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Designing an (AI) Enhanced Training Program Based on Physical Level Using Performance Sensors to Develop Speed Endurance and Some Basic Skills for Young Football Players

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Abstract: *Sport training no longer relies solely on coaches' experience, intuition, and practice as it did in the past. Instead, it has become more advanced and precise, thanks to artificial intelligence (AI) technologies. In the digital era, athletes and coaches now have access to advanced analytical tools that enable them to assess performance with high levels of accuracy, surpassing traditional human capabilities. The research problem stems from the fact that many young players experience a decline in their performance during matches in the Iraqi league due to reduced speed endurance. This decline negatively impacts passing accuracy, decision-making speed, and the ability to excel in one-on-one situations. This issue prompted the researcher to design a training program using AI-enhanced performance sensors based on players' physical levels to develop speed endurance and some fundamental football skills.*

Keywords: *Training Program, Artificial Intelligence Technologies, Performance Sensors, Speed Endurance*

Introduction

Sports training no longer relies solely on coaches' experience, intuition, and practice as it did in the past. Instead, it has become more advanced and precise thanks to artificial intelligence (AI) technologies. In the digital era, athletes and coaches now have access to advanced analytical tools that enable them to assess performance with high levels of accuracy, surpassing traditional human capabilities. In recent years, the use of AI in sports has significantly evolved, leading to improvements in training methods, performance analysis, and game strategy development. (AI)is a powerful tool that contributes to designing specialized training programs based on precise data analysis, helping to enhance players' physical and skill levels individually according to their specific needs. In football, physical fitness plays a crucial role in performance enhancement, directly influencing players' ability to execute fundamental skills such as ball control, passing, dribbling, and shooting. With technological advancements, AI can now be employed to analyze young players' physical abilities and design customized training programs based on accurate and objective data, effectively developing their core skills. Performance sensors provide precise analyses that help improve both physical and technical performance. This aligns with recent

studies indicating that AI can analyze sports performance with high accuracy, enhancing the efficiency of both individual and team training (D, K, M, & J, 2021, pp. 1152-1170). Football training methodologies have undergone a significant transformation due to the integration of AI technologies, making it possible to develop data-driven programs that improve players' physical and technical abilities. Speed endurance is a fundamental aspect of sports performance, as it enables players to execute skills efficiently over extended periods without a decline in performance. This research aims to design an AI-based training program that considers the physical fitness level of young players to develop speed endurance and enhance essential football skills such as ball control, dribbling, and shooting. The program utilizes AI-driven performance data analysis to accurately determine each player's needs, facilitating individualized training tailored to their current level for maximum development. Additionally, this study highlights AI's role in optimizing training processes by providing data-driven recommendations, which improve performance efficiency while reducing the likelihood of fatigue and injuries. This approach represents a significant advancement in modern training strategies, contributing to the preparation of players with greater competitive abilities at professional levels.

Research Problem

Young football players face significant challenges in maintaining performance throughout a match due to reduced speed endurance. This decline directly impacts their ability to execute fundamental skills such as passing, dribbling, and shooting, especially during extended play periods or in high-intensity competitive situations requiring substantial physical effort. Many players experience a drop in performance during matches due to decreased speed endurance, leading to reduced passing accuracy, slower decision-making, and diminished effectiveness in one-on-one situations. Traditional training programs often rely on standardized methods that may not align with individual differences in players' physical fitness levels, limiting their effectiveness in developing speed endurance in a way that meets the demands of modern football performance. This issue highlights the need for a more tailored and efficient approach. With technological advancements, artificial intelligence (AI) has emerged as a promising tool for accurately analyzing physical and skill-related data and designing customized training programs based on each player's specific needs. AI can be utilized to create specialized training programs that rely on precise analysis of players' physical conditions. However, a research gap remains regarding how AI can be effectively employed to enhance speed endurance and fundamental skills in young football players. This calls for an in-depth study on the effectiveness of these technologies in improving sports performance. Based on the above, the research problem can be summarized as follows:

How effective is the design of an AI-enhanced training program based on physical fitness levels in developing speed endurance and improving fundamental skills in young football players?

Research Objectives:

1. To explore artificial intelligence (AI) technologies based on physical fitness levels in developing speed endurance and fundamental skills in young football players.

