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Las habilidades de saque de los tenistas principiantes están influenciadas por los métodos de entrenamiento que utilizan la coordinación ojo-mano

The service skills of beginner tennis players are influenced by training methods using hand eye coordination

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Abstract. Background: The importance of hand eye coordination exercises enhances serve practice in the game of Court Tennis. Changes in hand eye coordination (HEC) training have a good influence on the game of tennis court. Study purpose: The purpose of this study was to determine the difference in the effect of serve exercises in improving hand eye coordination (HEC) of tennis games. Then look at the interaction between serve and HEC exercises to improve serve tennis skills. Materials and methods: The experimental research method used in this study with a sample of 48 sports students class of 2020 state universities located in Central Java, Indonesia. Data collection techniques were carried out by utilizing the Hewitt Tennis Achievement Test and hand eye coordination (HEC) using tennis ball catch. The data analysis technique uses ANAVA two-way factorial 2X2 analysis with a signification level of $\alpha = 0.05$ which means grouping A and B, calculations utilizing SPSS software version 26 for windows. Results: The results showed that A influenced to improve tennis serve skills with a value of ($0.000 < \alpha\ 0.05$) and was shown in the value ($F_{count} = 467.18 > F_{table}\ 4.05$). B affects to improve serve tennis skills with a value of ($0.000 < \alpha\ 0.05$) and is shown in the value ($F_{count} = 66.138 > F_{table}\ 4.05$). A and B have an interaction to improve serve tennis skills with values ($0.000 < \alpha\ 0.05$) and shown in values ($F_{count} = 14.311 > F_{table}\ 4.05$). Conclusions: There is an interaction between serve practice and HEC on the skills of serve tennis courts. This continues to have to be done repeatedly to be able to improve the continued attachment.
Keywords: Service, Eye Coordination, Tennis Skils, Raquet Sport

Resumen. Antecedentes: La importancia de los ejercicios de coordinación mano-ojo mejora la práctica del servicio en el juego de tenis de cancha. Los cambios en el entrenamiento de la coordinación mano-ojo (HEC) tienen una buena influencia en el juego de tenis. Propósito del estudio: El propósito de este estudio fue determinar la diferencia en el efecto de los ejercicios de servicio para mejorar la coordinación ojo-mano (HEC) en los juegos de tenis. Luego observe la interacción entre el servicio y los ejercicios HEC para mejorar las habilidades del tenis con servicio. Materiales y métodos: El método de investigación experimental utilizado en este estudio con una muestra de 48 estudiantes de deportes de 2020 universidades estatales ubicadas en Java Central, Indonesia. Las técnicas de recopilación de datos se llevaron a cabo utilizando la Prueba de logros en tenis de Hewitt y la coordinación ojo-mano (HEC) mediante la captura de pelotas de tenis. La técnica de análisis de datos utiliza análisis factorial 2X2 bidireccional ANAVA con un nivel de significación de $\alpha = 0.05$ que significa agrupar A y B, cálculos utilizando el software SPSS versión 26 para Windows. Resultados: Los resultados mostraron que A influyó en la mejora de las habilidades de saque en tenis con un valor de ($0.000 < \alpha\ 0.05$) y se mostró en el valor (Fcount = 467.18> Ftabla 4.05). B afecta a mejorar las habilidades del tenis con servicio con un valor de ($0.000 < \alpha\ 0.05$) y se muestra en el valor (Fcount = 66.138 > Ftable 4.05). A y B tienen una interacción para mejorar las habilidades del tenis con servicio con valores ($0.000 < \alpha\ 0.05$) y se muestran en valores (Fcount = 14.311 > Ftable 4.05). Conclusiones: Existe una interacción entre la práctica del servicio y el HEC en las habilidades del servicio en canchas de tenis. Esto sigue teniendo que hacerse repetidamente para poder mejorar el apego continuo.
Palabras clave: Servicio, Coordinación ocular, Habilidades de tenis, Deporte de raqueta

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Introduction

Tennis is a sport played between one or two opposing people limited by the net. Every tennis game uses rackets that people hold to hit the ball with rubber (Durán et al., 2021). In the game of tennis there are various types of strokes that can be used in the game (Abrams et al., 2012; Cortela et al., 2020). Strokes in tennis are divided into three groups: groundstroke, volleyball, and serve (Reid et al., 2015). In making a serve punch, stand behind the basline line between the center line and the sideline. The racket is tightly grasped towards the net, the weight must be balanced, the legs are stretched shoulder-width apart, and both knees are slightly bent in order to quickly move towards the ball we throw up (Machado et al., 2024; Registry, 2013; Roetert, 1998).

