IMPROVING PERFORMANCE CAPABLE KNOWLEDGE IN YOUTH BASKETBALL BY APPLYING WITH TARGETED SHOOTING PROGRAM

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ABSTRACT. Today's basketball player profile can be divided to four resources: *physical. mental.* spiritual and emotional (Woods, Jordan, 2010). Our research supervised the special basketball demands and the implementations to a training program that could help us to get a correct picture what, when, whom, how, where and why to teach (Winter, 1997). We researched the game performances as the ingredients of competitiveness based on a research of (Baker and Shea, 2013) and the theory of Four Factors by Dean Oliver (2004) as our starting points**. Purpose of study**. Evaluate of every scientific hypothesis. Observing a special shooting program that is used yearly and simultaneously for a men university basketball team. The main goal of our research is to analyses the common effects of these programs for the game performances of the players. Understanding the basketball player profiles of the participants regarding to their game performances. We'd like to find the details of the improvement of the game performances with a new method that will separate the team and individual parts of the training process. Our hope is that our findings will be useful for planning the basketball practices. We look for the answers which practice topics, drills, tests types and methods are the most effective to increase the special game performance in this model. **Methods.** We looked for answers on why and how questions with our descriptive research methods. We guaranteed the validity of our work to choose our model systemically. We followed a longitudinal and panel investigation to guarantee the proper tests data. The data were analyzed statistically with ANOVA regression, T probe. We have also used some expert explanation from the gathered data. Hudl video analyzer program. **Results**. 1. The game statistics of the players who took part on the individual shooting and conditional program do not affect the trend lines of the game performances. 2. The eFG% and FTF do not affect the trend lines of the game performances. No significant different because of the field goal and free throw attempts (434/193 - 88/49 and 99/78 - 39/26). 3. The players who were

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involved of the morning sessions had more attempts on the games and so higher point/game averages. (49.3 PPG - 14.1 PPG). They executed their shots with a colorful technical repertoire. Their game performance and statistics were more effective. **Conclusions.** The longitudinal investigation was reasonable because the goals and the programs must be changed within the yearly practice plan. The teaching methods depends on the changes of the offensive strategy of the team. The more information we have about the physical and mental resources, the more effective practice plan can be designed. A competitive shooting program can be properly designed that will consider the significant variants due to our findings. There is a significant connection between the performance of the practice program and the game performances.

Keywords: *shooting program, performance capable knowledge, physical resources, performance trend*

INTRODUCTION

From the aspect of the energy management. today's basketball player profile can be divided to four resources: *physical. mental.* spiritual and emotional (Woods. Jordan. 2010). Our research supervised the special basketball demands and the implementation to a training program that could help us to get a correct picture what. when. whom. how. where and why to teach (Winter. 1997).

- From a coordination point of view. I analyzed a categorically structured shooting program of a university basketball team. for which the theoretical background was based on. inter alia. the research of (Baker and Shea 2013) and (Shea, 2014). Also on Dean Oliver's Four Factor theory (2004).

MAIN PROBLEMS

Performance capable knowledge and competitive performance

Competitive performance is the aptitude of the athlete's ability to compete that is in a special and high state of excitement.

Shooting program's theoretical background

Six references were considered relevant.

1.) The first and perhaps most important tool to measure game efficiency in modern basketball is the application of the Four Factor Statistical Schema (Oliver, 2004).

In accordance with the subject of our research. effective field goal percentage and free throws are given special attention.

- *Effective FG% —> eFG% = (FGM + 0.5*FG3M)/FGA*
- Turnover TO% —> Poss. = FGA - OR + TO + 0.4 * FTA
- Offensive rebound OR% —> OR% = OR / (OR + Opponents Def Reb)
- *Free throw factor (two counting possibilities) FTF —> FTA/FGA or FTM/FGA*

2.) Other research has also found that free throw performance is of key importance in the team's success or failure (Kozar, Vaughn, Lord, Whitfield, Dye, 1994).

3.) The B.E.E.F. (namely Balance. Eyes. Elbow in. Follow through) method is a simple way of teaching and improving basic techniques (Barney and McGaha, 2006).

