ti	4.000	0.679	26.67%	0.928	6.19%	0.006	1.547	0.309
		Tf	4.928	0.828	32.85%					
	Control	Ti	4.071	0.615	27.14%	0.357	2.38%	0.174	0.893	0.179
		Tf	4.428	0.513	29.52%					
U16	Experimental	Ti	4.250	0.577	28.33%	0.500	3.33%	0.002	0.775	0.224
		Tf	4.750	0.447	31.67%					
	Control	Ti	4.187	0.543	27.91%	0.187	1.25%	0.383	0.632	0.257
		Tf	4.375	0.718	29.17%					
U14	Experimental	Ti	3.875	0.619	25.83%	0.437	2.91%	0.014	0.772	0.102
		Tf	4.312	0.602	28.75%					
	Control	Ti	3.750	0.577	25.00%	0.125	0.83%	0.633	0.671	0.421
		Tf	3.875	0.619	25.83%					

ΔX—difference of averages, *p*—level of probability, CI—confidence interval, U—under-age, Ti—initial test, Tf—final test.

Table 4. ANOVA between U14, U16, and U18 for the Shoot-Run Test.

Age Category	Groups	Mean	Mean Square	F (df)	*p*-Value
U18	Difference between groups E-C, Ti	−0.071	14.362	18.241 (2)	0.000
U16		0.063			
U14		0.125			
U18	Difference between groups E-C, Tf	0.500	8.853	12.532 (2)	0.000
U16		0.375			
U14		0.437			

XE—experimental group, C—control group, U—under-age, Ti—initial test, Tf—final test, Ti—initial test, F—F test, df- degree of freedom *p*—level of probability of F.

Table 5. Descriptive statistics for the 10 experimental throws test for the U14, U16, and U18 male experimental groups.

Age Category	Group	Tests	Mean	Standard Deviation	Effectiveness	ΔX Tf-Ti	Progress	*p*-Value	95% CI	
									Upper	Lower
U18	Experimental	Ti	4.500	0.854	45.00%	2.500	25.00%	0.000	2.993	2.006
		Tf	7.000	0.679	70.00%					
	Control	Ti	4.571	0.755	45.71%	1.311	13.11%	0.008	1.450	0.264
		Tf	5.882	0.755	58.82%					
U16	Experimental	Ti	3.875	0.718	38.75%	2.125	21.25%	0.000	2.596	1.653
		Tf	6.000	0.816	60.00%					
	Control	Ti	3.812	0.655	38.12%	1.000	10.00%	0.003	1.615	0.384
		Tf	4.812	0.834	48.12%					
U14	Experimental	Ti	3.750	0.774	37.50%	1.687	16.87%	0.000	2.324	1.050
		Tf	5.437	1.152	54.37%					
	Control	Ti	3.562	0.629	35.62%	0.937	9.37%	0.003	1.503	0.371
		Tf	4.500	0.894	45.00%					

ΔX—difference of averages, *p*—level of probability, CI—confidence interval, U—under-age, Ti—initial test, Tf—final test.

Table 6. ANOVA variance analysis between U14, U16, and U18 for the Shoot-Run Test.

Age Category	Groups	Mean	Mean Square	F (df)	*p*
U18	Difference between groups E-C, Ti	−0.071	16.739	19.416 (2)	0.000
U16		0.063			
U14		0.188			
U18	Difference between groups E-C, Tf	1.118	11.134	9.548 (2)	0.000
U16		1.118			
U14		0.937			

E—experimental group, C—control group, U—under-age, Ti—initial test, Tf—final test, Ti—initial test, F—F test, df- degree of freedom *p*—level of probability of F.

In Table 2 we compared the progress of the male groups for the U14, U16, and U18 age categories of the experimental and control groups in the FRB test. In all age categories, the male experimental groups showed superior progress compared to the male control groups. For the U18 age category, the differences in progress between the two experimental and control groups were 8.93% in the initial test and 5.35% in the final test, with the difference being 3.58% in favor of the male experimental group. In the U16 age category, the differences in progress between the two experimental and control groups were 6.25% at the initial test and 2.60% at the final test, with the difference being 3.65% in favor of the male experimental group. In the U14 age group, the differences in progress between the two experimental and control groups were 4.68% in the initial test and 1.04% in the final test, with a difference of 3.64% in favor of the male experimental group (Table 2). The ANOVA analisys for initial and final tests between all three group of study confirmed significant differences for the FRB test.

