Development of tennis skills training based on a trainer model for beginner athletes

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Abstract

Mastery of skills in tennis is very important to master for tennis players, especially beginner tennis players who need a lot of practice time to master the skills. Currently, tennis players only have a little time to practice, given the short duration of training with a coach. A training model that can improve beginners' mastery of tennis skills is needed. This study aimed to determine the success and effectiveness of the court tennis coach model developed for novice tennis players to improve their skills. The research method used in this study is research and development (R&D). The subjects in this study were divided into 2 stages, a small experimental stage of 15 athletes and a large trial stage of 40 athletes. The instrument in this study used a tennis dyer test. Based on the results of the assessment of sports equipment development materials, tennis coaches who are competent in their fields and sports test and measurement experts in the study "Development of coach-based tennis skills training for novice athletes" stated that the quality of assistive devices is categorized as "good" for use. Based on the paired sample t-test in this study, it is known that the Sig value (2-tailed) is 0.000, which means less than 0.05 or 0.000 < 0.05. Then, there is a real difference between the pre-test and post-test dyer tennis test data for beginner court tennis athletes. The developed model of court tennis coaches is effective for novice field tennis athletes.

Authors contribution: a – Preparing concepts; b – Formulating methods; c – Conducting research; d – Processing results; e – Interpretation and conclusions; f - Editing the final version

INTRODUCTION

A tennis player must be able to master basic techniques and types of strokes, have good physical ability, and have a good mentality to compete.

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Mastery of basic techniques also determines the good and bad of a tennis game. Mastering good ball-hitting skills will also improve the mastery of hitting. A tennis player must not only have mentality but must also be skilled in hitting, have a good physical condition, and master strategies and tactics in playing. These four factors are abilities that every tennis player must have. To master the game of court tennis, a player must master basic techniques and punching techniques. Basic tactics in playing court tennis include grip, standing skip, racket swing, contact points, and footwork, and then the punch includes service, groundstroke (forehand drive, backhand drive), volleyball, and smash (Afendi et al., 2021). Players who play well must have good forehand and backhand skills. To be able to have the ability in the game of court tennis, every tennis player needs to realize and master the types of techniques in the game of court tennis. Fajra Manai et al. (2021) state that tennis can run well if players can master tennis skills. Preliminary tennis players typically find it challenging to master the skills required in tennis. As highlighted by Juliansyah et al. (2019) and Suryono (2016), issues regarding tennis mastery include insufficient practice time, inadequate facilities like courts, and a need for mentors to aid in mastering tennis techniques. Mastering tennis is crucial for beginners, as the game progresses smoothly when players possess a mastery of tennis techniques (Irfan et al., 2020). Hence, there is a need for a tool that can assist beginners in practising and staying motivated to master the game of tennis.

Almost all beginner tennis players who learn the game of tennis have difficulties, so the game of tennis is often classified into difficult and complex types of skills. As revealed (Raibowo et al., 2020) tennis games are influenced by other people or the presence of environmental factors that are difficult to control. Furthermore, according to (Cahyadi et al., 2019), difficulties in mastering tennis skills occur because tennis players, when playing, will never receive or hit the ball in the exact same place but always move around where the ball falls. In addition, during the spin type of ball tennis, the ball's bounce, direction, height, speed, and distance of

the ball fall are difficult for the receiver to foreestimate. The game of court tennis is classified as a type of skill game that is open (open skill). Basic techniques in playing tennis consist of several techniques that must be mastered by a tennis player, namely serve, groundstrokes, volleyball, smash and lob (Budi et al., 2020; Raibowo et al., 2020).