4.) As per *Reliability and factoral validity of basketball shooting accuracy tests* research: the tests must be timed. carried out like a game **(**Pojskić, Šeparović, Užičanin, 2011). The Bosnian research confirms the importance of the time factor. meaning that the implementation of time constraints can make the completion of tests game-like.

5.) Lupton (2016) embodies the performance of the 'ideal basketball player'. Lupton strengthens us in the belief that it is worth customizing the conditioning and shooting goals to individuals.

6.) According to a Slovakian research. individual training was 54.84% of the training program. with the shooting program being 38.12%. (Zambová, Tománek.,2012)**.** that is. very significant.

HYPOTHESES

1. The performance trendline is moved to a balanced positive direction by those players' game statistics who participate in morning training sessions.
2. eFG% and FTF on their own do not affect the competitive performance trendline.
3. Those who participate in extra work perform better by completing special shooting and conditioning programs *simultaneously. which* will help to save time and win games (Nagy 2012). They are expected to be more active during the games. with more attempts and gaining points in more diverse ways. Significant correlation is expected between the improvement of individual test results and performance during the games.

OBJECTIVES

- Checking my hypotheses.
- Understanding the tendencies of the development of performance capable knowledge – competitive performance - at individual and team levels with a new approach.

I aimed to evaluate efficiency with the scientific understanding of the applied *shooting program* to make the results usable in practice. I have been researching which training materials. exercises. tests. training types and training methods are the most effective ways to improve performance in case of our sample.

RESOURCES AND METHODS

- The **representativeness of the research within the team** was ensured by stratification and then by *systematic sampling*.
- By *cross-sectional and longitudinal analysis* of the sample's participants. data was collected at different times. which was also done on the whole sample. This way. I got a performance trendline. but I also made *panel surveys*. namely our observations were performed with the same people as well.
- I made sure that the data and variables obtained during measurements and tests are related to the concepts emphasized based on the theoretical background. This is how I aimed to ensure the *validity* of the research.
- Throughout the year I carried out the functional mapping of the technical knowledge needed by the sport. placed these in the training program. collected and evaluated the data; in order to get a correct picture what. when. whom. how. where and why to teach (Winter. 1997)

Hudl video analysis program

The objective analysis of the games was enabled by the HUDL video analysis and statistical program. which was also successfully used in case of conditioning and shooting programs. (Hudl 2017)

Operationalization

The measuring tools

1. The nine types of **shooting program** workouts were divided into three main categories. The program strives to be gradual. but at the same time to have developing and educational effect. from the most general to the more specific tasks.

The coaches identified 14 categories in which each player needs to develop. These were tailored individually. I made documentation.

Based on these. I have created a personalized shooting test.

The measurement protocol

After a general. then sport-specific warm-up. performing the test exercises with the participants. The test was carried out by the athletes in the presence of the coaches. Only tests carried out with appropriate techniques and speed. as well as within the time limits were regarded as valid. There was no game or very demanding training on the test day or the day before.

Statistical methods

- To compare the average of groups with identical dispersion and normal distribution. I used the one-way ANOVA method.
- Relationships between variables were performed by regression analysis. I expected that we could predict the value of a dependent variable based on several independent variables.
- Differential analysis and probability variables were performed with paired- and two-sample T tests.

Checking the competitive performance

The technical tests used to check competitive performance were divided into 11+2 categories. This means that a field goal attempt was tagged with one of the 11 labels shown in Table 4.

For example: A player gets the ball outside of the arc and shoots right away. against a defender. with a time constrains. For us. this means / Catch and shoot / Contested Shot / Buzzer beater / Jump shot /. The plus two categories are the free throw and all shots. in which all 11 categories are included.

Table 1. The 11+2 categories of checking competitive performance (Own editing)

All shots	Free throw	Buzzer beater	Catch and shoot	Contested shot	Drive	Off balance	Post move	Jump shot	Layup	Hook	Floater	Dunk

Analysis of the games

At the start of the championship. with the knowledge of the opponents. the coaches made suggestions regarding the prospective main competitions. As a starting point. these games were regarded as basis for the checks. The development of the championship helped me specify the list of supposed main competitions. These main competitions were well-defined in time.