Analysis of the results of the experimental groups in the Student's statistical test showed that the results for all groups U14, U16, and U18 were statistically significant, with significance threshold values below the 0.05 reference value (Table 3). Analysis of the results of the Shoot-Run Test shows that all the male experimental groups had higher arithmetic means in the final tests compared to the initial tests. The variance values ranged between 0.200 and 0.687 which shows a normal spread. The median was between 4 and 5 points. The skewness parameter values ranged from −0.278 to 0.145, the distribution of the data being normal. The arithmetic means of the Shoot-Run Test at all initial and final tests in all the male experimental samples in the age categories U14, U16, and U18 fell between the upper and lower 95% CI limits, which validates the results of the arithmetic means of the test. In the Shoot-Run Test, the effectiveness and progress that was recorded by the male experimental teams were higher in the final tests compared to the initial ones. Thus, between the initial and final testing in the U18 category, the group improved its results by 0.928 points, representing a progress of 6.19%; between the initial and final testing in the U16 category, the group improved its results by 0.500 points, representing a progress of 3.33%; and between the initial and final testing in the U14 category, the group improved its results by 0.437 points, which was a progress of 2.91% (Table 3). The highest progress was made by the experimental male group in the U18 category, and the lowest by the U14, which was determined by the level of sports training, sports experience, and the peculiarities of age and physical development.

In the Shoot-Run test, the results of the male control groups were not statistically significant, with significance threshold values higher than the baseline value of $p < 0.05$. In the Shoot-Run Test, the arithmetic means at all initial and final tests in all three male control samples U14, U16, and U18 fell between the upper and lower 95% CI limits, which validates that the mean test results can be validated for this study. Analysis of the Shoot-Run Test results showed that all the male control groups had higher arithmetic means on the final tests compared to baseline. The variance values ranged from 0.246 to 0.517, with scatter being normal. The median of the test ranged between 4 and 4.50 points. The values of the statistical parameter Skewness ranged between −0.731 and 0.325, reflecting a normal distribution of the data in the Shoot- Run Test. In the Shoot-Run test, which is a complex test combining free throws with plyometric and athletic movements, the aim was to evaluate free throws, so the results of the male control groups in the final tests were better than in the initial tests, thus, between the initial and final tests in the U18 category, the group improved its results by 0.357 points, representing an improvement of 2.38%; between the initial and the final test in the U16 category, the group improved its results by 0.187 points, representing a progress of 1.25%; and between the initial and the final test in the U14 category, the group improved its results by 0.125 points, representing a progress of 0.83% (Table 3).

In all the age categories, the male experimental groups made better progress than the control groups in the Shoot-Run Test (Table 4). For the U18 age category, the differences in progress between the two experimental and control groups were 6.19% in the initial test and 2.38% in the final test, with the difference being 3.81% in favor of the male experimental group. In the Shoot-Run test, in the U16 age category, the differences in progress between the experimental and control groups were 3.33% in the initial test and 1.25% in the final test, with a difference of 2.08% in favor of the male experimental group. In the U14 age group, the differences in progress between the two experimental and control groups were 2.91% in the initial test and 0.83% in the final test, the difference being 2.08% in favor of the male experimental group. Differences between all the groups for the initial and final tests were statistical signicant for the Shoot-Run Test according to the ANOVA (Table 4).

The analysis of the results of the 10-tailed Experimental Throw Test shows that all the male experimental groups had higher arithmetic means on the final tests compared to the initial tests (Table 5). The arithmetic means on the 10-tailed Experimental Throw Test on all initial and final tests for all male experimental samples in the categories: U14, U16, and U18, fell between the upper and lower 95% CI limits which validates the mean test results. Analysis of the results recorded in the Student's *t*-test showed that the results for all three male experimental groups U18, U16, and U14 were statistically significant, with significance threshold values below the reference value of 0.05. Skewness parameter values ranged from −0.431 to 0.840, reflecting a normal distribution of the data. The median ranged from 4 to 6.50 points and the variance values ranged from 0.462 to 1.329, reflecting a normal distribution of the results. In the 10 experimental throws test, the aim was to evaluate the effectiveness of the free throws, thus, between the initial and final test in the U18 category, the group improved its results by 2.500 points, representing a progress of 25%; between the initial and final test in the U16 category, the group improved its results by 2.150 points, representing a progress of 21.25%; and between the initial and final test in the U14 category, the group improved its results by 1.687 points, representing a progress of 16.87%. The highest progress was made by the experimental male group in the U18 category and the lowest by the U14, the results being influenced by sporting experience and age particularities.