However, mastering court tennis skills takes much work for beginners. Beginners need a long time to master the skill because they must get used to holding and controlling the shot when hitting the ball with a racket (Prasetiono & Gandasari, 2018). The difficulty in mastering tennis skills occurs because while playing, tennis players will never receive or hit the ball in the exact same place but always move where the ball falls. In addition, during this type of spin of the tennis ball, the ball's bounce, direction, height, speed, and distance of the ball fall are difficult for the receiver to estimate. The game of court tennis is classified as a type of skill game that is open (open skill). Basic techniques in playing tennis consist of several techniques that must be mastered by a tennis player, namely serve, groundstrokes, volleyball, smash and lob (Budi et al., 2020; Raibowo et al., 2020). Based on the results of mastering skills carried out by novice players, it is necessary to break through in the form of developing training methods that players can use to master tennis skills.

Development in training models that aim to improve tennis skills or mastery of skills is a series of intensive processes related to previous models, evaluation of current athletes and solid scientific foundations (Fauzi et al., 2021). Although the process is time-consuming, time will be put to good use due to better training models, more likely to achieve a higher level of performance. So it can be concluded that with the existence of a field tennis trainer model for beginner athletes to master court tennis skills.

The selection of exercise models used in training skills in tennis must be appropriate because improving tennis skills is very important (Alim, 2019). The model must really practice the skills of a tennis court, especially the tennis stroke techniques required in tennis. The training

model that can be given to train skills in sports is a tool modification-based exercise model for beginner athletes (Ngatman et al., 2023). The tool modification-based tennis skill mastery training model for beginner tennis players is a modification of tennis exercises that can be done easily. Tennis players go through a practice process to master and improve their tennis skills by utilizing simple tools. So, the exercise model can be interpreted as a way of organizing the training atmosphere to achieve goals (Yang, 2013). This model will later be designed and formulated in development research to produce a product in the form of a tennis trainer model.

Seeing the importance of mastery of tennis skills for beginners to start mastering tennis skills, this study wants to provide the application of training-based method development for beginners as a tool so that players can master skills quickly. Looking at the research that will be carried out by researchers, namely developing a field tennis trainer model for novice athletes, researchers took the initiative to give a naming to the development of court tennis training products developed under the name of the court tennis trainer (IA) model. Development of tools in the world of sports as a tool to facilitate physical activity that can be done anywhere (Frans et al., 2021). So that this tool can help novice players practice tennis easily in the future. Furthermore, the development of this tool can answer the problem of the need for training aids for court tennis players, considering that there is so little time for players to learn court tennis.

METHOD

The research design used is research development (Research and Development). Design research and development is a process or steps to develop a new product or perfect an existing product, which can be accounted for (Sudjana, 2011). According to Sugiyono (2016), Research and development methods are research methods used to research to develop existing products (innovation) and to create new products (creations) that are tested. The development method will produce effective and efficient products so that they can be appropriately applied and benefit

its users. In addition, developed products can provide solutions and overcome problems.

This research aims to produce reaction agreement training aid products using martial arts sensors. The stages of development in this study use research and development (R & D) methods from Sugiyono (2016) as follows: 1) Research and information collecting, 2) Planning, 3) Developing preliminary form of product, 4) Preliminary field testing, 5) Revise test results, 6) Main product field, 6) Main filed testing, 7) Operational product revision, 8) Operational field testing, 9) Final product revision, 10) Dissemination and implementation.

Experts review the results of the modified tennis trainer model developed, useful for evaluating parts of the training model that need to be improved, removed or perfected, this is done in the design results in the form of written/drawing designs or from direct demonstration techniques in the field. The evaluation results from experts will be used as input in refining the design of the skill training product before being tested on small groups. The research subjects in this study were 55 players in the beginner category of court tennis players, which were divided into 2 groups, namely 15 people in small group trials and 40 people in large group trials. This study aimed to determine the results of developing a field tennis training model for beginner tennis players. The instruments used in this development research were structured interview guidelines and questionnaire sheets. The assessors of the development of this tool come from experts from various sports fields. The assessors are competent as design construction experts in sports with the competence of experts in the field of sports biomechanics, while coaching experts come from tennis coaching experts with international coaching competence, and in the field of measurement are assessed by sports equipment measurement experts with sports equipment megister competence.