The definition of main competitions:
- They were in the middle of the macrocycles.
- Another condition was to have close results.
- The position on the table.

Measurability

- During the research. it was ensured that with the help of the test I obtain data on shooting safety. competitiveness and the level of technical knowledge – both during trainings and games.
- There are weekly training tests. which consist of categories appropriate for the given day. It is important to note that changes could be made in the shooting program but not in the tests.
- With Hudl video analysis and statistical program. I got detailed reports and results on performance capable knowledge. both on team and individual levels.
- Changes in competitive performance were characterized by statistical results of main competitions. Changes based on training programs were verified by periodic shooting tests. My aim was to compare whether the trends in training programs can be found in the development of competitive performance.

Shooting program

Shooting program is well-suited for measuring performance capable knowledge and competitive performance. In case of my research. this is based on:

1. The preliminary program of the team's head coach. that has been developed using the experience gained over the past few years.
2. Studying the teams and players of NBA. researches. using the results from these and applying various individual training programs and techniques.

Research results of the shooting program

- The simultaneous application of a shooting and conditioning program helps to save time and win games (Nagy 2012) because there is a significant correlation between individual test results and game performance improvement.
- Based on the statistical analysis of the current games. the conditioning and shooting programs can be modified. resulting in improvement.
- Those who participated in the extra work perform better; their athlete's personality has also developed. Their performance capable knowledge reached a higher level.
- Apart from the goals of the team. the coaches also defined individual goals that I documented.

The (nine) types of the shooting program's training material were divided into three main categories. The program strives to be gradual but at the same time to have developing and educational effect. It goes from the most general to the more specific tasks. Of course. there are no 'clean days'. i.e. only one category on any given day. These are mixed. but the categories corresponding to the given day are in majority.

At the beginning of the week. days after the game. mainly technical shots were included in the training. In the middle of the week there was a greater emphasis on repetitive shots. Days before the game gamelike shots received the most attention.

Table 2. Nine types of the shooting program (Own editing)

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Mainly technical shots	Mainly repetitive shots		Mainly gamelike shots		Gamelike shots or Game day	
1. Technical						
	2. Repetitive	2. Repetitive				
3. Free throw	3. Free throw	3. Free throw	3. Free throw	3. Free throw	3. Free throw	3. Free throw
	4. Stressed	4. Stressed	4. Stressed			
		5. Special	5. Special			
6. Per segment	6. Per segment	6. Per segment	6. Per segment	6. Per segment	6. Per segment	6. Per segment
7. Per position	7. Per position	7. Per position	7. Per position	7. Per position	7. Per position	7. Per position
8. Situational	8. Situational	8. Situational	8. Situational	8. Situational	8. Situational	8. Situational
9. Competition	9. Competition	9. Competition	9. Competition			

In addition, the coaches identified 14 categories. in which each player had to develop within the shooting program. These were tailored individually. which was documented as per the below.

Table 3. 14 categories of individual goals (Own editing)

#	Sub-goals													
	Goal #1	Goal #2	Goal #3	Goal #4	Goal #5	Goal #6	Goal #7	Goal #8	Goal #9	Goal #10	Goal #11	Goal #12	Goal #13	Goal #14
#1				Outnumbering	From inbound		Contra layup	Contra mid-range	Drive and kick	Pick and roll	From 1:1	Cut	Run	Endgame situation
#2				Outnumbering	From inbound		Contra layup	Contra mid-range	Drive and kick	Pick and roll	From 1:1	Cut	Run	Endgame situation
#3	Center basic techniques	From rebound	Drive	Outnumbering	From inbound		Contra layup	Contra mid-range	Drive and kick	Pick and roll	From 1:1	Cut	Run	Endgame situation
#4				Outnumbering			Contra layup	Contra mid-range	Drive and kick	Pick and roll	From 1:1	Cut	Run	
#5	Center basic techniques	From rebound	Drive	Outnumbering	From inbound		Contra layup		Drive and kick	Pick and roll	From 1:1	Cut		Endgame situation
Categories	**Center basic techniques**	**From rebound**	**Drive**	**Outnumbering**	**From inbound**	**Basic technique**	**Contra layup**	**Contra mid-range**	**Drive and kick**	**Pick and roll**	**From 1:1**	**Cut**	**Run**	**Endgame situation**

Personalizing the test

Those athletes who are playing in several positions have to do more tests.

