The Effect of Proposed Training Promgramme on some kinetic Variables for Basketball Beginners jump Shot Skill Accuracy from The Right and Left side

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ABSTRACT

The aim of this study is to get to know the effects of a suggested training regimen concerning several kinematic characteristics and jump shot (from the left and right side) for basketball beginners, utilizing empirical research by creating two equivalent random groups suitable to the nature of such a study; by selecting a sample of 20 junior players in the field of basketball age group of 13-15 year olds mean 15.1 SD 0.64: A control group and an experimental group, each comprised of 10 members. Our control group was subjected to training using the conventional method, whereas the experimental group underwent the suggested training programme. The results of our study demonstrated that the new training programme yielded a positive effect in improving the values of several kinematic variables (ie velocity, angle and height of ball release). Especially of note was the vertical velocity, one of the most improved variables in basketball jump shots. Furthermore, this study recommends applying the new jump shot training regimen to the Palestinian school teams and junior clubs, as well as the importance of giving attention to the development of physical abilities for the adolescents, and the kinematic variables affecting the jump shot skills among basketball juniors during the training process.

Keywords: Gender; academic achievement; socio-economic factors; language learning.

Introduction

The use of technologies enveloping tools and utilities for athletic gait analysis can potentially give the upper hand to a team or player over their competition by directly applying the principles and laws of the science of kinematics. Kinesiology is a crucial science in the sports field that can help develop performance and better economise the exerted energy in individual and group competitions, especially the latter type of games such as basketball. Oudejans, Karamat, Stolk, (2012) sees that the goal of each player in the match is to score the highest number of points in the hoop of the opposing team by jump or set shots, the former of which has become more difficult due to its inverse relation to the guards' heights and the accuracy needed to net a goal. Knudson and Morrison (2002) point out that scoring points in matches is achieved using a myriad of methods of shooting for the hoop, with the most popular by far being the jump shot, averaging at 70 per cent of the total scoring attempts.

By the same token, Hay (1994) reckons that there are three factors affecting the jump shots: the elevation of the ball during aim, and the initial velocity and angle of the thrown ball, essentially adhering to the law of ballistics, with Blazevich (2010) asserting the three stages of the jump shot method: The preparation phase (starting with a two-handed grip of the ball and ending with creating an athletic stance using the feet as balance); this phase is critical to achieving an ideal vertical jump increasing thrust as a result, then comes the execution phase (initiated by the shoulders' upwards movement until the feet leave the ground), and finally comes the follow up (aiming) phase which comprises leaving the ground and actually shooting the ball towards the hoop.

Given these points, Okazaki and Andre (2015) alluded to basketball playmakers' tendency to achieve the best results depending on their understanding of the variables affecting the trajectory of the ball and the phases of jump shot

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and the body stance at the time of performing this technique. When the player smartly utilizes all of her body articulations it can help achieve a correct motor sequence, starting by pushing against the floor to the bending of knees to actuate an optimal reaction leading up to the shooting arm stance, as well as helping increase momentum and thrust. (Kilani, Eslim, and Al-kilani, 2009).

In essence the scholars conducting this study sustain that many previous studies underlined the importance of technical aspects and analysis of kinematic variable values (ball release velocity, angle and height of release) to the overall accuracy of the jump shot skill among junior players, and that by discovering common mistakes and improving upon shooting accuracy a better technique can be acquired.(Kilani, 2009, Eslim, Al-Kilani, and Kilani,2010).

The problem addressed by the study had arisen to the scholars' attention upon inspecting the statistical analysis sheet for each game of the Palestinian basketball juniors league, which demonstrated low scoring percentages during the tournament as observed by the researchers, (mainly due to the players' lacking techniques whenever it concerned to the jump shot.) Chiefly to blame for this is the coaching parties' lack of academic and applied knowledge of these variables and methods of training, plus the coaches' reliance on personal experience and reluctance to adopt modern training methods in their regimens had proven detrimental to netting results. With this in mind, the study aimed to identify the most important kinematic variables critical to improving juniors' performance levels, in the lead-up to designing a proposed training regimen based on the key kinematic variables and accuracy of the jump shot technique, in an effort to improve the performance of the study sample members, ultimately shedding light on the potential influence such a regimen could have on juniors' playing performance.