The assessment weight of the results of the questionnaire data is added up by each respondent, after getting a score or total number of

answers from each respondent, the score is then presented using the percentage of approval formula as follows.

$$P = \frac{x}{xi}100\%$$

P = Percentage of test subject evaluation results

X = Total score answers by test subjects

Xi = Maximum number of answers in the aspect of assessment by test subjects

100% = Constant.

The results of the data calculation are then made in the form of a percentage multiplied by 100%. According to Arikunto (2019), there are five eligibility categories. The range of percentage numbers always respects a scale. The expected value is 100% and a minimum of 0%.

Table 1. Eligibility percentage (Gumantan et al., 2021)

Achievement Level	Qualification	Descriptions
90-100	Very good	No revision required
80-89	Good	No revision required
65-79	Enough	Revised
55-64	Less	Revised
0-54	Very Less	Revised

Meanwhile, to determine the effectiveness of training model development, measurement tests were used for initial measurements (pre-test) and final measurements (post-test) using court tennis playing tests in the form of forehand and backhand strokes of court tennis, the level of ability of forehand and backhand strokes are used tests with a tennis dyer test. To determine the effectiveness of the ability to play field tennis in the sport of field tennis, a t-test with a significance level of 5% is used. The t-test can be used to look for differences between the two groups. It is said that there is a difference between the two variables if the t-count test criteria are more significant than the t-table.

RESULT

The "IA" court tennis trainer model was validated by 3 experts consisting of sports equipment development experts, tennis coaches who are competent in their fields, and sports test and measurement experts. The data collection instrument uses questionnaires consisting of 5 questions each and filled directly by experts. The instrument is a closed questionnaire with appropriate or inappropriate answer choices. The results of experts' assessment of the development of court tennis training tools for beginners are presented in the following table.

1) Sports Equipment Development Expert

The implementation of the sports equipment development expert carried out in two stages

Table 2. Sports equipment development expert test

No	Rated aspect	Score obtained	Category
1	Appearance	90	Excellent
2	Material/Content	85	Good
3	Use	90	Excellent
	Mean	88	Good

Material experts in this study use qualified judges in the field of engineering. Material testing by conformity experts is carried out twice; aspects of assessment seen in this product material include physical, design, appearance, and use. The results of the validation of the jury material can be seen in Table 2. The assessment by the material jury regarding the product "Development of tennis skills training based on the coaching model for the form of beginner athletes" showed that for the assessment of the physical aspects of 90 which were categorized "Very Good", for the aspects of design and appearance 85 which were categorized "Good", and for the aspects of the use of 90 which were categorized "Good", According to sports equipment development experts, the total feasibility test assessment of the research material "Development of tennis skills training based on the coaching model for the form of beginner athletes" on average amounted to 88 categorized as "Good".

Sports equipment development practitioners are carried out by experts according to ability, who have experience training beginners.

2) Coaching Expert

The implementation of coaching expert**s** was carried out in two stages

Table 3. Coaching expert test

No	Rated aspect	Score obtained	Category
1	Appearance	85	Good
2	Material/Content	90	Very Good
3	Use	90	Very Good
	Mean	88	Good

The assessment by coaching experts of the product "Development of tennis skills training based on trainer model for beginner athletes" in Table 4 shows that for the performance assessment, 85 is categorized as "good", for the material/content aspect, 90 is categorized as "excellent", and for the use aspect 90 is categorized as "very good". According to coaching experts, the average feasibility test assessment of the research material "Development of tennis skills training based on trainer model for beginner athletes" is 88, categorized as "good". The judging of coaching experts is carried out by experts according to ability, who have experience training athletes and beginners in sports.