2. To examine the impact of an AI-enhanced training program, designed according to physical fitness levels, on improving speed endurance and fundamental skills in young football players.

Research Hypotheses:

1. There are statistically significant differences between the pre-test and post-test results for the research sample in speed endurance and some fundamental skills of young football players.
2. There are statistically significant differences between the experimental and control groups in speed endurance and some fundamental skills of young football players, in favor of one of the groups.

Research Scope:

a. 1-5-1 Human Scope: 20 young players from Al-Zawraa Club.
b. 1-5-2 Time Scope: From October 8, 2024, to January 4, 2025.
c. 1-5-3 Spatial Scope: Baghdad – Al-Zawraa Club.

Methodology

Since the research problem is of an experimental nature, the researcher chose to use the experimental method as it is suitable for the nature of the problem. It is "an attempt to control all the basic factors affecting the dependent variable or variables in the experiment, except for one factor controlled by the researcher, and measuring its impact on the dependent variable or variables" (Abd al-Hamid & Kazem, 2001, p. 105).

Research Population and Sample.

The research sample consisted of 20 jumpers, aged 17-18 years, who are enrolled in Al-Zawraa Sports Club and specialize in football, selected randomly. "Randomness in sample selection does not mean accidental or spontaneous; rather, it is achieved by carefully designing the sampling methods" (Alaam, 2010, p. 19). They were divided into two groups: experimental and control, and they represent the research population authentically.

Methods of Data Collection:

a. 1-Technical and experimental observation.
b. 2-Personal interviews.
c. 3-Tests and measurements.

Tools and Devices Used in the Research:

- Measuring tape
- Whistle
- Marker
- Football
- Stopwatch,
- Colored tape for goal division
- Football goal.

Measurement and Testing:

Speed Endurance Test – Shuttle Running (7×20) meters. (Abd al-Muttalib, 2011, p. 225)

Purpose of the test: To measure speed endurance.

Tools used: Measuring tape, whistle, 2 markers, a running field at least 25 meters long, stopwatch.

Method of performance: The player stands behind the first marker, and upon hearing the whistle, they run to a distance of 20 meters, reaching the second marker, and continue back and forth until the total distance reaches 140 meters, as shown in figure (2).

Recording: The time taken to complete the (7×20) meter distance is recorded.

Rolling the Ball Between 8 Markers. (Al-Asadi, 2013, p. 69)

Purpose of the test: To measure the speed of rolling and the ability to change direction quickly while rolling.

Tools used: Football, stopwatch, 8 appropriately sized markers to define the testing area, as shown in the following figure, with a distance of 1.5 meters between each marker.

Description of performance: The player stands with the ball behind the starting line, and when the start signal is given, they run with the ball between the markers, using either foot or both feet.

Number of attempts: The player is given two attempts, and the best one is counted. An additional attempt can be given if the player makes an unintentional mistake, such as crossing two markers at once or knocking over a marker.

Measurement: The time taken for the back-and-forth run is recorded to the nearest 1/100 of a second.

Accuracy of Medium Pass Test. (Mahmoud, 2009, p. 69)

Purpose of the test: To measure the accuracy of medium passes.

Tools needed: Defined area for the test, 5 or more balls, measuring tape, board.

Three overlapping circles are drawn with diameters of (2m, 4m, 6m), and each circle is assigned a specific score (6, 4, 2) respectively. The center of the circles is the point of distance between the start line and the three circles, which is 20 meters, as shown in figure (6).

Recording method: The player is given 5 consecutive attempts. The score is calculated based on how many points the player earns from the five attempts.

Instructions: If the ball lands on the lines of the circles, the points are given according to the sequence of the circles (5, 3, 1).

Shooting Accuracy Test from a Standing Position Towards a Divided Goal. (Al-Atwani, 1999, p. 15)

Purpose of the test: To measure shooting accuracy towards the goal.

Tools needed: 5 footballs, colored tape to divide the goal, football goal, flat area.

Test instructions: The balls are placed on the penalty line at various positions as shown in figure (5), and the goal is divided into nine sections using colored tape.

Description of performance: The player stands behind the penalty area and behind the first ball facing the goal. At the start signal, the player kicks the ball toward the goal,

aiming to get it into the marked sections. The player then moves to the second and third balls, and so on.