Following the aforementioned points, it is now possible to put forth the question: Does the proposed training regimen affect kinematic variables (pertaining to the skill and accuracy of the jump shot from different positions) when it comes to junior basketball players in the state of Palestine?

The main objective of the study was to identify the effect of the proposed training programme on various kinematic variables for the skill and accuracy of the jump shot (on the right and left sides) among basketball juniors in Palestine.

Study Objectives

This study aimed to identify the impact of the proposed training programme on some of the kinematic variables for the skill and precision of the jump shot (on the right and left sides) among basketball juniors in Palestine.

Study Sample

The study sample encompassed 20 members selected from the Bethlehem Governorate junior clubs pool of players. They were distributed in a simple random way to two equally identical groups: a control group and an experimental group. Each group consisted of 10 participants, with ages ranging between 13 and 15 years. The experimental group was subjected to the new training programme, whereas the control group remained with the conventional programme. The scholars homogenized the experimental group and the control group in terms of key variables (age, height and weight) as demonstrated in tables (1) and (2).

Table 1. Arithmetic means, standard deviations and Shapiro-wilk test for the normal distribution of basketball players in terms of age, height, and body mass (N = 20)

Variables	Unit of Measurement	Total	Mean	SD	Median	Normal distribution
Age	Year	20	15.1	0.64	15.1	0.16
Height	Cm	20	178.1	6.62	178	0.28
Weight	Kg	20	68.4	4.78	68	0.20

Table (1) shows the level of significance of the Shapiro-wilk distribution test for age, height and weight measurements. It was found that the values of the significance level were greater than (≥α0.05), which means that there are no statistically significant differences between the experimental group and the control group.

Table 2. Arithmetic means, standard deviations and test value (T) denoting differences in some kinematic variables between the control and experimental groups in the prior measurement of the aiming on the right side with a passive guard and the left side with a active guard

Variables	Group	Shooting from the right side (Passive guard)				Shooting from the left side (Active guard)			
		Mean	SD	t	Sig	Mean	SD	t	Sig
Speed of release (m/s)	Control	5.22	0.21	0.22	0.83	5.42	0.32	0.15	0.89
	Experimental	5.20	0.20			5.44	0.30		
Vertical speed (m/s)	Control	3.48	0.17	0.20	0.84	3.76	0.14	0.65	0.52
	Experimental	3.50	0.26			3.81	0.20		
Horizontal speed(m/s)	Control	3.88	0.19	0.34	0.74	3.90	0.50	0.12	0.91
	Experimental	3.85	0.20			3.88	0.20		
Angle of release (°)	Control	41.9	1.45	0.64	0.53	44	3.62	0.32	0.76
	Experimental	42.3	1.34			44.5	3.44		
Height of release (meter)	Control	2.24	0.13	0.61	0.51	2.30	0.10	0.22	0.83
	Experimental	2.27	0.12			2.31	0.10		
Jump Shot Accuracy	Control	0.30	0.48	1.18	0.25	0.50	0.71	0.36	0.72

Experimental Protocol

In order to analyze the skill of jump shot, the scholars conducted the following:

1 – videography of the study sample was conducted in the Abu Ammar Youth Hall and Catholic Action in Bethlehem, where two Sony-HDR-CX220E cameras were used, each of which sporting a shooting rate of 25 frames/sec and installed on adjustable tripods on level ground. One camera was placed vertically on the right side plane, with the other being placed vertically at the left side away 10 meters from the 3-point line. Each were elevated from floor at exactly 1.5 meters.

Figure 1 Key shooting areas

2 – The study sample was given a period of 10 minutes for warm-up with familiarization trials before conducting the experiment.

3 – videographic material was then transferred from the two cameras to the computer.

4 – To test the accuracy of the jump shot (from the left and right sides), the scholars measured the skill performance of the players using the forward scoring test employed by Clarke and Clarke (1987), by calculating the number of successful scoring attempts during the performance.