The differences that were recorded by the male control group for the 10 experimental throws test were significant for all the samples of the research for the U14, U16, and U18 age categories (Table 5). The values of the variance ranged from 0.396 to 0.800, with the spread being normal for the Experimental 10-Throw Test. The median values ranged between 4 and 5 points. The values of the statistical parameter Skewness ranged between −0.967 and 0.657, with the distribution of the data being within normal limits. In the 10 Experimental Throw Test, the arithmetic means at all the initial and final tests in all three male control samples U14, U16, and U18 fell between the upper and lower 95% CI limits, which validates that the mean test results can be considered for this study. Statistical analysis of the recorded test results of the Experimental 10-Throw Test showed that all the male control groups recorded higher arithmetic means in the final tests compared to the initial ones. In the 10-Throw Experimental Test, for the male control groups the results in the final tests were better than in the initial tests, so between the initial and final tests in the U18 category, the group improved its results by 1.311 points, representing a progress of

13.11%; between the initial and the final test in the U16 category, the group improved its results by 1 point, representing a progress of 10%; and between the initial and the final test in the U14 category, the group improved its results by 0.937 points, representing a progress of 9.37% (Table 5).

The ANOVA analysis for initial and final test between all three groups of study confirmed an significan differences the 10 experimental throws test. In this test, both samples recorded statistically significant progress between the final and the initial testing. Comparison of experimental and control men's progress in the Experimental 10 Throw Test for the U14, U16 and U18 age groups reveals improvements of 5.602 higher of the experimental groups compared to the control groups The differences in progress between the two experimental and control groups in favor of the male experimental group were: 16.43% for the U18 age category; by 11.25% in the U16 age category; by 7.50% in the U14 age category in favor of the male experimental group (Table 6).

4. Discussion

Our study aimed to highlight the impact that the implementation of a specific exercise program can have on the optimization of basketball free throw effectiveness in three categories of junior men, U14, U16, and U18, by testing an innovative system called "System and technical device for motor learning process in the field of sport science and physical education with direct applicability in basketball specific training-free throw improvement". We also aimed to identify differences in progress between the experimental and control groups for the three age categories of male juniors, U14, U16, and U18, by means of a standardized test and two tests that were designed by us in order to evaluate the effectiveness of the innovative device when it was implemented in the training and testing process. We believe that the results that were highlighted by our study will facilitate the enrichment of knowledge on how to improve the technique and effectiveness of free throws by using innovative technologies.

Analyzing the results of the three motor tests, we can see that significant progress was recorded in the final test compared to the initial one in all three categories of the experimental group, U14, U16, and U18. Also, the progress results in the three tests were superior in the experimental groups compared to the control groups, highlighting the effectiveness of the use of the system and the innovative technical device that was designed to prepare and improve free throws. The results of the study on the impact of the system and the innovative technical device on the effectiveness of the free throws confirm the conclusions of previous studies that have highlighted the importance of designing and adapting technology for different sports games [34–37], and for basketball training, of technical elements that are specific to basketball [38–40].

We believe that the superior progress of the experimental male samples compared to the control samples is due to the implementation of the experimental free-throw preparation program in which the proposed innovative system and device was used. The results of our study complete the level of knowledge of the impact of information technologies in the process of technical sports training. So far, several relevant studies have been carried out on the defining aspects of free throws in basketball in which the aim was to investigate ways to improve the free throw execution technique [11,41,42]. In other studies, the kinematic model was analyzed from the perspective of three degrees of freedom, targeting ball velocity, angle of throw, and the impact of these components on the effectiveness of a free throw by evaluating specific body postural elements during a free throw [23,43–46]. Another paper describes analysis of the kinematic parameters that are required by free throws made during the learning process and identifies the aspects that have a greater impact on the effectiveness of the throw. The authors used a 200 Hz camera and SIMI-Motion software (Simi Reality Motion Systems GmbH) [47]. Research using different free-throw information systems and technologies have looked at the initial angle, ball trajectory, player body height, ball angle, and velocity, etc. [48–50]. In another study, the initial angle, velocity, rotation, and ball flight height were analyzed, concluding that the angle of the ball during the throw should be about 52°, which allows an effectiveness level of 70% [51].