3) Measurements Expert

Table 4. Measurements expert test

No	Rated aspect	Score obtained	Category
1	Appearance	80	Good
2	Material/Content	90	Very Good
3	Use	85	Good
	Mean	83	Good

Table 7 shows the results of the Use Test assessment of respondents in large groups. Based on the results of the product assessment "Development of tennis skills training based on trainer model for beginner athletes," Table 4 shows that for appearance assessment, 80 is categorized as "good", for material/content aspects, 90 is categorized as "very good", and for usage aspects, 85 is categorized as "good". According to test and measurement experts in the field of sports, the

average feasibility test assessment of the research material "Development of tennis skills training based on trainer model for beginner athletes" is 883, categorized as "good". Experts who have experience in the field of sports carry out expert judging of tests and measurements in the field of sports according to ability.

Based on the results of the assessment of sports equipment development materials, tennis coaches who are competent in their fields and sports test and measurement experts in the study "Development of tennis skills training based on trainer model for beginner athletes" stated that the quality of sensory-based reaction speed training aids in Pencak silat is categorized as "good" for use. Some of the basic movements will be explained later; athletes can do tennis technique skills training using the media "Development of tennis skills training based on trainer model for beginner athletes" so that it becomes a tool in training.

Table 5. Normality test data

Groups	N	Kolmogorov-Smirnova
		Asymp. Sig. (2-tailed)
Pre-test	15	0.594
Post-test	15	0.974

Based on the table above, the Kolmogorov Smirnov value for the pre-test Dyer tennis test data on beginner tennis athletes was 0.832 with Asymp. Sig. (2-tailed) = 0.594 > 0.05, which means the normal distribution model. The magnitude of the Kolomogrovsmirnov value for the tennis test dyer data on beginner tennis athletes was 0.584 with Asymp. Sig. (2-tailed) = 0.974 > 0.05, which means the distribution model is normal. Based on the analysis shows that the two data variables are normally distributed. Therefore, data analysis can be continued for variance homogeneity tests.

Table 6. Homogeneity test

Shooting Accuracy			
Levene Statistic	df1	df2	Sig.
1.880	3	6	0.234

Based on the summary of the homogeneity test mentioned above, it is known that Sig = 0.234, which is greater than the significance level of 5%; this is indicated by a Sig of >0.05. Since Sig = 0.234> 0.05, it is concluded that there is no difference between the variance of pre-test and post-test data dyer tennis test beginner athletes tennis court, which means it is homogeneous. From both test requirements, as discussed above, all analysis requirements, namely, normally distributed data and homogenvariance, have been met and, therefore, can be continued with t-test analysis (paired t-test).

Table 7. Hypothesis test

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pretest – posttest	-1.667	1.234	.319	-2.350	-.983	-5.229	14	.000

Based on the paired sample t-test in this study, it is known that the Sig value (2-tailed) is 0.000, which means less than 0.05 or 0.000 < 0.05. We know a real difference exists between the pre-test and post-test dyer tennis test data for beginner field tennis athletes. Based on this information, the developed field tennis trainer model for beginner athletes is effective and can improve the ability/skill of groundstroke forehand and backhand groundstroke.

Table 8. Paired t-test sample statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Large-scale pre-tests	12.45	40	4.379	.692
	Large-scale post-test	15.60	40	4.684	.741

Based on the output results using SPSS 25, the average total value of strokes before treatment using the "IA" field tennis trainer model for beginner athletes was 12.45. After being given treatment using the "IA" field tennis trainer model for athletes, it was 15.60, meaning that the average value of the dyer tennis test in beginner field tennis athletes increased.

Table 9. Paired t-test pre-test and post-test

		N	Correlation	Sig.
Pair 1	Large-scale pretest & large-scale posttest	40	.894	.000

Based on the results of the table output above, the coefficient of the Dyer tennis test before and after treatment was 0.894 with a p-value of 0.00 < 0.05, so the conclusion is significant. The author uses an alpha standard of 0.05 because this study is a social field where the number is quite conducive to use, in contrast to research that is medical or consumption in nature, the error bias must be as small as possible (0.01). After the data went through the normality and homogeneity test stage, the author did a t-test for the next stage.