5 – The proposed training programme:

In order to achieve the objectives of the study, the proposed training programme was based on the kinematic variables and the original form of the juniors' jump shot technique, upon consulting many studies and references with the aid of experts in this field (Kilani, 2006). Table 7, (8), (9) and (10) indicate the temporal distribution of ingredients of the proposed training programme.

Table 4. Chronological distribution of the proposed training programme

Number of training modules	Number of weeks	Training time	Training duration per week	Total time in (minutes)
24	8	90	270	2160

Table 5. Chronological distribution of module parts

Training module	Content of the module	Daily training time (minutes)	Training duration per week (minutes)	Total programme duration (minutes)
Introductory	Warm up	10	30	240
Main	Physical fitness training	30	90	720
	Special preparation for basketball game	40	120	960
Closing	Cool down	10	30	240

Table 6. Time value distributions of training module components

Part of the training module	First month				Second month			
	First week	Second week	Third week	Fourth week	First week	Second week	Third week	Fourth week
Warm up	30min	30min	30min	30min	30min	30min	30min	30min
Reaction speed	21min	25min	25min	14min	14min	21min	14min	25min
Arm speed strength characteristic	35min	20min	20min	20min	20min	35min	20min	20min
Foot speed strength characteristic	20min	25min	25min	35min	35min	20min	35min	25min
Speed of transition	14min	20min	20min	21min	21min	14min	21min	20min
Jump shot on the move	20min	30min	40min	15min	40min	40min	40min	45min
Passing + jump shot	40min	30min	30min	45min	15min	30min	15min	20min
Dribbling + jump shot	40min	40min	30min	45min	25min	20min	25min	20min
Perimeter jump shot	20min	20min	20min	15min	40min	30min	40min	35min
Cool down	30min	30min	30min	30min	30min	30min	30min	30min

Table 7. Percentage and allotted time distributions for module components during the first and second months

Part of the training module	First month		Second month	
	Duration	Percentage	Duration	Percentage
Warm up	120minute	11.29%	120minute	11.29%
Reaction speed	85minute	7.78%	74minute	6.90%
Arm speed strength characteristic	95minute	8.80%	95minute	8.80%
Foot speed strength characteristic	105minute	9.70%	115minute	10.34%
Speed of transition	75minute	6.94%	76minute	6.98%
Jump shot on the move	105minute	9.70%	165minute	15.27%
Passing + jump shot	145minute	13.40%	80minute	7.40%
Dribbling + jump shot	155minute	14.45%	90minute	8.33%
Perimeter jump shot	75minute	6.94%	145minute	13.40%
Cool down	120minute	11.29%	120minute	11.29%
Totals	1080minute	100%	1080minute	100%

6 – The conventional programme

The scholars applied the conventional programme practiced by the control group under the same conditions of the experimental group in terms of the total of training sessions (90 minutes each), and the duration of the training programme itself (8 weeks.)

7 – Test validity

The kinematic variables of the jump shot skill and accuracy were selected by referring to previous studies (Okasakie and Rodacki (2012), Rojas et al. (2000) and Miller and Bartlett (1996)). Using content validity as baseline. the study's variables were conveyed to a number of arbitrators in the field of basketball and kinetic analysis, to garner their opinion on the appropriate variables—in order to achieve the objectives of the study—and to make any corrections they see fit, thus retaining the variables deemed most suitable to this study's objectives and hypotheses.

8 – Test stability

The Pearson correlation coefficient was used to determine the stability of the study variables, via employing the test-retest method on a survey sample consisting of 5 players entirely foreign to the study sample, with a week of grace between the two attempts.

Table 8. The stability coefficient of each of the tests used

Variables	Stability coefficient
Release Velocity (m/s)	*0.84
Vertical velocity (m/s)	*0.82
Horizontal velocity (m/s)	*0.78
Release angle (°)	*0.86
Release height (m)	*0.88
Jump shots	*0.80

($\alpha \leq 0.05$)

The table above shows that all stability coefficients of the variables under study ranged from 0.78 to 0.88, all of which are statistically significant and reflect high stability coefficients that satisfy the study objectives.

Data analysis

An analysis of 65 successful attempts for both control and experimental groups for the skill of jump shot of the left and right sides was carried out as shown in (Table (3)).