Serve skills in tennis can be the key to victory, as the success rate affects getting points more than with defensive strokes (Durán et al., 2021; Rodríguez Cayetano et al., 2021). If the serve is weakened, the chance of earning points will decrease. This is often used by opponents to attack and have the opportunity to earn points (P. F. Luna-Villouta et al., 2022). So you can know that serve is considered important for the beginning of the game which results in speed, strength and accuracy players can start attacks to urge opponents (Koçyiğit et al., 2020).

In basic tennis serve techniques at the learning stage for beginners must be effective, efficient and right on target to

be able to improve skills (Cortela et al., 2020). Beginners start with a half-swing flat serve, hold the racket with a forehand eastern grip (Amico & Schaefer, 2022; Brown & Soulier, 2013). Indeed, in every training method applied by the coach wherever it is, it must have its own training goals, just how the athlete follows the instructions given by the coach (Blanch & Solé, 2021). In theory, forehand eastern grips are done to make serve strokes simpler than continental grips. Eastern grip when done to serve does not require pronation movements of the shoulders and arms (Mavvidis et al., 2014; Zhou & Shen, 2022) This pronation movement is done to change the angle of the racket when it impacts with the ball when the ball is thrown up to be hit. On the continental grip when used to serve the angle of the racket when the impact with the ball is narrow (Fetisova et al., 2021). Using a continental grip to serve a player must understand when he should change the angle of the racket with a pronation motion on impact with the ball, when the ball is thrown and ready to be hit (Nugroho et al., 2024).

Hand eye coordination (HEC) in the tennis skills of beginner players in early adulthood can certainly influence the sequence of several movements into one efficient and effective movement pattern (Kasambala et al., 2022). Hand eye coordination training for those aged 17 years and over of course has special training to provide stimulation for hand movements. Hand eye coordination (HEC) is the skill of stimulating hand movements received through the eyes and hands as the main mover to carry out the desired movement. HEC is needed to perform certain skills and movements that will be carried out as desired (Harris et al., 2022). The eyes carry out the main function and the function of the hand is to carry out certain movements by combining movements called hand eye coordination (HEC). In tennis, especially the serving technique really requires HEC, without HEC you will not be able to serve (M. S. Kovacs, 2007; Nugroho et al., 2024).

So research on the use of tennis serves was carried out taking into account the age of the early adult beginner players (Fett et al., 2020). Providing service training at the start of tennis practice will impact changes in the future which may affect playing ability (Shahril et al., 2024). This research discusses the effect of the HEC serve training method to improve tennis serve skills. Service drills conducted using eastern and continental and HEC will be divided into above average HEC and below average HEC. It is important in research as a good basis because it can be used as a method of initial training for tennis service skills that are effective, efficient and quickly mastered according to the desired target.

Materials and method

Method

The research was conducted using experimental methods to determine the effect of independent and attributive variable treatment on the dependent variable in research (Jonassen & Driscoll, 2013).

Participant

The sample in this study was 48 sports students from the class of 2020, male from state universities in Central Java, Indonesia. The selection of 48 research samples was carried out on beginners aged 17-20 years in the early adulthood category who had the characteristics of being sportsmen and new to the game of tennis. These 48 people were then divided into two groups A1 and A2 with predetermined sections. group A1 practiced serving using an eastern grip, group A2 practiced serving using a continental grip. group B1 eye hand coordination (HEC) is above average and group B2 eye hand coordination (HEC) is below average, each group A1B1, A1B2, A2B1, A2B2 consists of 12 students.

Variables Instruments

The data collection technique uses hewitt tennis achievement test for serve skills with 1,2,3,4,5,6 serving norms placed on the target servebox. Hewitt tennis achievement test is used to measure the accuracy and accuracy of beginner serve tennis to improve skills (Broer & Miller, 2013).

Hand eye coordination (HEC) uses a tennis ball catch. The test is carried out by throwing a tennis ball against the wall with a distance of 2.5 m and on the wall there is a circle target with a diameter of 30 cm, the target circle is attached to the wall with a height of shoulder length each individual who will perform (Jansen et al., 2021). Each sample throws 20 throws, which are divided into:

1. 10 throws, right-hand throw catch right-handed.
2. 10 throws, right-hand throw catch left-handed.

The independent variable in this study was serve training using eastern and continental grips, the attributive variable in this study HEC was above average and below average, the dependent variable in the study of serve tennis skills.

