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DEVELOPMENT OF A CHANGE OF DIRECTION TRAINING MODEL FOR JUNIOR TENNIS ATHLETES

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Abstract. This research aims to develop a Change of Direction (CoD) training model for junior tennis athletes. Developing a training model using the ADDIE approach (analysis, design, development, implementation, evaluation). In the fifth stage or evaluation, using a sample of 46, to determine the effectiveness of the CoD training model. The N-Gain Score test is used to determine the effectiveness of the CoD training model in junior tennis athletes. The research results showed that the average pretest was 17.66 sec, and after treatment (posttest) it was 17.02 sec. The results of the N-Gain Score test obtained an average value of 0.43, which means that the development of the CoD training model has moderate effectiveness in improving direction change skills in junior tennis athletes. Thus, the CoD training model developed can be applied to improve direction change skills in junior tennis athletes. Future research will need to determine the most effective form of training to improve athletes' change-of-direction skills, taking into account other factors that influence change-of-direction performance. So it can answer the challenge of how the CoD training method can significantly improve the ability to change direction and ultimately contribute to the performance of tennis athletes.

Keywords: *change of direction*; tennis; developing model

INTRODUCTION

Lawn tennis is the most popular racquet sport and is one of the most popular sports globally, with more than 1.2 billion fans and more than 80 million players. In the game of tennis, every movement involves complex motor skills. Tennis players must be able to react as quickly as possible to the opponent's actions and must also be able to move in all directions, as well as put themselves in a good position to return the ball quickly and with the required accuracy.(Hernández-Davo et al., 2021). Therefore, tennis players must have proper footwork patterns and the ability to make quick changes in direction, because they are used in shot preparation, deceleration, reorientation and acceleration movements.(Volk et al., 2023). All of these things require perception, anticipation, decision making, physical capacity, and coordination, so that ultimately you have the ability to make quick movements and stop and start again quickly.(Zemková & Hamar, 2014). Thus it can be concluded that tennis players must have the ability to anticipate, react and move more efficiently in responding to game situations.

According to Sinkovic et al. (2022) The ability to change direction or Change of Direction (CoD) is considered an important motor skill in tennis. Supported by previous research which states that CoD ability has a medium and higher impact on tennis performance than linear sprint (LS)(Volk et al., 2023). Additionally, good CoD skills have a strong relationship with higher levels of achievement and reduced risk of injury(Fox, 2018).This is because an athlete who can perform CoD skillfully is certainly supported by good physical fitness components. Literature studies show a relationship between CoD and components of physical fitness, namely CoD is correlated with linear running speed, jumping ability, muscle strength and maximum leg strength, both explosive and reactive.(Horníková & Zemková, 2021).

Despite the importance of CoD abilities in tennis, there is little research that focuses on developing CoD qualities in junior tennis athletes. In fact, providing training programs that combine various motor skills is an important strategy for young athletes, because it can maximize motor skill proficiency, reducing the risk of acute injuries and overuse injuries.(Lloyd et al., 2013), ultimately influencing the

long-term development of your career as an athlete. Apart from that, at a young age there is a period of Peak Height Velocity (PHV), which is where very rapid growth occurs. In sports where boys and girls train together, using an athlete's stage of maturation (PHV) rather than chronological age is a better measure for designing an athlete's training program.(Fernandez-Fernandez et al., 2023).It is known that maturation can influence many aspects of physical performance such as speed, CoD, and/or jumping ability(Lloyd et al., 2013). Supported statement fromFernandez-Fernandez et al. (2023)that, age around PHVmay be a key point in the ever-increasing speed of young tennis players, although not significant until the post-PHV stage.The age of PHV usually occurs around the age of 13–15 years for boys and 11–12 years for girls (Malina et al., 2004) in(Tsutsui et al., 2022). For this reason, it is necessary to understand the relevant performance characteristics for tennis players from an early age, this not only contributes to future success, but also allows players to have the best skills, thereby increasing the chances for junior athletes to achieve success in tennis.(Siener et al., 2021).

Young athletes are the cornerstone of a nation's competitive sports development and their positive and healthy development is vital to the country's long-term success(Wu et al., 2023).The results of the above explanation can be of great interest to coaches and researchers involved in the development and training of elite tennis players. CoD motor skills on the court should be a primary training goal for junior tennis players. This is because, so that athletes develop according to their level and support the performance and achievements of tennis athletes. Based on this, the author really wants to conduct research to provide solutions and options by developing a change of direction or CoD training model. The results of implementing this training program for junior tennis athletes, thus contributing to the athletes developing part of their physical skills, namely change of direction skills.