Table 9. A quantitative characterization of the prior and post measurements for the sample's jump shot attempts (N = 20)

Shooting area	Group	Basketball		Attempts analyzed
		Pre-test	Post-test	
Right side with a passive guard	Control	3	8	11
	Experimental	7	17	24
Left side with active guard	Control	5	9	14
	Experimental	4	12	16

The values of kinematic variables under study were obtained through the Kinovea application using the following steps:

- Setting the scale to a wooden box, 40 cm in height.
- Calibrating the 25 frames/second cameras used in the study using:
- Method 1: Consulting the technical specifications in the product's manual.
- Method 2: Setting a stopwatch to record the time it takes a ruler to leave the grip of a person holding it, whilst shooting the sequence and comparing the recorded time to the number of frames generated in the same period.

- The frame rate was calculated by applying the following equation: 1/25 = 0.04 seconds (time per frame).

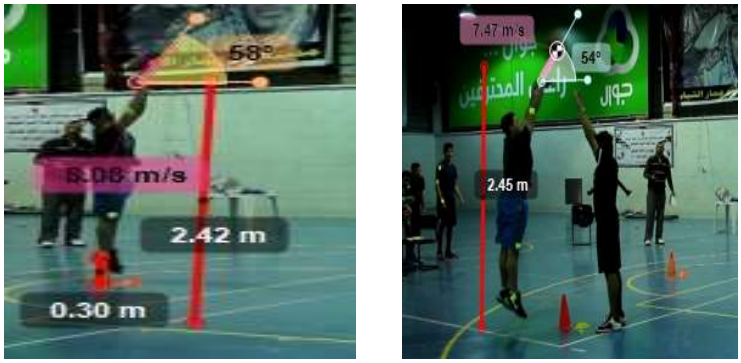

Figure 2. Various player kinematic variables

Study Variables

The scholars calculated each dependent kinematic variables under study as follows:

- Release velocity: calculated using Kinovea's tracking tool with the trajectory of the ball. Unit of measurement is *m/s*.
- Vertical velocity: A vertical vector that is equal to the sum of release velocity × sine. Unit of measurement is *m/s*.
- Horizontal velocity: A horizontal vector that is equal to the sum of release velocity × cosine. Unit of measurement is *m/s*.
- Ball release angle: The trajectory taken by the ball at the moment of launch, relative to the horizontal position, determined by using the application's goniometer. Unit of measurement is *degrees*.
- Release height: The maximum height of the ball at the moment of release (vertical distance), and is calculated using the application's line drawing tool. Unit of measurement is *meters*.

Statistical Analysis

In order to draw a comparison between the prior and post values for kinematic variables concerning the jump shot skill, the scholars processed the data obtained using the SPSS application to extract the following statistical methods:

- Arithmetic means, standard deviations and percentages.
- The Normal distribution function (Shapiro-wilk).
- Pearson correlation coefficient (PPC).
- Paired sample-t-test to indicate statistically significant differences among the interrelated samples.
- Independent sample t-test for independent samples.

Results

The results of the study established there were statistically significant differences at the level of ($\alpha \leq 0.05$) between the prior and post measurements in favor of the latter in the basketball experimental group from the right side with a negative defender and the left side with positive defender.

The study's results also indicated no statistically significant differences at the level of ($\alpha \leq 0.05$) between the prior and post measurements in the control group on the right side with a negative defender and the left side with a positive defender.

More importantly, the results achieved by the study indicated statistically significant differences at the level of ($\alpha \leq 0.05$) between the control and experimental groups in the post measurements, favoring the experimental group in all the study variables pertaining to shooting from the right side with the presence of passive guard and the left side with active guard.