Research procedure

Starting with a pretest using the hewitt tennis achievement test for tennis serve accuracy and a HEC test using a tennis ball catch. After the initial test was carried out, the division of the research sample was continued into factorial cells.

Table 1.
Grouping of research sample data

Serve Practice	Hand Eye Coordination	
	Above average (B1)	Below average (B2)
Eatern (A1)	A1B1	A1B2
Continental (A2)	A2B1	A2B2

A1B1 : Eastern serve grip and HEC exercises are above average.
A1B2 : Eastern serve grip and HEC training below average.
A2B1 : Above-average continental and HEC serve grip training.
A2B2 : Continental serve grip and HEC training is below average.

The treatment in the study was carried out training on

the accuracy and accuracy of serve using eastern and continental grips, and ended with a postest using the hewitt tennis achievement test. The research was carried out on the Tennis Court of the Faculty of Teacher Training and Education, Sebelas Maret University for 8 weeks. The treatment in this study was serve exercises with eastern and continental grips with HEC ratios above and below average (Price, 2019). During the treatment as many as 12 meetings. All samples of each individual made 128 serve strokes using both eastern and continental grips. From the number of strokes made each meeting divided by practice progress into: 1) from the serve line, 2) from 3/4 of the field, 3) from the baseline line.

Data Analysis

The data analysis technique uses two-way ANAVA analysis with 2X2 factorial. Testing data at signification level $\alpha = 0.05$ using SPSS Version 26 software for windows. Test data normality using kolmogorov-smirnov and homogeneity test using levene's test on tennis serve skills. The results of data analysis using two-way ANAVA at a signification level of $\alpha < 0.05$.

Results

The results of the study were obtained from the final test results of tennis serve skills, which were obtained from serve exercises with eastern and continental grips and HEC above and below average. Hereby, the total value of tennis serve skill test results is influenced by serve and HEC practice.

Hypothesis testing using two-way anova 2X2 factor analysis with SPSS software version 26 for windows, results from serve tennis skill tests from students. The results of the calculations obtained are further designed in the table as follows.

Table 2.
ANAVA results recapitulation of serve skills

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1795.333a	7	256,476	92,147	0,000
Intercept	34561,333	1	34561,333	12417,246	0,000
A	1302,083	1	1302,083	467,814	0,000
B	184,083	1	184,083	66,138	0,000
A * B	12,000	1	12,000	14,311	0,000
Error	111,333	40	12,783		
Total	36468,000	48			
Corrected Total	1906,667	47			

R Squared = .942 (Adjusted R Squared = .931)

The effect of eastern and continental serve exercises to improve serve tennis skills

There was a significant difference in the effect between the eastern and continental grip groups (A1 and A2) on serve skill ($F_{-count} = 467.18 > F_{-table}$ for degrees 1 and 40 and a value of 4.05) or $F_{-count} > F_{-table}$, with a significant level 0.000 less than α 0.05 ($0.000 < \alpha$ 0.05), H0 rejected H1 accepted. So the F test can be used to determine whether the proposed hypothesis is accepted.

Table 3.
Results of the Test-tukey analysis differences between eastern and continental grip serve training groups on serve skills

Difference	Q_{-count}	Q_{-table}	Sig.	Description
A_1	6,916	3,96	.000	There are differences
A_2				

Test-tukey (Q) analysis results on the difference between eastern and continental serve grip training on serve skills, obtained the difference in average value or Q-count value of 6.916 and Q-table 3.96. The table shows that the real difference in significance (p) is smaller than α 0.05 ($0.000 < \alpha = 0.05$). The serve exercise using eastern grip had a value (A1 28.79) and the continental grip group as a whole obtained a value (A2 27.54). Overall, the two serve exercises proved to have differences to improve serve tennis skills and it was proven that eastern serve grip exercises were higher (good) than serve exercises using continental grips to improve serve tennis skills.

The effect of hand eye coordination (HEC) to improve tennis serve skills

There was a significant difference in the effect between above-average HEC and below-average HEC (B1 and B2) on serve skills ($F_{-count} = 66.138 > F_{-table}$ for degrees of freedom 1 and 40 and a value of 4.05) or $F_{-count} > F_{-table}$, with a significant level of 0.000 less than α 0.05 ($0.000 < \alpha$ 0.05), H0 rejected H2 accepted. So the F test can be used to determine whether the proposed hypothesis is accepted.