Based on the shooting program. I have prepared the survey material. namely the test.

Table 4. The shooting test (Own editing)

Test						
1. Repetitive	**2. Free throw**	**3. Stressed**	**4. Special**	**5. Per position**	**6. Situational**	**7. Competition**
From 3 places V movement mid-range	10 shots. 1 shoots. 1 collects. 1 runs	25 triples. 15 sprint	2 inbound location foot-back-spin	6" organized dribbling +1 fake	Team-level measurement —> 3' 3 people's connection. dribble entry task. against 2 defenders	3' —> 30 treys —> 6 places
Team-level measurement —> 3'. 2 Cut to the center from the place of throw-in. in a row		Star drill mid-range. 3 laps		5 center technique		
		Team-level measurement —> 4'15"		Solo 4 technique		
				Mikan exercise. 30"		

According to the coaches' expectations. the test was personalized. The table below shows which tests should each player perform. These are characterized per position and per person.

Table 5. Test broken down to individuals, with partial results (Own editing)

Individualized test									
Player #1	From 3 places V movement mid-range	10 shots. 1 shoots. 1 collects. 1	25 triples. 15 sprints	2 inbound location foot-back-	6" organized dribbling +1 fake	Solo 4 technique	3' —> 30 treys —> 6 places		**Throw-in**
Test 1	18	10	19	3	4	4	35		93
Test 2	21	10	19	4	4	5	36		99
Test 3	23	10	20	6	4	8	38		109
Player #2	From 3 places V movement mid-range	10 shots. 1 shoots. 1 collects. 1	25 triples. 15 sprints	2 inbound location foot-back-	6" organized dribbling +1 fake	Solo 4 technique	3' —> 30 treys —> 6 places		
Test 1	20	9	13	3	4	5	36		90
Test 2	22	10	15	4	4	6	35		96
Test 3	23	10	18	5	4	7	36		103
Player #3	From 3 places V movement mid-range	10 shots. 1 shoots. 1 collects. 1	25 triples. 15 sprints	2 inbound location foot-back-	5 center technique	Solo 4 technique	Mikan exercise. 30"	3' —> 30 treys —> 6	

Test 1	23	8	17	6	17	2	26	25	124
Test 2	23	10	16	5	18	4	26	28	130
Test 3	22	10	16	5	18	6	25	30	132

Player #4	From 3 places V movement mid-range	10 shots. 1 shoots. 1 collects. 1	25 triples. 15 sprints	2 inbound location foot-back-	6" organized dribbling +1 fake	Solo 4 technique	3' —> 30 treys —> 6 places	
Test 1	18	7	6	2	3	2	11	49
Test 2	18	7	8	3	4	3	11	54
Test 3	20	8	12	3	4	5	13	65

Player #5	From 3 places V movement mid-range	10 shots. 1 shoots. 1 collects. 1	Star drill mid-range. 3 lans	2 inbound location foot-back-	5 center technique	Mikan exercise. 30"	3' —> 30 treys —> 6 places	
Test 1	12	10	10	4	14	21	21	92
Test 2	14	10	10	4	16	19	20	93
Test 3	17	10	12	3	19	23	21	105

- I highlighted the test results of five players. Players #1. #2 and #3 participated both in the morning and evening workouts. while players #4 and #5 only attended the evening training sessions.
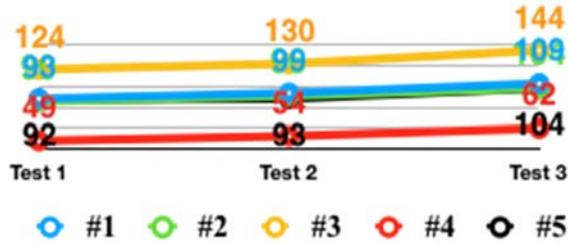
Figure 1. Test results of the five players (Own editing)

- Players #1. #2 and #4 play the same or almost the same position. They had to complete the same tests.
- Players #3 and #5 play almost on the same position. player #3 had to perform one additional test.
- It can be seen that all five players have improved their performance test-by-test.
- However, it can be observed that those players who participated in the morning training sessions have significantly higher values than those who attended only the evening workouts.
- During the shooting tests. all five players showed progress. however, there was a significant difference between those who attended the morning workouts and those who did not.