The results of our study on the major impact of the use of technological devices on the optimization of the technical training process was in line with another study that included basketball players who played in the Polish second division in the 2015/2016 season and the Polish national youth team in 2017 [21]. The analyzed group consisted of 30 men aged 18.8 ± 2.3 years. During the research, the sequence of free throws under controlled conditions was captured during the execution of 200 shots, and the conclusion of the study highlighted that the points that were scored in a basketball game by successfully shooting free throws have a significant weight in the total score of the team [21]. In the same direction of research, a study that was carried out on six basketball players aimed at identifying the values of six angular kinematic parameters in the execution of throws by using video recordings and kinematic analysis of the movement, concluding that the segments involved in the throw must be in a similar plane, and the parabolic trajectory of the ball must be directed towards the trailing edge of the ring [52]. Along the same lines as our study, another study that involved 20 basketball players analyzed 13 body kinematic variables when making free throws at the basket. The analysis was carried out with the help of three Canon cameras and the Kinematic Analysis System, with the results highlighting angular values at the level of the main joints that were involved in the successful execution of free throws [53]. The optimization of the training program and the improvement of the basketball game technique is in line with the current trend of technological modernization of the sport through the adaptation and implementation of computer technologies that facilitate the monitoring, real-time optimization, and evaluation of physical and technical parameters [54–58].

The use of this technology can have multiple benefits in terms of optimizing free throws during training. The installation of the equipment is relatively easy, and the timely feedback that the equipment gives to the subject facilitates the readjustment of the trajectory of each throw, thereby facilitating the increase of their efficiency. The placement and use of the equipment requires a minimum instruction that the trainers must do by following the instructions for using the specialized device. The equipment can be mainly applied in individualized and individual training sessions, and in sports training sessions whose duration can vary depending on the technical level of the subjects. After performing each set of 5–10 executions, it is recommended to watch the recording and analyze the deviations from the ideal trajectory. It is recommended that these viewings be carried out during the training sessions in order to provide timely feedback. We consider the use of this equipment, intended for the optimization of free throws in basketball, to be very efficient, especially in the junior stages. We consider that the earlier this equipment is used in sports training, the more the technical level of execution of throws and their efficiency improves.

Strengths and limitations. The main strengths of the study were the implementation of an innovative system and device called "System and technical device for motor learning process in the field of sport science and physical education with direct applicability in basketball specific training-free throw improvement" in the framework of the basketball specific free throw effectiveness training and evaluation program; the design and implementation of the experimental training program for free throw improvement using the proposed innovative system and device; the relatively large number of male juniors subjects, structured in three experimental groups and three control groups corresponding to the U14, U16, and U18 size categories; the application of a standardized evaluation test; and the design and validation of two more tests to evaluate free throw effectiveness in adapted conditions—Shoot-Run Test and the experimental 10-shot test. The results of the study facilitate the use of the proposed innovative system and device and the adaptation of the experimental training program to other size categories and to female samples. The main limitations were the non-involvement of female juniors in the study and no free throw effectiveness was recorded in the study under game conditions.

5. Conclusions

The general hypothesis of the research was confirmed, thus implementing the innovative device designed and intended to improve free-throwing, called "System and device for sport-specific motor learning and how to use it—System and technical device for motor learning process in the field of sport science and physical education with direct applicability in basketball-specific training—improvement of free throw shooting" in the training program at the junior level resulted in significant improvements in the execution technique. This is reflected in the effectiveness of basketball-specific free throws at the U14, U16 and U18 male junior level. Through the implementation of the innovative system and device for motor learning, the effectiveness of free throw shooting improved for all players in the experimental age groups: U14, U16, and U18 proving evidence for a positive, upward dynamic in relation to the increasing age category. In all three motor tests, the progress of the experimental groups was superior to the control groups as a result of the implementation of the experimental exercise program using the innovative system and device designed to improve free throws. The results of the study highlighted the major impact on the effectiveness and timeliness of the implementation of the innovative technology in the process of training and evaluation of free throws specific to the game of basketball. The effectiveness of the throws is conditioned by the efficiency of the combination of the kinematic parameters of the body in order to achieve the optimal trajectory of the ball for a successful shot at the basket. The results of this study facilitate the expansion of knowledge regarding the impact of innovative technologies in the efficiency of the preparation process of free throws in basketball.

By using the device in the training process, we will facilitate the optimization of the learning and motor control of free throws. During the free throw training process, the motor control functions of the athletes can also be developed. In the case of the study, the improvement of the motor control of the free throws aimed at repeating one identical task, i.e., the free throw. The execution is coordinated by the CNS by making the motor reflex arc, the use of the sensory feed-back of the movement provided by the CNS regarding the decision, the moment of execution, the performance movements, accomplishing the goal, changing and adjusting execution parameters, and storing information for future executions [59–62]. The progress of sports training in sports games is increasingly dependent on the use of specialized technologies, and the device that was developed and used by us can add value to the training process and the improvement of basketball free throw technique, especially in the junior stages.