METHOD

This research is research and development namely research that aims to produce certain products that are considered reliable because they have gone through studies that suit the needs in the field. The method used uses the ADDIE (analysis, design, development, implementation, evaluation) approach in

planning and developing a change of direction or CoD training model to improve change of direction skills in junior tennis athletes. The following are the stages of model development that refer to(Personal, 2014). These stages are depicted in the following diagram.

Figure 1. Model development flow using the ADDIE approach

Analysis In this stage, the researcher or model designer carries out the training needs assessment process by collecting information or data related to the problems faced in the field. Problems that have been identified then need to find solutions. Design, is the stage for designing and developing a CoD training model. CoD training implementation plans, instruments or evaluations to assess the effect of the CoD training model on improving direction change skills in junior tennis athletes are also determined at the design stage. Development, stages for creating an effective and efficient CoD training model. Implementation, namely the implementation stage or implementation of the training model in accordance with the previously prepared design. Evaluation, a stage to assess the quality or effectiveness of the CoD training model applied in the previous stage.

This research was carried out for 6 months, with the research location in Jakarta. The samples in this study were junior tennis athletes aged 14-16 years and under who were spread across all tennis clubs in the Jakarta area, and totaled 46 samples. Test*N-Gain Score*used to determine the effectiveness of the CoD training model applied to the research sample. The division of categories based on value obtained uses the N-Gain Score formula according to (Voluntary et al., 2024) can be seen in Table 1.

Table 1. N-Gain Score Category

N-Gain Score value	Category
$0.70 \leq g \leq 100$	Tall
$0.30 \leq g < 0.70$	Currently
$0.00 < g < 0.30$	Low
$g = 0.00$	No increase occurred
$-1.00 \leq g < 0.00$	There was a decline

RESULTS AND DISCUSSION

Research result

Based on the results of the needs analysis, data was obtained that 38% of coaches in Jakarta had never provided a change of direction or CoD training program to athletes. Apart from that, 48.57% of the physical training

programs given by trainers were not varied. Meanwhile, trainers who need the latest CoD training model are 100%. Thus, researchers developed a CoD training model with 30 types of training to meet training needs and improve direction change skills in tennis athletes. Furthermore, the results of applying the CoD training model to 46 junior tennis athletes, obtained pretest and posttest scores are presented in Table 2.

Table 2. Descriptive Statistics of Pretest and Posttest Data

Results	*Mean*	*Std. Deviation*
Pretest	17,664	0.751
Posttest	17,021	0.067

Based on the data in Table 2, it shows that the average pretest score for the research sample was 17.664, while the posttest score was 17.021. Pretest and posttest scores are also presented in bar chart form, and can be seen in Figure 1.

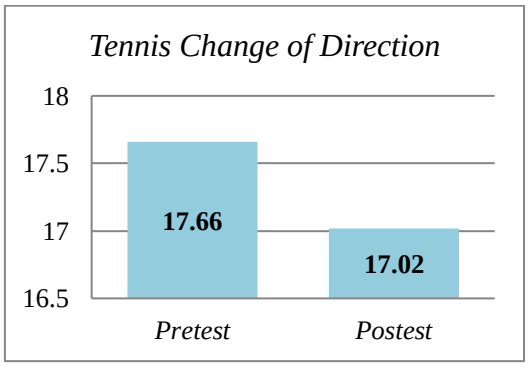

Figure 1. Diagram of Average Results of CoD Practice Pretest and Posttest

Next, to find out the effectiveness of the CoD training model to improve the changing direction skills of junior tennis athletes, data analysis was carried outby finding the difference between the pretest and posttest scores using the N-Gain Score formula. The results of data calculations are presented in Table 3.

Table 3. Calculation Results of Pretest and Posttest Data using the N-Gain Score Formula