Table 6. Test broken down to individuals from the aspect of development (Own editing)

		From 3 places V movement mid-range	10 shots. 1 shoots. 1 collects. 1 runs	25 triples. 15 sprints or Star drill mid-range. 3 laps	2 inbound location leg-back-spin	6" organized dribbling +1 fake or 5 center techniques	Solo 4 techniques or Mikan exercise. 30"	3' —> 30 treys —> 6 places	Made shots
Player 1	Test 1	18	10	19	3	4	4	35	93
	Test 3	23	10	20	6	4	8	38	109
	Change	127.78%	100.00%	105.26%	200.00%	100.00%	200.00%	108.57%	117.20%
Player 2	Test 1	20	9	13	3	4	5	36	90
	Test 3	23	10	18	5	4	7	36	103
	Change	115.00%	111.11%	138.46%	166.67%	100.00%	140.00%	100.00%	114.44%
Player 3	Test 1	23	8	17	6	17	2	25	98
	Test 3	22	10	16	5	18	6	30	107
	Change	95.65%	125.00%	94.12%	83.33%	105.88%	300.00%	120.00%	109.18%
Player 4	Test 1	18	7	6	2	3	2	11	49
	Test 3	20	8	12	3	4	5	13	65
	Change	111.11%	114.29%	200.00%	150.00%	133.33%	250.00%	118.18%	132.65%
Player 5	Test 1	12	10	10	4	14	21	21	92
	Test 3	17	10	12	3	19	23	21	105
	Change	141.67%	100.00%	120.00%	75.00%	135.71%	109.52%	100.00%	114.13%

The analysis of the shooting test results (variance analysis (ANOVA)) shows improvement in each task. with the exception of player #3. and I can show significant difference between the players in all test exercises. The results of player #3 show only minor changes. presumably. during the tests the player was in better form and fitness level than the others. During the games. his performance was determining.

For this reason, I have checked (with two-sample t-test) if I can detect any differences based on the established groups (per position and the frequency of training session attendance).

Based on the positions. I have found differences in case of exercise 4 (t=4.840. p=0.017). Players #1. #2 and #4 performed better than players #3 and #5 as field players are more likely to use the exercise described in the test.

The results of the two-sample t-tests carried out per position and frequency of training attendance show that in exercise 3 (t=-3.548. p=0.041). and in the total number of made shots. player #4 shows the biggest improvement. The reason for this might be that the first survey was due at the end of September. It can be assumed that by that time. player #4 still has not reached the expected competitive form. and thus under-performed compared to himself during the test. Then on the third test at the end of May. when the team was preparing for the finals. he was closer to his ideal form and the completed shooting program could also have an effect. (Note: Players #1. #2 and #4 played on the same position. Players #1 and #2 also worked out in the mornings and had much higher values than player #4. The performance of players #1 and #2 improved to a lesser extent; however, their achieved value is significantly higher.)

During the analysis of the games. the following 13 metrics were used:
FGM: Field Goals Made
FGA: Field Goals Attempted
FG%: Field Goal Percentage
2 FGM: 2-point Field Goals Made
2 FGA: 2-point Field Goals Attempted
2 FG%: 2-point Field Goal Percentage
3 FGM: 3-point Field Goals Made
3 FGA: 3-point Field Goals Attempted
3 FG%: 3-point Field Goal Percentage
FTM: Free Throws Made
FTA: Free Throws Attempted
FT%: Free Throws Percentage
eFG%: Effective Field Goal Percentage

- I picked five players from the team. Three of them regularly participated in the morning and evening training sessions. Two of them were training only during the evening sessions. The upper part of the table shows the overall attempts of the team. the three players and two players during the games. The lower part of the table shows the average of the attempts for the team. the three players and two players.
- It can be seen from the table that those who participated in the morning trainings as well have dominantly more field goal attempts. made field goal attempts. free throw and made free throw attempts.
- Moreover. it can be seen that they score three times as many points as those who only train in the evening.
- Those who participated in the morning trainings had significantly more attempts at the games. making their points/game average notably higher. (49.3 PPG - 14.1 PPG)

The eFG% and the FTF do not show significant difference between the three and two players. but this is due to the number of field goal attempts and free throw attempts. (434/193 - 88/49 and 99/78 - 39/26).