Author Contributions: Conceptualization, M.O., B.M.O. and D.B.; methodology, M.O., B.M.O. and D.B.; software, M.O., B.M.O. and D.B.; validation, M.O., B.M.O. and D.B.; formal analysis, M.O., B.M.O. and D.B.; investigation, M.O., B.M.O. and D.B.; data curation, M.O., B.M.O. and D.B.; writing—original draft preparation, M.O., B.M.O. and D.B.; writing—review and editing M.O., B.M.O. and D.B.; visualization, M.O., B.M.O. and D.B.; supervision, M.O., B.M.O. and D.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Reviewers Committee of Interdisciplinary Doctoral School, Transylvania University of Brasov, no. 78/01.10.2018.

Informed Consent Statement: Informed consent was obtained from all subjects that were involved in the study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Aoki, M.S.; Ronda, L.T.; Marcelino, P.R.; Drago, G.; Carling, C.; Bradley, P.S.; Moreira, A. Monitoring Training Loads in Professional Basketball Players Engaged in a Periodized Training Program. *J. Strength Cond. Res.* **2017**, *31*, 348–358. [CrossRef]
2. Berkelmans, D.M.; Dalbo, V.J.; Kean, C.O.; Milanović, Z.; Stojanović, E.; Stojiljković, N.; Scanlan, A.T. Heart Rate Monitoring in Basketball: Applications, Player Responses, and Practical Recommendations. *J. Strength Cond. Res.* **2018**, *32*, 2383–2399. [CrossRef]
3. Ferioli, D.; Rucco, D.; Rampinini, E.; La Torre, A.; Manfredi, M.M.; Conte, D. Combined Effect of Number of Players and Dribbling on Game-Based-Drill Demands in Basketball. *Int. J. Sports Physiol. Perform* **2020**, *15*, 825–832. [CrossRef]
4. Fox, J.L.; Scanlan, A.T.; Stanton, R. A Review of Player Monitoring Approaches in Basketball: Current Trends and Future Directions. *J. Strength Cond. Res.* **2017**, *31*, 2021–2029. [CrossRef]
5. Gray, R. Comparing the constraints led approach, differential learning and prescriptive instruction for training opposite-field hitting in baseball. *Psychol. Sport Exerc.* **2020**, *51*, 101797. [CrossRef]
6. Guimarães, E.; Baxter-Jones, A.; Williams, A.M.; Tavares, F.; Janeira, M.A.; Maia, J. Tracking Technical Skill Development in Young Basketball Players: The INEX Study. *Int. J. Environ. Res. Public Health.* **2021**, *18*, 4094. [CrossRef]
7. Mancha-Triguero, D.; García-Rubio, J.; Calleja-González, J.; Ibáñez, S.J. Physical fitness in basketball players: A systematic review. *J. Sports Med. Phys. Fitness* **2019**, *59*, 1513–1525. [CrossRef]
8. Mandić, R.; Jakovljević, S.; Erčulj, F.; Štrumbelj, E. Trends in NBA and Euroleague basketball: Analysis and comparison of statistical data from 2000 to 2017. *PLoS ONE* **2019**, *14*, e0223524. [CrossRef]
9. Petway, A.J.; Freitas, T.T.; Calleja-González, J.; Medina Leal, D.; Alcaraz, P.E. Training load and match-play demands in basketball based on competition level: A systematic review. *PLoS ONE* **2020**, *15*, e0229212. [CrossRef]
10. Anderson, D.I.; Lohse, K.R.; Lopes, T.C.V.; Williams, A.M. Individual differences in motor skill learning: Past, present and future. *Hum. Mov. Sci.* **2021**, *78*, 102818. [CrossRef]
11. Slegers, N.; Lee, D.; Wong, G. The Relationship of Intra-Individual Release Variability with Distance and Shooting Performance in Basketball. *J. Sport. Sci. Med.* **2021**, *20*, 508–515. [CrossRef]
12. Te Wierike, S.C.M.; Huijgen, B.C.H.; Jonker, L.; Elferink-Gemser, M.T.; Visscher, C. The importance and development of ball control and (self-reported) self-regulatory skills in basketball players for different positions. *J. Sports Sci.* **2018**, *1*, 710–716. [CrossRef]