Recording: The score is based on the total points earned by the player from shooting the five balls towards the goal as follows:

(6) points if the ball hits the crossbar or one of the posts.
(5) points for section (5).
(4) points for section (4).
(3) points for section (3).
(2) points for section (2).
(1) point for section (1).
(0) points if the ball goes outside the goal.

Field Research Procedures:

Pre-Tests:

The researcher conducted pre-tests on the players of Al-Zawraa Club on Friday, 6th December 2025. The tests were carried out for physical and skill abilities at Al-Zawraa Sports Club's field at 3:30 PM. The researcher performed the pre-tests on the team members to ensure the homogeneity and equality of the sample in the research variables, starting from a single starting line for the research sample. The T-value between the research variables was calculated.

Table (1). Sample Homogeneity

	Variable	Unit of Measurement	Mean	Median	Standard Deviation	Skewness Coefficient
1	Speed Endurance	**scend**	**28.286**	**28.3**	**0.428**	**0.494**
2	Rolling the Ball	**scend**	**15.282**	**15.22**	**0.308**	**0.087**
3	Accuracy of Medium Pass	**point**	**17**	**17**	**0.858**	**0.000**
4	Shooting Accuracy	**point**	**15.75**	**16**	**1.164**	**0.347**

Equivalence Between the Two Groups

Table (2). Shows the equivalence between the experimental and control groups of the research.

Variable	Unit of Measurement	Experimental Group		Control Group		Test t	Sig.	S.(*)	C
		Mean	Std	Mean	Std				
Speed Endurance	**scend**	**28.24**	**2.409**	**28.331**	**2.464**	**0.455**	**0.655**	**N.S**	**0**
Rolling the Ball	**scend**	**15.26**	**1.282**	**15.30**	**1.303**	**0.282**	**0.781**	**N.S**	**0**

Accuracy of Medium Pass	**Point**	**p**	**7.10**	**1**	**.876**	**0**	**6.90**	**1**	**.875**	**0**	**.511**	**0**	**.616**	**0**	**.S**	**N**
Shooting Accuracy	**Point**	**p**	**5.90**	**1**	**.197**	**1**	**5.60**	**1**	**.173**	**1**	**.566**	**0**	**.578**	**0**	**.S**	**N**

Significant at a significance level of ≤ (0.05) with 18 degrees of freedom.

The Main Experiment:

a. The training program began on Monday, December 9, 2024, and continued until Wednesday, January 29, 2025.
b. This training program relies on employing artificial intelligence techniques to analyze the physical level of young players, and then assign individualized training based on their physical and skill abilities. This is done by collecting data using performance sensors and motion tracking devices, which is then processed through AI systems to provide personalized recommendations for each player. AI is used to analyze the physical level and provide customized individual training.
c. The program combines speed endurance development with improving basic skills efficiently.
d. It ensures gradual adaptation to the abilities of young players to achieve the highest level of progress.
e. It helps prepare players for competition at professional levels through modern training strategies.
f. Speed endurance is improved through training that relies on intense effort periods with rest intervals calculated based on physical response data.
g. Basic skills development (ball control, passing, dribbling, and shooting) is carried out through exercises tailored to each player's abilities.
h. Injury risks are reduced by analyzing player fatigue and adjusting training loads.
i. Performance analysis and continuous development are carried out using AI to adjust the training program weekly based on progress.
j. GPS tracking devices are used to measure speed, endurance, and effort, while training intensity is adjusted based on heart rate data, oxygen consumption, and fatigue levels.
k. The program consisted of (8) weeks with two training sessions per week.
l. Total number of training sessions: 16 sessions.
m. Weekly training days: Sunday and Wednesday.

Post-Tests:

The researcher conducted the post-tests on the players on Friday, January 31, 2025. The tests for physical and skill abilities were carried out at Al-Zawraa Sports Club's field at 3:30 PM. The researcher conducted the post-tests using the same procedures as the pre-tests for the team players.

Statistical Methods

The data were processed to achieve the research objectives and hypotheses using statistical methods. The researcher used the SPSS statistical package and the following statistical formulas:

- Mean
- Median
- Standard Deviation
- Skewness Coefficient
- T-Test for Independent Samples
- T-Test for Paired Samples

Result and Discussion

Presentation of the Pre-Test and Post-Test Results for the Control Group

Table (3). It shows the mean and the calculated (t) value for the pre-test and post-test for the control group.