Table 10. Arithmetical means, standard deviations and (t) values for study variables in the experimental group's prior and post measurements

Variables	Group	Shooting from the right side (passive guard)				Shooting from the left side (active guard)			
		Mean	SD	t	Sig	Mean	SD	t	Sig
Release velocity (m/s)	Pre-test	5.20	0.20	8.01	0.00	5.44	0.30	7.90	0.00
	Post-test	6.11	0.39			6.21	0.08		
Verticav Velocity (m/s)	Pre-test	3.50	0.26	15.20	0.00	3.81	0.20	17.1	0.00
	Post-test	4.87	0.12			5.04	0.11		
Horizontal velocity (m/s)	Pre-test	3.85	0.21	2.48	0.03	3.88	0.20	4.01	0.00
	Post-test	3.67	0.10			3.62	0.08		
Release angle (°)	Pre-test	42.3	1.34	19.8	0.00	44.5	3.44	8.52	0.00
	Post-test	53.0	1.05			54.3	1.18		
Release Height (m)	Pre-test	2.27	0.13	2.84	0.01	2.31	0.10	3.09	0.00
	Post-test	2.40	0.07			2.44	0.09		
Jump shots	Pre-test	0.70	0.68	2.51	0.02	0.40	0.52	2.19	0.04
	Post-test	1.70	1.06			1.20	1.03		

Table 11. Arithmetical means, standard deviations and (t) values for study variables in the control group prior and post measurements

Variables	Group	Shooting from the right side (passive guard)				Shooting from the left side (active guard)			
		Mean	SD	t	Sig	Mean	SD	t	Sig
Releasevelocity (m/s)	Pre-test	5.22	0.21	1.50	0.15	5.42	0.32	0.81	0.42
	Post-test	5.34	0.14			5.56	0.43		
Vertical velocity (m/s)	Pre-test	3.48	0.17	2.19	0.07	3.76	0.14	1.64	0.12
	Post-test	3.65	0.18			3.97	0.45		
Horizontal velocity (m/s)	Pre-test	3.88	0.19	0.25	0.80	3.90	0.50	0.06	0.95
	Post-test	3.90	0.17			3.88	0.20		
Release angle (°)	Pre-test	41.9	1.45	2.15	0.06	44	3.62	0.92	0.37
	Post-test	43.1	1.00			45.7	4.62		
Release height (m)	Pre-test	2.24	0.13	1.06	0.30	2.30	0.10	0.52	0.61
	Post-test	2.30	0.11			2.33	0.15		
Jump shots	Pre-test	0.30	0.48	1.70	0.11	0.50	0.71	1.40	0.18
	Post-test	0.80	0.78			0.90	0.73		

Table 12. Arithmetic means, standard deviations and *t* values of variables in sample post-measurement

Variables	Group	Shooting from the right side (passive guard)				Shooting from the left side (active guard)			
		Mean	SD	t	Sig	Mean	SD	t	Sig
Release velocity (m/s)	Control	5.34	0.14	7.46	0.00	5.56	0.43	4.62	0.00
	Experimental	6.11	0.29			6.21	0.08		
Vertical velocity (m/s)	Control	3.65	0.18	18.3	0.00	3.97	0.45	7.32	0.00
	Experimental	4.87	0.12			5.04	0.11		
Horizontal velocity (m/s)	Control	3.90	0.17	3.70	0.03	3.88	0.20	3.73	0.00
	Experimental	3.67	0.10			3.62	0.08		
Release angle (°)	Control	43.1	1.00	21.6	0.00	45.7	4.62	5.70	0.00
	Experimental	53.0	1.05			54.3	1.18		
Release height (m)	Control	2.30	0.11	3.02	0.01	2.33	0.12	2.29	0.03
	Experimental	2.40	0.07			2.44	0.09		

Discussion

The results of the study were consistent with Brancazio (1981), Kundson (2007) and Satern (1993), which indicated that the speed of throwing the ball during the free throw ranged from 6 m/s to 6.30 m/s. The angle of release of the ball was found to be higher than the results of Rojas et al. (2000), which ranged between 42-47 degrees. The larger the angle of the released ball, the higher the vertical vector and lower the horizontal vector and vice versa, negatively impacting the ball's potential to reach the hoop. On the other hand, the results of this study differed with the study of Khlifa et al. (2012), which indicated that the speed of ball-throwing of younger players ranged between 6.56 m/s-7.06 m/s. The scholars pointed out the increase in the values of the kinematic variables of the experimental group) with a negative defender from the right side and a positive defender from the left side) is attributed to the nature of the proposed training programme, which helps improve the strength of the muscles of the feet along with the player making on-the-fly body adjustments in line with the situation she is facing. Consequently, we also found it enhances the speed and angle of ball release, elevation of throwing in tow, as well as forming better articulation in order to avoid guarding players from intercepting the shot. The study of Okasakie and Rodacki (2012) indicated that the decrease in the angle of release, coupled with increasing the speed of shooting, are due to adjustments in motor performance (it being a primary factor in the accuracy of shooting). This is in line with Rojas et al. (2000) who found the presence of a guard prompts a higher elevation at the moment of aiming, due to body adjustments made in relation to the guard's position, entailing a higher angle of throwing despite actually a reduced hang time.