13. Matsunaga, N.; Oshikawa, T. Muscle synergy during free throw shooting in basketball is different between scored and missed shots. *Front. Sports Act. Living* **2022**, *4*, 990925. [CrossRef]
14. Giancamilli, F.; Galli, F.; Chirico, A.; Fegatelli, D.; Mallia, L.; Palombi, T.; Lucidi, F. High-Pressure Game Conditions Affect Quiet Eye Depending on the Player's Expertise: Evidence from the Basketball Three-Point Shot. *Brain Sci.* **2022**, *12*, 286. [CrossRef]
15. Milley, K.R.; Ouellette, G.P. Putting Attention on the Spot in Coaching: Shifting to an External Focus of Attention with Imagery Techniques to Improve Basketball Free-Throw Shooting Performance. *Front. Psychol.* **2021**, *12*, 645676. [CrossRef]
16. Button, C.; MacLeod, M.; Sanders, R.; Coleman, S. Examining movement variability in the basketball free-throw action at different skill levels. *Res. Q. Exerc. Sport* **2003**, *74*, 257–269. [CrossRef]
17. Mascret, N.; Vors, O.; Marqueste, T.; Cury, F. Stress Responses, Competition, and Free-Throw Performance: The Predicting Role of Other-Approach Goals. *Psychol. Rep.* **2022**, *125*, 3049–3068. [CrossRef]
18. Kearns, D.W.; Crossman, J. Effects of a cognitive intervention package on the free-throw performance of varsity basketball players during practice and competition. *Percept. Mot. Ski.* **1992**, *75*, 1243–1253. [CrossRef]
19. Pakosz, P.; Domaszewski, P.; Konieczny, M.; Bączkowicz, D. Muscle activation time and free-throw effectiveness in basketball. *Sci. Rep.* **2021**, *11*, 7489. [CrossRef] [PubMed]
20. Moradi, J. Benefits of a Guided Motor-Mental Preperformance Routine on Learning the Basketball Free Throw. *Percept. Mot. Ski.* **2020**, *127*, 248–262. [CrossRef]
21. Przednowek, K.; Krzeszowski, T.; Przednowek, K.H.; Lenik, P. A System for Analysing the Basketball Free Throw Trajectory Based on Particle Swarm Optimization. *Appl. Sci.* **2018**, *8*, 2090. [CrossRef]
22. Cabarkapa, D.; Cabarkapa, D.V.; Philipp, N.M.; Eserhaut, D.A.; Downey, G.G.; Fry, A.C. Impact of Distance and Proficiency on Shooting Kinematics in Professional Male Basketball Players. *J. Funct. Morphol. Kinesiol.* **2022**, *7*, 78. [CrossRef]
23. Gür, G.; Kilinç, H.E.; Ayhan, C.; Tunay, V.B. Independent Contributions of Upper Extremity Variables in Free Throw Shooting Accuracy from Multiple Positions: A Pilot Study in College Basketball Players. *Spor. Bilimleri. Araştırmaları. Dergisi.* **2017**, *2*, 1–12. [CrossRef]
24. Kurano, J.; Hayashi, M.; Yamamoto, T.; Kataoka, H.; Tanabiki, M.; Furuyama, J.; Aoki, Y. Ball trajectory extraction in team sports videos by focusing on ball holder candidates for a play search and 3D virtual display system. *J. Signal Process.* **2015**, *19*, 147–150. [CrossRef]
25. Lenik, P.; Krzeszowski, T.; Przednowek, K.; Lenik, J. The analysis of basketball free throw trajectory using PSO algorithm. In Proceedings of the 3rd International Congress on Sport Sciences Research and Technology Support, Lisbon, Portugal, 15–17 November 2015; pp. 250–256.
26. Ammar, A.; Chtourou, H.; Abdelkarim, O.; Parish, A.; Hoekelmann, A. Free throw shot in basketball: Kinematic analysis of scored and missed shots during the learning process. *Sport Sci. Health* **2016**, *12*, 27–33. [CrossRef]
27. Cabarkapa, D.; Eserhaut, D.A.; Fry, A.C.; Cabarkapa, D.V.; Philipp, N.M.; Whiting, S.M.; Downey, G.G. Relationship between Upper and Lower Body Strength and Basketball Shooting Performance. *Sports* **2022**, *10*, 139. [CrossRef]