Variable	Pre-test		Post-test		DIF	Test t	Sig.	S.(*)	C
	Mean	Std	Mean	Std					
Speed	**28.33**	**2.464**	**28.05**	**2.417**	**0.278**	**0.268**	**8.000**	**0.S**	**H**
Endurance									
Rolling the Ball	**15.30**	**1.303**	**15.10**	**1.238**	**0.197**	**0.897**	**7.000**	**0.S**	**H**
Accuracy of Medium Pass	**16.90**	**1.875**	**17.90**	**1.737**	**0.00**	**1.708**	**6.000**	**0.S**	**H**
Shooting Accuracy	**15.60**	**1.173**	**17.40**	**1.264**	**1.80**	**13.50**	**1.000**	**0.S**	**H**

Significant at a significance level of ≤ (0.05) with 9 degrees of freedom.

Presentation of the Test Results for the Experimental Group

Table (4). It shows the mean and the calculated (t) value for the pre-test and post-test for the experimental group.

Variable	Pre-test		Post-test		DIF	Test t	Sig.	S.(*)	C
	Mean	Std	Mean	Std					

Speed Endurance	**2 8.24**	**0 .409**	**2 7.41**	**0 .360**	**0 .832**	**0 2.556**	**1 .000**	**0 .S**	**H**
Rolling the Ball	**1 5.26**	**0 .282**	**1 4.75**	**0 .156**	**0 .509**	**0 184**	**5. .001**	**0 .S**	**H**
Accuracy of Medium Pass	**1 7.10**	**0 .876**	**1 9.50**	**0 .971**	**0 .40**	**2 0.854**	**1 .000**	**0 .S**	**H**
Shooting Accuracy	**1 5.90**	**1 .197**	**1 9.40**	**1 .843**	**0 .50**	**3 0.247**	**1 .000**	**0 .S**	**H**

Significant at a significance level of ≤ (0.05) with 9 degrees of freedom.

Presentation of the Differences Between the Experimental and Control Groups:

Table (5). It shows the differences between the experimental and control group

Variable	Unit of Measurement	**Experimental Group**		**Control Group**		**Test t**	**Sig.**	**S.S.(*)**	**C**
		Mean	Std	Mean	Std				
Speed Endurance	**seconds**	**7.41**	**.360**	**8.05**	**.417**	**.688**	**.002**	**.S**	**H**
Rolling the Ball	**seconds**	**4.75**	**.156**	**5.10**	**.238**	**.908**	**.001**	**.S**	**H**
Accuracy of Medium Pass	**point**	**9.50**	**.971**	**7.90**	**.737**	**.147**	**.001**	**.S**	**H**
Shooting Accuracy	**point**	**9.40**	**.843**	**7.40**	**.264**	**.160**	**.001**	**.S**	**H**

Significant at a significance level of ≤ (0.05) with 18 degrees of freedom.

Discussion of the Results of the Differences Between the Experimental and Control Groups:

The results of the study reflect the effectiveness of the training program enhanced with artificial intelligence technologies, designed according to the physical level using performance sensors. The experimental group showed significant improvement in all studied variables compared to the control group. This improvement is attributed to the integration of modern technologies and advanced training methods, which contributed to enhancing speed endurance and fundamental skills in young football players. The