Table 10. Paired t-test statistical sample

		Paired Differences							
					95% Confidence Interval of the Difference				Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	
Pair 1	Large-scale pretest - large-scale posttest	-3.150	2.107	.333	-3.824	-2.476	-9.456	39	.000

In the paired t-test, this sample test is carried out to determine whether there is an increase in forehand groundstroke and backhand groundstroke skills after receiving a certain treatment. Based on the paired sample t-test in this study, it is known that the Sig value (2-tailed) is 0.000, which means less than 0.05 or 0.000 < 0.05. We can see that there is a real difference between the pre-test data and the post-test dyer tennis test data for beginner field tennis athletes. Based on this information, the

developed field tennis trainer model for beginner athletes is effective and can improve the ability/skill of forehead groundstroke and backhand groundstroke.

DISCUSSION

Based on the results of the assessment of sports equipment development materials, tennis coaches who are competent in their fields and sports test and measurement experts in the study "Development of coach-based tennis skills training for beginner athletes" stated that the quality of assistive devices is categorized as "good" for use. Based on the paired sample t-test in this study, it is known that the Sig value (2-tailed) is 0.000, which means less than 0.05 or 0.000 < 0.05. Then, there is a real difference between the pre-test and post-test dyer tennis test data for beginner court tennis athletes. Based on this information, the field tennis coach model developed for beginner athletes is effective and can improve the ability/skill of forehead groundstroke and backhand groundstroke.

The field tennis trainer model for beginner tennis athletes is a training product made through several stages to become an "IA" court tennis trainer model that can be used independently so beginner athletes can still do exercises without being accompanied by a coach. Tennis players can practice independently to master sports skills (Mossman et al., 2021). Practice in mastering skills must be done for a long time, so it is not enough just to practice during sessions with trainers (Lubans et al., 2010). Several other studies that state training media based on training support methods to improve mastery of skills are training processes, including research conducted by Pluta et al. (2020), which concluded that training support media in sports activities are feasible to be used and effective in the training process to support athletes' skills.

The stages that researchers do so that they can produce a product that is suitable for use. The first stage was to distribute questionnaires to beginner players and get an affirmative response with the design of a court tennis trainer model for beginner athletes researchers carried out a product design through pictures and then showed the product design to

the expert judgment to be declared worthy or not worth testing. This was done because it was declared feasible, so the researchers proceeded to the next stage, namely small-scale trials. After the trial is carried out, the researcher provides a questionnaire to the expert judgment that is useful for evaluating the parts of the exercise model that need to be improved, eliminated or refined. Then, trials of the "IA" court tennis trainer model on a larger scale will be conducted for further improvement to become the final product. The results of the study stated that the use of the field tennis trainer model can increase mastery of skills and learning motivation of users/sportsmen, the field tennis trainer model can help athletes in the training process and can facilitate understanding the material well (Cunningham et al., 2022). Beginners, when mastering skills in sports, can increase training time so that beginners are able to master sports skills (Sugihartono, 2019). Mastering skills must be carried out by every athlete who wants to excel because mastery of skills is one of the keys to achieving sports achievements (Connaughton et al., 2010).

The use of the field tennis trainer model media in tennis training can facilitate the understanding and strengthen athletes' ball fealing by understanding the material in the field tennis trainer model relating activities in the daily lives of athletes Agustiyanto, (2023). This is in line with the findings of previous researchers who showed that the court tennis trainer model media has met the criteria for use as a training medium (Falcão et al., 2020; Raibowo et al., 2022).