28. Verhoeven, F.M.; Newell, K.M. Coordination and control of posture and ball release in basketball free-throw shooting. *Hum. Mov. Sci.* **2016**, *49*, 216–224. [CrossRef]
29. Ma, Z.; Hao, Q. Posture Monitoring of Basketball Training Based on Intelligent Wearable Device. *J Healthc. Eng.* **2022**, *2022*, 4121104. [CrossRef]
30. Chen, W.J.; Jhou, M.J.; Lee, T.S.; Lu, C.J. Hybrid Basketball Game Outcome Prediction Model by Integrating Data Mining Methods for the National Basketball Association. *Entropy* **2021**, *23*, 477. [CrossRef]
31. Cheng, Y.; Liang, X.; Xu, Y.; Kuang, X. Artificial Intelligence Technology in Basketball Training Action Recognition. *Front. Neurorobot.* **2022**, *16*, 819784. [CrossRef]
32. Wei, W.; Qin, Z.; Yan, B.; Wang, Q. Application Effect of Motion Capture Technology in Basketball Resistance Training and Shooting Hit Rate in Immersive Virtual Reality Environment. *Comput. Intell. Neurosci.* **2022**, *2022*, 4584980. [CrossRef]
33. Specific Tests of Romanian Basketball Federation–(Romanian-Norme de Control Specifică Federației Române de Baschet). Available online: https://www.frbaschet.ro/regulamente/Probe_si_Norme_de_control_2012.pdf (accessed on 14 December 2022).
34. Dellaserra, C.L.; Gao, Y.; Ransdell, L. Use of integrated technology in team sports: A review of opportunities, challenges, and future directions for athletes. *J. Strength Cond. Res.* **2014**, *28*, 556–573. [CrossRef]
35. Felipe, J.L.; Garcia-Unanue, J.; Gallardo, L.; Sanchez-Sanchez, J. Tracking Systems Used to Monitor the Performance and Activity Profile in Elite Team Sports. *Sensors* **2021**, *21*, 8251. [CrossRef]
36. Windt, J.; MacDonald, K.; Taylor, D.; Zumbo, B.D.; Sporer, B.C.; Martin, D.T. "To Tech or Not to Tech?" A Critical Decision-Making Framework for Implementing Technology in Sport. *J. Athl. Train.* **2020**, *55*, 902–910. [CrossRef]
37. Tang, W. Application of Wireless Network Multisensor Fusion Technology in Sports Training. *Comput. Intell. Neurosci.* **2022**, *2022*, 9836697. [CrossRef]
38. Nie, S.; Li, Y.; Ma, B.; Zhang, Y.; Song, J. The Construction of Basketball Training System Based on Motion Capture Technology. *J. Healthc. Eng.* **2021**, *2021*, 2481686. [CrossRef]
39. Hong, X. Kinect and Few-Shot Technology-Based Simulation of Physical Fitness and Health Training Model for Basketball Players in Plateau Area. *Comput. Intell. Neurosci.* **2022**, *2022*, 2256522. [CrossRef]
40. Chi, Y.; Li, J. Concrete Application of Computer Virtual Image Technology in Modern Sports Training. *Comput. Intell. Neurosci.* **2022**, *2022*, 6807106. [CrossRef]
41. Covaci, A.; Postelnicu, C.C.; Panfir, A.N.; Talaba, D. A virtual reality simulator for basketball free-throw skills development. In *Doctoral Conference on Computing, Electrical and Industrial Systems*; Springer: Berlin/Heidelberg, Germany, 2012; pp. 105–112.
42. Oancea, B.M.; Bondoc-Ionescu, D. The influence of a specialized methodology in order to develop free throws in U14-U15 basketball competitive yield. *Anu. Univ. Din Oradea Fasc. Educ. Fiz. Și Sport* **2015**, *25*, 16–26.
43. Guimarães, E.; Baxter-Jones, A.; Maia, J.; Fonseca, P.; Santos, A.; Santos, E.; Tavares, F.; Janeira, M.A. The Roles of Growth, Maturation, Physical Fitness, and Technical Skills on Selection for a Portuguese Under-14 Years Basketball Team. *Sports* **2019**, *7*, 61. [CrossRef]
44. Coves, A.; Caballero, C.; Moreno, F.J. Relationship between kinematic variability and performance in basketball free-throw. *Int. J. Perform. Anal. Sport* **2020**, *20*, 931–941. [CrossRef]
45. Iacob, R.; Budescu, E.; Merticaru, E.; Oprişan, C. The Kinematic Model with Three Degrees of Freedom Associated to the Direct Throwing in Basketball Game. *Appl. Mech. Mater.* **2014**, *658*, 495–500. [CrossRef]
46. Sevrez, V.; Bourdin, C. On the role of proprioception in making free throws in basketball. *Res. Q. Exerc. Sport* **2015**, *86*, 274–280. [CrossRef]
47. Okazaki, V.H.A.; Rodacki, A.L.F. Increased distance of shooting on basketball jump shot. *J. Sports Sci. Med.* **2012**, *11*, 231.
48. Rauch, J.; Leidersdorf, E.; Reeves, T.; Borkan, L.; Elliott, M.; Ugrinowitsch, C. Different movement strategies in the countermovement jump amongst a large cohort of NBA players. *Int. J. Environ. Res. Public Health* **2020**, *17*, 6394. [CrossRef]
49. Sarang, R.; Motlagh, M.J.; Tehrani, A.A.; Pouladian, M. A new learning control system for basketball free throws based on real time video image processing and biofeedback. *Eng. Technol. Appl. Sci. Res.* **2018**, *8*, 2405–2411. [CrossRef]
50. Chakraborty, B.; Meher, S. A trajectory-based ball detection and tracking system with applications to shooting angle and velocity estimation in basketball videos. In Proceedings of the 2013 Annual IEEE India Conference (INDICON), Mumbai, India, 13–15 December 2013; pp. 1–6.
51. Tran, C.M.; Silverberg, L.M. Optimal release conditions for the free throw in men's basketball. *J. Sports Sci.* **2008**, *26*, 1147–1155. [CrossRef]
52. Hussain, I.; Ahmad, F.; Rani, N. Investigation of Bio-Kinematic Elements of Three Point Shoot in Basketball. *Int. J. Sports Sci.* **2017**, *7*, 163–169. [CrossRef]
53. Kelmendi, D.S.; Miftari, F.; Tekin, M. Kinematic Analysis of the Basketball Free Throw in Preparation Phase of Elite Athletes. *Int. J. Hum. Mov. Sport. Sci.* **2021**, *9*, 1204–1212. [CrossRef]
54. Yang, T.; Jiang, C.; Li, P. Video Analysis and System Construction of Basketball Game by Lightweight Deep Learning under the Internet of Things. *Comput. Intell. Neurosci.* **2022**, *2022*, 6118798. [CrossRef]
55. Chidambaram, S.; Maheswaran, Y.; Patel, K.; Sounderajah, V.; Hashimoto, D.A.; Seastedt, K.P.; McGregor, A.H.; Markar, S.R.; Darzi, A. Using Artificial Intelligence-Enhanced Sensing and Wearable Technology in Sports Medicine and Performance Optimisation. *Sensors* **2022**, *22*, 6920. [CrossRef]