Respondent	*Pretest*	*Posttest*	*N-Gain*	Category
1	18.97	18.15	0.33	Currently
2	18.81	18.55	0.09	Low
3	18.75	17.78	0.35	Currently
4	16.87	16.15	0.83	Tall
5	16.96	16,12	0.87	Tall
6	17.24	16.89	0.28	Currently
7	16.88	16.5	0.43	Currently
8	18.1	16.55	0.74	Tall
9	17.88	17.15	0.39	Currently
10	17.04	16.65	0.38	Currently
11	18.58	17.05	0.59	Currently
12	17,19	16.58	0.51	Currently
13	18.28	17.85	0.19	Low
14	18.87	17.15	0.60	Currently
15	18.91	17.25	0.57	Currently
16	17.73	17.65	0.05	Low
17	18.41	17.8	0.25	Low
18	18.76	17.8	0.35	Currently
19	17.95	17.12	0.43	Currently
20	16.82	16,12	0.85	Tall
21	17.64	17.15	0.30	Low
22	16.83	16.54	0.35	Currently
23	17.45	17.15	0.21	Low
24	18.87	18.8	0.02	Low
25	17.15	16.57	0.50	Currently
26	16.45	16.33	0.27	Low
27	17.12	16.8	0.29	Low
28	17.44	16.88	0.39	Currently
29	16.78	16,12	0.85	Tall
30	17.98	17.05	0.47	Currently
31	18.43	17.85	0.24	Low
32	18.12	17.54	0.27	Low
33	16.98	16,18	0.82	Tall
34	17.77	17.08	0.39	Currently
35	16.87	16.09	0.90	Tall

36	17.98	17.08	0.45	Currently
37	17.88	17.05	0.44	Currently
38	17.77	16.98	0.45	Currently
39	18.22	17.65	0.26	Low
40	16.45	16.4	0.11	Low
41	18.12	17.8	0.15	Low
42	17.46	17.3	0.11	Low
43	17.5	16.78	0.48	Currently
44	16.75	16.23	0.69	Currently
45	16.8	16.33	0.59	Currently
46	16.77	16.38	0.51	Currently
Average	**17.66**	**17.02**	**0.43**	**Currently**

Based on the results of data calculations using the N-Gain Score formula, an average N-Gain Score was obtained of 0.43, which means that the CoD training development model has moderate effectiveness in improving direction change skills in junior tennis athletes.

Discussion

The sport of tennis is characterized by short duration and high intensity games that are physically demanding on the body. In a tennis match, the training intensity reaches 60-70% of the maximum oxygen volume (VO2max), the average maximum heart rate reaches 60-80%, and the ratio of physical work to rest is around 1:1 to 1:4(Fernandez et al., 2006). A tennis player also runs an average of 3 meters per shot and reaches 8-12 meters in one point (Fernandez et al., 2006a). Age, gender, physique, technique and psychological components will all influence a tennis player's performance. In addition, optimal planning and training programs will increase the effectiveness of a tennis player's game(Nagel & Avram, 2013).This research aims to develop a change of direction or COD training model to improve the change of direction skills of junior tennis athletes, and test the effectiveness of developing this training model. Through several stages, 30 CoD training models were obtained. Results of testing the effectiveness of the CoD training modelwith the N-Gain Score formula has moderate effectiveness in improving direction change skills in junior tennis athletes. In line with previous research which states that CoD ability has a medium and higher impact on tennis performance than linear sprint (LS)(Volk et al., 2023).

Remembering that tennis is a sport that uses both types of agility (Change of direction and reactive agility) which are important in specific conditions in the game, and agility is an important indicator because tennis players must react quickly and provide a basis for conditioning when receiving the ball from an opponent and changing it. efficiently to increase its agility(Baja et al., 2022). In a tennis match, the

average tennis player changes direction in one point four times, and in a rally match it usually lasts less than eight seconds (five to seven changes in direction).(Fernandez et al., 2006b) Therefore, tennis playersmust have good change of direction skills to be able to react as quickly as possible, even helping players to be more agile because CoD is a determinant of physical agility(Martín-Moya et al., 2023). If concluded, then CoD strengthens the need for tennis, and it is important to determine specific training.

In competitive tennis, the competitiveness displayed by athletes in competing is reflected in five main aspects: physical fitness, intelligence, mental ability, skills, and tactical ability.(Zhang, 2024). Training athletes' CoD abilities is part of the training to improve*physical fitness*athlete. This is because fitness components such as strength and/or power have a strong relationship with CoD ability(Buhmann et al., 2022). When doing CoD movements Athletes should focus on using maximal force in short periods of time. Future research needs to determine the most effective form of training for developing CoD abilities,taking into account other factorswhich affects the performance of direction change capabilities. Thus, it can answer the challenge of how the CoD training method has a significant or high impact on improving athletes' change of direction skills, and ultimately can contribute to the achievement of tennis athletes' achievements..

CONCLUSION

Based on the results of the research and data analysis carried out, 30 models of direction change training have a moderate contribution to improving direction change skills in junior tennis athletes, with an average of*N-Gain Score*0.43. The results of this research can be used as a reference training model for coaches to improve the ability to change direction for junior tennis athletes.

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