This model is made as simple as possible to make it easier for coaches and athletes in the training process amid the COVID-19 pandemic. This model is perfect for beginner athletes because it can train how to hit the ball using forehand and backhand techniques. Developing training media based on the development of tools or devices for sports techniques refers to the development model, so it has implications for the feasibility of training media products produced in the development process. Besides that, the Borg & Gall development model is used to produce a product that aims to create effective training activities for athletes and

coaches (Afendi et al., 2021; Amni et al., 2019; Sitompul, 2020). As usual, beginner athletes have difficulty in doing punch practice because the ball is difficult to control. Coaches can also monitor online athlete training using this court tennis trainer model. Therefore, the author highly recommends this tennis trainer model for beginner athletes to improve their skills in playing court tennis.

Data shows that the results of the treatment given to beginner tennis athletes are due to the formation of habits or movement patterns that begin to form by continuing to train. In general, the escalation experienced by beginner athletes from pre-test to post-test has increased by 3 points. The increase is due to the treatment given, and the author assumes that if the treatment is given longer and more massively, the increase can be more significant. Therefore, this court tennis trainer model significantly influences the punching skills of beginner athletes. In addition, judging from the media used, it has also increased in all aspects. This is because the media used is considered to have a complexity of the needs of the technique aspects used in tennis.

For this reason, it is necessary to select auxiliary media in sports training that suits the needs according to sports, which also refers to training methods. As the opinion expressed (Ratten, 2019), selecting and determining the type of auxiliary media in sports is an important aspect of making the attractiveness of exercise because increasing the attractiveness affects the effectiveness and efficiency of the exercise process in sports. Exercise auxiliary media is a useful tool for achieving the efficiency and effectiveness of an exercise process in sports, such as understanding, clarity, and exercise objectives (Pino-Ortega & Rico-González, 2021).

In this study, researchers innovated the development of tools in the form of training-based methods for tennis beginners as a tool to master tennis skills. The limitation of this study lies in the product trials on a very small sample and limited to the surrounding environment; besides that, the limited time makes this study less effective. So, in the future, beginners

can be tested on various subjects with the development of tennis training-based training methods. Researchers believe this research can also give birth to several sports training auxiliary products so that, in such a modern era, they can design a tool that makes it easier for athletes to practice sports.

CONCLUSION

Based on the assessment results of material judges, practitioner judges, and respondents to product trials and usage trials in the study Very Worth It" for use. Furthermore, the field tennis trainer model results for beginner athletes are developed effectively and can improve the ability/skill of forehead groundstroke and backhand groundstroke. The limitation of this study lies in the product trials on a very small sample and limited to the surrounding environment; besides that, the limited time makes this study less effective.

From the limitations of this study, future developments could build upon the current achievements. For instance, large-scale trials involving beginner tennis subjects from various regions, genders, and diverse skill levels, especially among children. This research could be enhanced by assessing different tools to measure their effectiveness, benefiting a wider audience.

REFERENCES

Afendi, F., Wani, B., & Rewo, J. M. (2021). Pengembangan Model Latihan Pukulan Forehand Tenis Meja Sebagai Aktivitas Pembelajaran Pjok Pada Siswa SMP. *Jurnal Edukasi Citra Olahraga*, *1*(3). https://doi.org/10.38048/jor.v1i3.497

Agustiyanto, A. (2023). Effect of boteli and frequency modification exercise in improving groundstroke forehand really skills in tennis. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*, *9*(2). https://doi.org/10.29407/js_unpgri.v9i2.19953

Alim, A. (2019). Pengaruh Model Latihan Kekuatan Spesifik Tenis Terhadap Kekuatan Petenis DIY. *MEDIKORA*, *17*(1). https://doi.org/10.21831/medikora.v17i1.23489

Amni, H., Sulaiman, I., & Hernawan, H. (2019). Model Latihan Keterampilan Groundstroke Pada Cabang Olahraga Tenis Lapangan.

Jurnal Terapan Ilmu Keolahragaan, *4*(2). https://doi.org/10.17509/jtikor.v4i2.18968

Arikunto, S. (2019). *Prosedur Penelitian Suatu Pendekatan Praktik*. Rineka Cipta.