56. Palmer, J.A.; Bini, R.; Wundersitz, D.; Kingsley, M. On-Court Activity and Game-Related Statistics during Scoring Streaks in Basketball: Applied Use of Accelerometers. *Sensors* **2022**, *22*, 4059. [CrossRef]
57. Agresta, C.; Freehill, M.T.; Zendler, J.; Giblin, G.; Cain, S. Sensor Location Matters When Estimating Player Workload for Baseball Pitching. *Sensors* **2022**, *22*, 9008. [CrossRef]
58. Covaci, A.; Talaba, D. Towards Improvement in Free Throw Skills by the Means of Virtual Reality. *AWERProcedia Inf. Technol. Comput. Sci.* **2013**, *3*, 1683–1688.
59. Scurt, M.D.; Scurt, C.; Balint, L.; Mijaica, R. Relationship between Body Mass Index and Muscle Strength, Potential Health Risk Factor at Puberty. *Rev. Rom. Pentru Educ. Multidimens.* **2022**, *14*, 93–111. [CrossRef]
60. Drugau, S.; Balint, L.; Mijaica, R. Self-Perception of Skills Specific to Professional Development in Physical Education and Sports. *Bull. Transilv. Univ. Braşov. Ser. IX Sci. Hum. Kinet.* **2022**, *15*, 71–78. [CrossRef]
61. Badau, D.; Badau, A.; Ene-Voiculescu, C.; Larion, A.; Ene-Voiculescu, V.; Mihaila, I.; Fleancu, J.L.; Tudor, V.; Tifrea, C.; Cotovanu, A.S.; et al. The Impact of Implementing an Exergame Program on the Level of Reaction Time Optimization in Handball, Volleyball, and Basketball Players. *Int. J. Environ. Res. Public Health* **2022**, *19*, 5598. [CrossRef]
62. Muntianu, V.-A.; Abalașei, B.-A.; Nichifor, F.; Dumitru, I.-M. The Correlation between Psychological Characteristics and Psychomotor Abilities of Junior Handball Players. *Children* **2022**, *9*, 767. [CrossRef]