The results of the study also demonstrated the lack of statistically significant differences between the prior and post measurement of the basketball control group in the right side with the presence of passive guard, which is attributed to the nature and aspects of the conventional training programme being applied to members of this group. The weak physical capacity of the control group was reflected in adapting to the changing conditions during the jump, where the presence of passive guard adversely impacted the values of kinematic variables (release velocity, horizontal velocity, height of release). The results of this study weighed in less than those attained by Rojas et al. (2000), Brancazio (1981), Kundson (2007), and Satern (1993), which all indicated that the velocity of throwing the ball during the free jump shot ranged from 6 m/s to 6.30 m/s, corresponding with Gunter (1996) that the speed of release is based on the power the player attains during the motor sequence.

Conclusion

1 – The proposed training programme on some kinematic variables has a positive, statistically significant effect regarding the development of the jump shot skill in basketball.

2 – Divergent values were observed regarding some kinematic jump shot variables between the experimental and control groups, with the former demonstrating superiority in both kinematic values and shot accuracy.

3 – Of the various kinematic variables influenced by this study, vertical velocity was found to have improved considerably among the members of the experimental and control groups, with a higher proportion for the experimental group.

4 – An increased ball release yield was attained by the experimental group when aiming in the presence of either a passive or active guard.

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أثر برنامج تدريبي مقترح على بعض المتغيرات الكينماتيكية لمهارة التصويب بالوثب من أعلى لدى ناشئي كرة السلة من الجانب الأيسر والأيمن

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ملخص

هدفت هذه الدراسة إلى التعرف على أثر برنامج تدريبي مقترح على بعض المتغيرات الكينماتيكية لمهارة التصويب بالوثب من أعلى لدى ناشئي كرة السل)من الجانب الأيسر والأيمن (وتم استخدام المنهج التجريبي لملائمته لطبيعة الدراسة وأهدافها على عينة تكونت من **20**ناشئاً للفئة العمرية من **13** إلى **15**عامًا المتوسط الحسابي **15.1**والانحراف المعياري **0.64**تم تقسيمهم إلى مجموعتين عشوائيتين تتناسبان مع طبيعة مثل هذه الدراسة ؛ وتم توزيعهم الى مجموعتين مجموعة ضابطة ومجموعة تجريبي ، يتألف كل منهم من **10**لاعبين.تعرضت المجموعة الضابطة للتدريب باستخدام الطريقة التقليدية، في حين خضعت المجموعة التجريبية لبرنامج التدريب المقترح .وأظهرت نتائج دراستنا أن البرنامج التدريبي الجديد أثمر بشكل إيجابي في تحسين قيم العديد من المتغيرات الكينماتيكية)السرعة والزاوية وارتفاع إطلاق الكرة .(وتجدر الإشارة بوجه خاص إلى السرعة العمودية، وهي واحدة من أكثر المتغيرات الكينماتيكية التي أحدثت تحسناً كبيراً في التصويب بالوثب بكرة السلة .علاوة على ذلك، توصي هذه الدراسة بتطبيق البرنامج التدريبي المقتر على فرق المدارس الفلسطينية والأندية الصغير ، فضلاً عن أهمية الاهتمام بتطوير القدرات البدنية، والمتغيرات الكينماتيكية والتدريب على مهارة التصويب بالوثب بين ناشئي كرة السلة.

الكلمات الدالة: النتغيرات الكينماتيكية، التصويب بالوثب لأعلى، ناشئي كرة السلة.

* الجامعة الأردنية. تاريخ استلام البحث 2019/10/27، وتاريخ قبوله 2020/1/7.