Brouwers, J., Sotiriadou, P., & De Bosscher, V. (2015). An examination of the stakeholders and elite athlete development pathways in tennis. *European Sport Management Quarterly*, *15*(4). https://doi.org/10.1080/16184742.2015.1067239

Budi, D. R., Syafei, M., Nanang, M., Kusuma, H., Suhartoyo, T., Hidayat, R., & Deri, A. (2020). Pengaruh metode latihan terhadap peningkatan hasil pukulan forehand dan backhand tenis lapangan. *Jurnal SPORTIF: Jurnal Penelitian Pembelajaran*, *6*(1). https://doi.org/10.29407/js_unpgri.v6i1.13920

Cahyadi, R. I., Saputra, Y. M., & Mahendra, A. (2019). Pengaruh Informasi Umpan Balik Knowledge Of Results (KR) dan Motor Ability terhadap Tingkat Penguasaan Groundstroke Forehand Tenis. *Jurnal Terapan Ilmu Keolahragaan*, *4*(2). https://doi.org/10.17509/jtikor.v4i2.21617

Chae, M. (2017). An innovative teaching approach to product development: creating tennis wear for female baby boomers. *Fashion and Textiles*, *4*(1). https://doi.org/10.1186/s40691-017-0098-9

Connaughton, D., Hanton, S., & Jones, G. (2010). The development and maintenance of mental toughness in the world's best performers. *Sport Psychologist*, *24*(2). https://doi.org/10.1123/tsp.24.2.168

Cunningham, I., Mergler, J., & Wattie, N. (2022). Training and development in sport officials: A systematic review. In *Scandinavian Journal of Medicine and Science in Sports* (Vol. 32, Issue 4). https://doi.org/10.1111/sms.14128

Fajra Manai, A. S., Pusmiati, I. A. M. M., Mangolo, S. M. T., & Ibrahim, M. M. (2021). Studi Eksperimen Pendekatan Belajar Sistem Terpusat Dan Acak Terhadap Kemampuan Tenis Lapangan. *SPORTIVE: Journal Of Physical Education, Sport and Recreation*, *5*(2). https://doi.org/10.26858/sportive.v5i2.23117

Falcão, W. R., Bloom, G. A., & Sabiston, C. M. (2020). The impact of humanistic coach training on youth athletes' development through sport. *International Journal of Sports Science and Coaching*, *15*(5–6). https://doi.org/10.1177/1747954120933975

Fauzi, D., Hanif, A. S., & Siregar, N. M. (2021). The effect of a game-based mini tennis training model on improving the skills of groundstroke forehand drive tennis. *Journal of Physical Education and Sport*, *21*. https://doi.org/10.7752/jpes.2021.s4311

Frans Devin Tarigan, & Amir Supriadi. (2021). Pengembangan Alat Latihan Ketepatan Sasaran Forehand Drive Padacabang Olahraga Tenis Lapangan Tahun 2021. *Journal Physical Health Recreation*,

2(1). https://doi.org/10.55081/jphr.v2i1.520

Gumantan, A., Mahfud, I., & Yuliandra, R. (2021). Pengembangan Alat Ukur Tes Fisik dan Keterampilan Cabang Olahraga Futsal berbasis Dekstop Program. *JOSSAE Journal of Sport Science and Education*, *6*, 146–155. https://doi.org/10.26740/jossae.v6n2.p146-155

Irfan Arifianto, & Raibowo, S. (2020). Model Latihan Koordinasi Dalam Bentuk Video Menggunakan Variasi Tekanan Bola Untuk Atlet Tenis Lapangan Tingkat Yunior. *STAND : Journal Sports Teaching and Development*, *1*(2), 78–88. https://doi.org/10.36456/j-stand.v1i2.2671

Juliansyah, M. A., Iyakrus, I., & Destriana, D. (2019). Pengaruh Latihan Menggunakan Raket Tenis Lapangan Terhadap Hasil Pukulan Overhead Lob Bulu Tangkis. *Altius : Jurnal Ilmu Olahraga Dan Kesehatan*, *6*(2). https://doi.org/10.36706/altius.v6i2.8075