Table 4.
The results of the Tukey Test analysis differences in HEC groups above and below average on serve skills

Difference	Q_{-count}	Q_{-table}	Sig.	Description
B_1	5,583	3,96	.000	There are differences
B_2				

Test analysis test results Test (Q) data on the difference in HEC material above the average and below the average against the serve skill, obtained the difference in the average value or Q-count value of 5.583 and Q-table 3.96 the difference in real significance (p) is smaller than 0.05 ($0.000 < 0.05$), to be seen in the column table Significance (p) is 0.000, or probability far below □ 0.05. The results of the analysis of serve skills in the HEC group were above average (B1 = 30.58) and below average obtained a value of (B2 = 25.79). Because overall HEC above and below average in both serve exercises was shown to improve serve skills, HEC above average was higher (good) than HEC below average.

The effect of interaction between eastern and continental serve exercises with HEC to improve serve skills

There was a significant interaction between serve training (A) and HEC (B) to serve skills ($F_{-count} = 14.311 > F_{-table}$ for degrees of freedom 1 and 40 and a value of 4.05) or $F_{-count} > F_{-table}$, with a significant level of 0.000 less than α 0.05 ($0.000 < \alpha$ 0.05), H0 rejected H3 accepted. So the F test can be used to determine whether the proposed hypothesis is accepted.

Table 5.
The results of the analysis of the interaction between serve training and HEC on serve skills

Interaction	Maximum	minimum	Sig.	Description
Int. AxB	28,79	27,54	0,000	There are differences
	30,58	25,79		

The results of data analysis show that the analysis of variance in table 5 shows that at $\alpha = 0.05$ obtained a maximum value of $0.000 < \alpha\ 0.05$, for serve training obtained an average maximum value of (A1 28.79) and an average minimum value obtained (A2 27.54) while HEC obtained an average maximum value of (B1 = 30.58) and an average minimum value of 0.000 = 25.79) so that a decision can be made that reject H0 and accept H3. So it can be concluded that there is an interaction between serve training and HEC on serve skills. To further clarify the interaction between serve training and length of serve skills can be seen in figure 1.

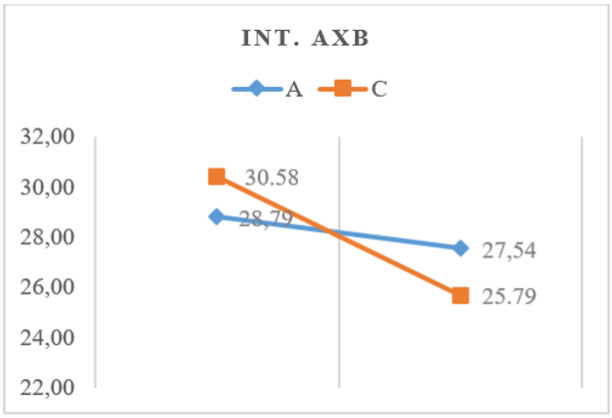

Figure 1. Interaction of serve and HEC training on serve skills

Discussion

The discussion above shows that there is an influence of serving practice on tennis serving skills. The results of the influence of service practice can be seen in table 2 on factor A and table 3. Beginner players start with a half-swing serve, holding the racket with an eastern forehand (Brown & Soulier, 2013). Eastern grip serve training is more effective, efficient, right on target, and easier to learn for beginner players (Nugroho et al., 2024). With an eastern grip serving racket, there is no need for pronation of the shoulder and arm to produce a serve. Beginner players practice serving strokes continuously which is useful for finding the correct hitting position (Smith, 2017). The research results also show that practicing the eastern grip serve is considered more feasible for beginner players because the movements are considered not complicated (Osorio Roa et al., 2023). The serve uses a continental grip which is considered more complicated and takes longer to practice because training also pays attention to the position of the feet when throwing, and there must be a slight location to reach the ball assisted by pronation movements on the shoulders and arms to change the narrow angle of the racket cross section. So from the research results it was found that the eastern grip is considered suitable for beginner players, while the continental grip is used by intermediate, advanced and pro level players to serve blows (Brown & Soulier, 2013).

Serving training for beginner players must be able to coordinate the eyes as the main function carrier, and the hands that carry out certain movements can be interpreted as a combination of movements (Kurniawan et al., 2021). The game of tennis, especially the service technique, requires HEC, without HEC it is impossible to hit a serve (M. Kovacs et al., 2007). Thus, if you don't have a good HEC you won't be able to hit because the momentum of when you will be hit is unknown (Zambelli et al., 2022).