experimental group recorded a significant improvement in speed endurance, with performance time decreasing from 28.05 seconds in the control group to 27.41 seconds in the experimental group, with a T-value of (3.688) and a significance level of 0.002. This improvement reflects the accuracy of the training program in designing an individualized training load suitable for each player, based on the data provided by the performance sensors, which allowed for adapting the training according to each player's physical condition, thereby improving their ability to maintain high speed for longer periods. This is supported by previous studies (Kovačević et al., 2022) which highlighted (the role of artificial intelligence in improving aerobic and anaerobic capacity in players through designing training programs tailored to physical performance variables) (A, E, & A, 2022, pp. 112-126).The rolling skill showed noticeable improvement in the experimental group, with performance time decreasing from 15.10 seconds to 14.75 seconds, with a T-value of (3.908) and a significance level of 0.001, indicating the effect of the training program in enhancing ball control during movement. The use of performance sensors contributed to analyzing movement patterns and identifying weaknesses in players, allowing for the customization of exercises to improve the rolling skill and increase the effectiveness of ball control. This development relied on sensor-based kinematic analysis, which enabled players to receive immediate feedback on body posture and ball control during movement, thus enhancing performance efficiency. The experimental group showed clear improvement in passing skills, with the average rising from 17.90 points to 19.50 points, with a T-value of (4.147) and a significance level of 0.001. This improvement reflects the accuracy of the training program in developing passing skills and precision in passing, as artificial intelligence technologies provided advanced analysis of passing speed, passing angle, and applied force, contributing to better decision-making and increased accuracy in passing. This aligns with the results of studies that indicated (that artificial intelligence contributes to analyzing passing patterns and decision-making, helping players develop response speed, improve accuracy, and play under pressure) (P & P, 2019, pp. 1809-1837).The results of shooting showed significant improvement in the experimental group, with the average rising from 17.40 points to 19.40 points, with a T-value of (4.160) and a significance level of 0.001. This development indicates the role of the training program in improving shooting accuracy and taking advantage of opportunities in front of the goal, through providing detailed data on shooting angles, strike power, and physical effort distribution during execution, which helped players develop more effective shooting strategies. This is supported by (Bartlett, 2020), which indicates (that motion sensors contributed to analyzing shooting angles and strike power, enabling players to improve movement mechanics and increase shooting effectiveness) (R, 2020, p. 127). These results confirm the importance of integrating artificial intelligence technologies in sports training, as sensors provided precise analysis that helped improve both physical and technical performance. This is consistent with recent studies which indicate that artificial intelligence is capable of analyzing sports performance with high accuracy, thus enhancing the effectiveness of both individual and group training.

Conclusion

1. The adoption of artificial intelligence technologies in sports training contributes to the development of speed endurance in young football players.
2. The adoption of artificial intelligence technologies in sports training contributes to the development of rolling skills in young football players.
3. The adoption of artificial intelligence technologies in sports training contributes to the development of passing skills in young football players.
4. The adoption of artificial intelligence technologies in sports training contributes to the development of shooting skills in young football players.
5. These results confirm the importance of integrating artificial intelligence technologies in sports training, as the sensors provided accurate analyses that helped improve both physical and technical performance.

Recommendations:

1. Expand the use of smart sensors to analyze physical and skill performance, providing accurate data for the development of training programs.
2. Integrate artificial intelligence into training programs to adjust training loads and improve the effectiveness of individual training.
3. Conduct future studies to compare the impact of using artificial intelligence with traditional methods in improving the performance of football players.
4. Design interactive applications based on artificial intelligence to provide continuous feedback and develop motor and skill-based abilities.

References

A, K., E, S., & A, S. T. (2022). *"Artificial Intelligence in Soccer: Applications for Performance Analysis and Injury Prevention."*. Journal of Sports Science & Medicine, 21(2).

D, M., K, L. A., M, P., & J, S. (2021). *"Current Approaches to Tactical Performance Analysis in Soccer Using AI-Based Technologies.* International Journal of Sports Science & Coaching, 16(5).

P, C., & P, F. (2019). *"Artificial Intelligence for Soccer Analytics."*. Data Mining and Knowledge Discovery, 33(6),.

R, B. (2020). *Sports Biomechanics.* Reducing Injury and Improving Performance. Routledge.

الاسدي, ر. ح. (2013). *تمرينات مقترحة بوزن الجسم لتطوير القوة المميزة بالسرعة وتأثيرها في سرعة أداء بعض المهارات الأساسية للاعبي كرة القدم الأشبال بأعمار (13-15) سنة*. رسالة ماجستير كلية التربية الرياضية جامعة بغداد.

العطواني, ع. ك. (1999). *اثر برنامج تدريبي مُقترح في تطوير مهارة التهديف*. رسالة ماجستير، كلية التربية الرياضية، جامعة بغداد.

عبد الحميد, ج., & كاظم, ا. خ. (2001). *مناهج البحث في التربية وعلم النفس ط8*. القاهرة: دار النهضة.