Lauer, L., Gould, D., Roman, N., & Pierce, M. (2010). How parents influence junior tennis players' development: Qualitative narratives. *Journal of Clinical Sport Psychology*, *4*(1). https://doi.org/10.1123/jcsp.4.1.69

Lubans, D. R., Morgan, P. J., Cliff, D. P., Barnett, L. M., & Okely, A. D. (2010). Fundamental movement skills in children and adolescents: Review of associated health benefits. In *Sports Medicine* (Vol. 40, Issue 12). https://doi.org/10.2165/11536850-000000000-00000

Masrun, M., Umar, U., Yendrizal, Y., & Khairuddin, K. (2022). Efektivitas Case Method Terhadap Hasil Belajar Service Tenis. *Jurnal Patriot*, *4*(4). https://doi.org/10.24036/patriot.v4i4.896

Mossman, G. J., Robertson, C., Williamson, B., & Cronin, L. (2021). Coaches, parents, or peers: Who has the greatest influence on sports participants' life skills development? *Journal of Sports Sciences*, *39*(21). https://doi.org/10.1080/02640414.2021.1939980

Ngatman, Guntur, Gani, I., & Broto, D. P. (2023). Tennis training model to improve groundstroke skills in children. *Cakrawala Pendidikan*, *42*(1). https://doi.org/10.21831/cp.v42i1.47414

Pino-Ortega, J., & Rico-González, M. (2021). The Use of Applied Technology in Team Sport. In *The Use of Applied Technology in Team Sport*. https://doi.org/10.4324/9781003157007

Pluta, B., Galas, S., Krzykała, M., & Andrzejewski, M. (2020). The motor and leisure time conditioning of young table tennis players' physical fitness. *International Journal of Environmental Research and Public Health*, *17*(16). https://doi.org/10.3390/ijerph17165733

Prasetiono, B. A., & Gandasari, M. F. (2018). Model Rangkaian Tes Keterampilan Tenis Lapangan pada Pemain Putra Kelompok Usia 12-14 Tahun. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*, *4*(2). https://doi.org/10.29407/js_unpgri.v4i2.12498

Raibowo, S., Adi, S., & Hariadi, I. (2020). Efektivitas dan Uji Kelayakan

Bahan Ajar Tenis Lapangan Berbasis Multimedia Interaktif. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *5*(7). https://doi.org/10.17977/jptpp.v5i7.13726

Raibowo, S., Fathoni, A. F., & Adi, S. (2022). Audio-visual teaching materials supporting tennis. *Jurnal SPORTIF: Jurnal Penelitian Pembelajaran*, *8*(2). https://doi.org/10.29407/js_unpgri.v8i2.17748

Ratten, V. (2019). Sports Technology and Innovation. In *Sports Technology and Innovation*. https://doi.org/10.1007/978-3-319-75046-0

Sitompul, S. R. (2020). Development of tennis serve learning models based on multiple training. *International Journal of Human Movement and Sports Sciences*, *8*(6). https://doi.org/10.13189/saj.2020.080702

Sugihartono, T. (2019). Model Problem Based Learning Meningkatkan Keterampilan Senam Irama Pada Pembelajaran Penjasorkes. *Altius: Jurnal Ilmu Olahraga Dan Kesehatan*, *8*(1). https://doi.org/10.36706/altius.v8i1.8274

Suryono, S. (2016). Pengaruh metode latihan dan persepsi kinestetik terhadap keterampilan groundstrokes tenis lapangan pada siswa SD. *Jurnal Keolahragaan*, *4*(2). https://doi.org/10.21831/jk.v4i2.10901

Yang, H. (2013). Evaluation model of physical fitness of young tennis athletes based on AHP-TOPSIS comprehensive evaluation. *International Journal of Applied Mathematics and Statistics*, *39*(9).