Table 7. The team. the three and two players' total and average number of attempts. during the 11 major games (Own editing)

Total	Made field goal attempt	Field goal attempt	Point / Game	Made free throw	Free throw attempts
Team	420	875	97.3	134	192
3 players	193	434	49.3	78	99
2 players	49	88	14.1	26	39
Average	Made field goal attempt	Field goal attempt	Point / Game	Made free throw	Free throw attempts
Team	38.2	79.5	97.3	12.2	17.5
3 players	17.5	39.5	49.3	7.1	9.0
2 players	5.4	9.8	14.1	2.9	4.3

- The following three figures show the eFG% of the team. the three and two players and the corresponding performance trendlines during the 11 games. (Note: The last three games were a series of physical stress; they had to play three games in three days. The two players have 9 games because they did not play in two games.)
- It can be seen that in case of the team. the performance trendline is stagnant. the change is minimal. It increases in case of the three players. while it decreases in case of the two players. However. the previous table is important as it shows the number of attempts.
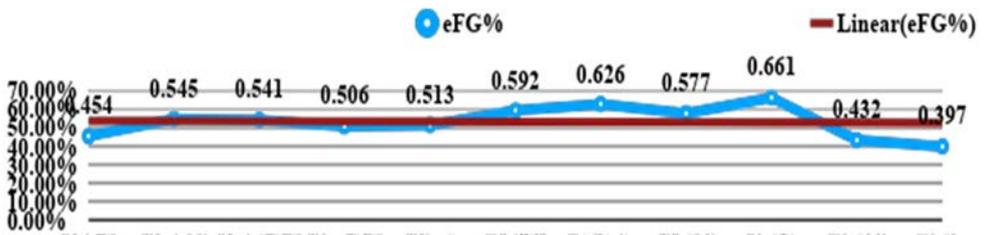
Figure 2. The team's eFG% and the corresponding trendline (Own editing)
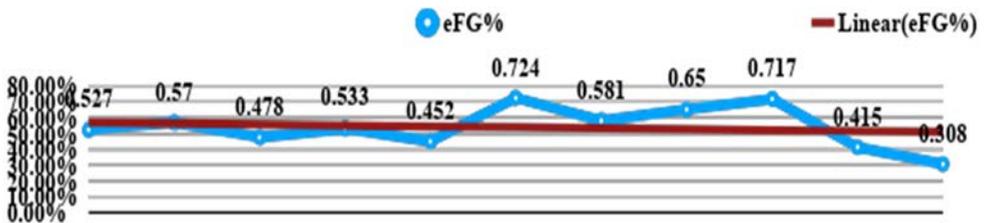
Figure 3. The three players' eFG% and the corresponding trendline (Own editing)
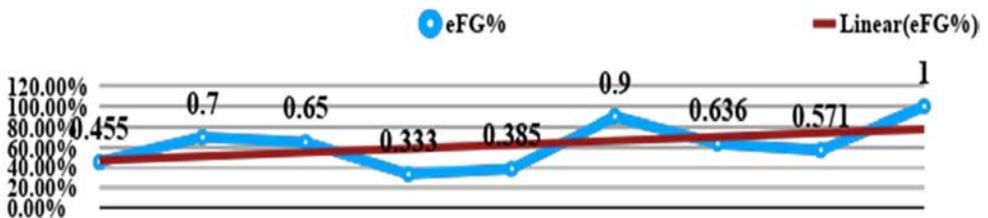

Figure 4. The two players' eFG% and the corresponding trendline (Own editing)

90

- The three figures below show the free throw factors of the team. the three players and the two players. as well as the corresponding performance trendline during the 11 major games. (Note: The last three games were a series of physical stress; they had to play three games in three days. The two players have 9 games because they did not play in two games. 0.01 value means that during the game. there were no free throw attempts or no made free throw attempts.)
- It can be seen that in case of the team. the performance trendline is stagnant. the change is minimal. Minimal change can be observed in case of the three players. while there is a significant decrease in case of the two players. However. here just as in the case of eFG%. the previous table is of great importance where the number of attempts was visible.