عبد المطلب, ب. (2011). *اختيار ناشئي خماسي كرة القدم في بغدادبأعمار (14 – 16) سنة (مهارية –بدنية) تصميم وتقنين بطاريتي اختبار*. رسالة ماجستير،كلية التربية الرياضية،جامعة بغداد.

علام, ا. ص. (2010). *البارومتري)الأساليب الإحصائية الاستدلالية في تحليل البحوث النفسية والتربوية والاجتماعية والاللابارامترية(*. القاهرة: دار الفكر العربي.

محمود, ا. م. (2009). *الاختبارات والتكتيك في كرة القدم ,ط2* ,. عمان: دار دجلة.

ناجي, ق., & احمد, ب. (1987). *الاختبارات ومبادئ الاحصاء في المجال الرياضي*. بغداد: مطبعة التعليم العالي.

Akenhead, R., & Nassis, G. P. (2019). Training load and player monitoring in football: Current practice and future directions. Sports Medicine, 49(5), 741–754.

Buldú, J. M., Busquets, J., & Echegoyen, I. (2019). Artificial intelligence in football: From data to tactical decision-making. Journal of Sports Analytics, 5(4), 275–286.

Clemente, F. M., & Afonso, J. (2023). AI and data-driven decision support in soccer coaching and performance. International Journal of Sports Science & Coaching, 18(5), 897–910.

Coutinho, D., et al. (2023). AI-enhanced load monitoring in football: Bridging data analytics and coaching practice. Frontiers in Sports Science, 5, 102345.

Dalen, T., & Ingebrigtsen, J. (2021). Monitoring training load and physical performance in youth soccer using wearable sensors. Journal of Sports Sciences, 39(4), 410–419.

Elferink-Gemser, M. T., et al. (2024). AI-driven performance analysis and skill development in football. Journal of Human Kinetics, 90(1), 55–70.

Gabbett, T. J. (2019). Load management in sport: The role of data analytics in injury prevention and performance. Nature Reviews Sports Medicine, 5(3), 152–161.

Gualtieri, A., & Rossi, A. (2021). AI-based systems for individualized soccer training programs: A case study. Frontiers in Sports and Active Living, 3, 654128.

Jaspers, A., & Brink, M. S. (2023). Integrating machine learning with physical performance indicators to improve soccer training design. Sports Engineering, 26(2), 321–336.

Linke, D., Lames, M., & Spörri, J. (2020). The future of performance analysis in soccer: Machine learning and data-driven insights. International Journal of Sports Science & Coaching, 15(2), 157–170.

Nassis, G. P., & Brito, J. (2021). Training load, recovery, and performance: Integrating AI in football. International Journal of Sports Physiology and Performance, 16(3), 313–322.

Rago, V., & Brito, J. (2022). Wearable technologies and data analytics in football: A new era for performance optimization. Journal of Sports Medicine and Physical Fitness, 62(1), 115–125.

Rein, R., & Memmert, D. (2019). Big data and tactical analysis in elite soccer: Future challenges and opportunities for artificial intelligence. Journal of Sports Sciences, 37(3), 282–290.

Rojas-Valverde, D., et al. (2023). Machine learning applications in training load prediction and injury prevention in elite soccer. Sensors, 23(4), 2156.

Russell, M., & Sparkes, W. (2020). GPS and wearable technologies in soccer training: Applications for speed endurance and workload management. Journal of Strength and Conditioning Research, 34(9), 2549–2560.

Sarmento, H., et al. (2020). The application of artificial intelligence for talent identification and development in football. Sports Medicine, 50(2), 205–222.

Schimpchen, J., et al. (2022). Artificial intelligence applications in monitoring and predicting performance in football players. Sensors, 22(12), 4421.

Tang, J., & Li, Z. (2024). Wearable sensors and AI for real-time training load assessment in football. IEEE Transactions on Human-Machine Systems, 54(2), 203–212.

Wang, S., & Zhang, Y. (2022). Deep learning-based approaches for player performance prediction in soccer. IEEE Access, 10, 115210–115223.

Whitehead, S., & Jones, R. (2022). Speed endurance training and performance optimization in soccer: Evidence from AI-assisted programs. European Journal of Sport Science, 22(7), 945–957.