HEC analysis decisions affect tennis serve skills. These results can be seen in table 2 for factor B and table 4. In total, the results of tennis serve skills that have a HEC above average are better than those with a HEC below average. Therefore, the discussion regarding the advantages of beginner players who have HEC above average is the superiority of force on the speed of serving. then given treatment for eight weeks with two weeks of practice, he gained significant ability to serve. HEC is needed to perform certain skills and movements that will be carried out as desired (Harris et al., 2022). HEC is very important when serving, if HEC is not very good it will be difficult to hit the ball. Coordination and transfer of energy when swinging the arm and racket so that the ball can be hit right in the middle of the racket head. After being able to master the sequence, an optimal projection will be created at the point of impact of the racket with the ball. In this optimal projection the ball can be directed to the target as desired (Cortela et al., 2020).

The accuracy and precision of hitting that comes from intense practice is an important foundation in perfecting any type of serve (Beckmanni et al., 2021). This can certainly be seen in research conducted by repeated practice of novice players which has an impact on changes in their abilities. Beginner players who use hand eye coordination with an Eastern and Continental grip are able to develop a good serve through repeated practice and playing a fun, stress-free game. Servicing practice carried out by novice players provides an impact on existing changes by continuing to practice to perfect it (Hoskins-Burney & Carrington, 2014). No matter the player's level or serving style, it is an important key in determining the outcome of a tightly contested match (Cruz et al., 2023). Throwing the ball when serving helps players control and determine the direction of the shot. Players must perfect every small step starting from throwing the ball, bending the knee, launching, and swinging the racket in contact with the ball to the placement of the serve which is often paid attention (M. Kovacs & Ellenbecker, 2011). When the racket collides with the ball, the arm position must also use a pronation movement to change the angle of the racket, so that the collision of the racket with the ball is right at the racket switch point (M. Kovacs & Ellenbecker, 2011). The serve is the only shot in tennis that can be completely and

absolutely mastered by all players, so it must be used skillfully (Hoskins-Burney & Carrington, 2014; P. Luna-Villouta et al., 2023).

Hypothesis test to prove the existence of an interaction between serve training and HEC on tennis serve skills. The results of the interaction can be seen in table 5 and figure 1. In the treatment carried out on the field, pay attention to the racket for service practice and adjust it to the HEC between above average and below average. The choice of racket is adjusted to the comfort of each individual who uses it (Knudson, 2006; Mavvidis et al., 2014). The racket affects the swing movement when hitting the ball, a light racket is more suitable for beginner players (Brown & Soulier, 2013; Machado et al., 2024). Biomec principles of balance and intertia. First, inertia, which is an obstacle to the speed of the racket when hitting it, becomes an important inertial obstacle when the ball collides (Fett et al., 2021; Knudson, 2006). Second, muscles have mechanical properties that become weaker the faster they shorten, so the ability to hold objects with low inertia (racquets) can affect coordination and how muscles are used (Turner, 2018). Practice serves using an eastern grip with HEC above and below average, so it is easier to swing the racket, does not require complicated movements, and those using a continental grip with HEC above and below average, it is easier to swing the racket with movement complicated. By reducing the weight of the racket, it will make it easier and faster to swing the racket when it collides with the ball (Keller et al., 2018; Knudson, 2006).

Several studies regarding training methods improve tennis serve skills. Training methods using eastern and continental grips as a comparison are better used for beginner players (Nugroho et al., 2024). So the research results show that serving training is better using the eastern grip than the continental grip for beginners. These results can be seen in table 3. New findings were also found in this research, HEC is very important for being able to serve in tennis. Serving practice with HEC is an integral part of influencing tennis serving skills. The interaction between serve training and HEC can be seen in table 5 and figure 1.

Conclusion

Differences in training effects using eastern and continental grips as well as differences in HEC are seen on average. There is an interaction between serve training and hand eye coordination on tennis serve skills. The impact of these interaction factors also shows that when using serve drills to improve tennis serve skills and eye-hand coordination, both eastern and continental grip drills. It has been empirically proven that when training is carried out, tennis players' serving skills improve due to the compatibility between the training methods applied. To be able to improve serving skills for beginners, pay attention to the grip to be used, the mass of the racket, understand biomec principles such as balance and intertia, force and timing, coordination and energy transfer, optimal projection. By paying attention to these things, it is felt that it will be quicker to improve service abilities for both those using eastern and continental grips as well as those with above average and below average HEC.

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Conflict Of Interest

The research does not contain material that the authors consider to be a conflict of interest.

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