**Figure 5.** The team's FTF and the corresponding trendline (Own editing)
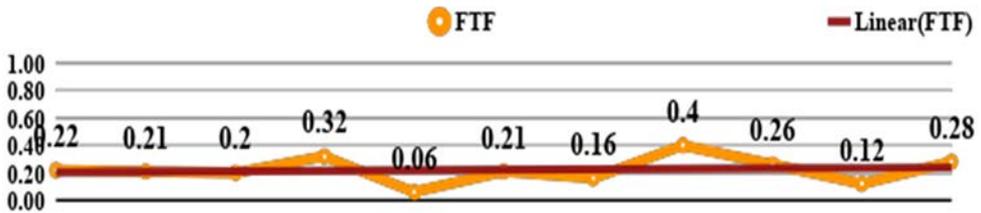
Figure 6. The three players' FTF and the corresponding trendline (Own editing)
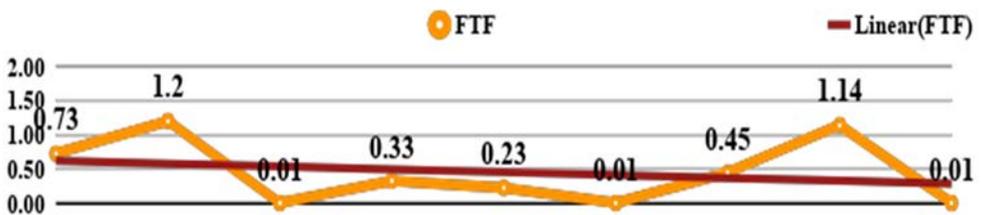
Figure 7. The two players' FTF and the corresponding trendline (Own editing)

- Players #1 and #2 attend training sessions on a regular basis; their performance is determined by the shooting program.
- Even though player #3 attends the morning sessions. his performance is not efficient enough compared to the others. has not been able to make as much progress. This is probably due to his performance capability (his relationship with training. the coach. motivation. etc.) or his general physical condition as he was often injured.
- Player #4 has good capabilities. is able to improve his performance and show good results without the morning training sessions. The reason for this might be that the first survey was due at the end of September. It can be assumed that by that time. player #4 still has not reached the expected competitive form. and thus under-performed compared to himself during the test. Then on the third test at the end of May. when the team was preparing for the finals. he was closer to his ideal form and the completed shooting program could also have an effect. (Note: Players #1. #2 and #4 played on the same position. Players #1 and #2 also worked out in the mornings and had much higher values than player #4. The performance of players #1 and #2 improved to a lesser extent; however, their achieved value is significantly higher.)
- Player #5 fits into the statistics. shows improvement. but only to a small extent.

Hypotheses review

1. **Not accepted** the assumption that the performance trendline is moved to a balanced positive direction by those players' game statistics who participate in morning training sessions.

2. The hypothesis was **accepted** that. eFG% and FTF on their own do not affect the competitive performance trendline. The eFG% and FTF does not show any significant difference between the three and two players. but this is due to the number of field attempts and free throws. (434/193 - 88/49 and 99/78 - 39/26)

3. **Partially true** that the performance improved for those who participated in the morning shooting program.

Those who participated in the morning training sessions had more attempts during the games. making their points/game average significantly higher (49.3 PPG - 14.1 PPG). Those who attended the morning trainings attempted to score in more diverse technical repertoire. The tests confirm that those who completed the shooting program have improved their statistical results during the games. thus their competitive performance.

DISCUSSION AND CONCLUSIONS

Longer term research is justified as the development tasks change during the preparatory year. Data collection completed with the end of the season. With the new knowledge it is possible to analyze the new season as well to compare the new values will be received during the next season.

The shooting program can be developed which takes into account the variables that are typical of the sample. since the results show a significant correlation between performance measured during the trainings and games.

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