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Designing a Technological Medium to Enhance the kinematical Variables of Certain Racket-Sports Skills

This research is presented for acquiring the PhD degree
in Physical Education.

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Research summary

Research Title

Designing a technological medium to improve some of the kinematic variables of some racket sports skills

Introduction:

The global interest in the science of sports training has increased at recent times, which is concerned with improving and developing sports performance to achieve sporting achievements in various age stages, The development of sports performance depends on developing its various inputs, whether they are physical or skillful or through learning and mastering the basic or complicated skills, or kinetic sentences. Speed of motor performance plays an effective role, especially in sports activities with changing situations.

The sports field in the twenty-first century is witnessing a great development in various fields through the use of modern technologies with the possibilities, means and methods of training in order to develop the level of achievement.

Whereas the era in which we live is the era of science and technology. The scientific and technological revolution, which have dominated all areas of our lives, pushes us to use its applications in all fields in general and the sports field in particular. We can realize the importance of scientific and technological progress in the sports field through the global achievements of the champions of various games, especially the individual and it was able to find ideal solutions to advance the level of sports by developing and creating the best devices and tools to support modern sports training science.

Where technology, with its various types, has been activated and employed in various fields of knowledge and has benefited from it in various subspecialties. Technology is not an end in itself, but rather a tool and means to quickly reach the real goal of developing the training process in the sports field in general and in the sports of tennis and table tennis in particular.

It was also mentioned in an article published on a statistical study conducted by the American College of Sports and Medicine (ACSM) in January (2019) entitled "Top 10 Fitness Trends in the New Year" It presents a permanent annual statistic for the most used training methods in the field of sports training. On top of the list of this statistic was the training using the wearable technology known as (Wearable

Technology) as the most used technique. It followed by the group training method in second place, then the third place which is High Intensity Interval Training Method (HIIT).

Research problem:

According to what was stated in the notes of the **International Tennis Federation (ITF)** that the conditions for any correct hit are depend on three variables, namely (the angle of the head of the racket at the moment of hitting, the speed of the head of the racket, the path of movement of the head of the racket)

These variables, if we are able to measure and define them accurately, they will greatly contribute to identifying some weaknesses in the performance of the players.

Daniel A. James & Nicola Petrone explained in 2016 that sports and medical tests to analyze and improve sports performance are traditionally performed in laboratories, where the required devices are available and the surrounding environmental conditions are easy to control.

In this environment, the dynamic characteristics of athletes are evaluated using treadmills, rowing machines, and stationary bicycles. In general, these machines and devices allow athletes to be monitored using tools that cannot be used in a training environment. These analysis methods often require the athlete to continue performing almost consistently, allowing a constant field of observation for the player as well as data-display devices and a relatively constant proximity of equipment such as their associated electronic sensors as well as respiratory analysis equipment. The trade-off here was between the accuracy of these high-precision (but often bulky and expensive) systems and the ability to transport small, lightweight, fast and wearable sensors (with increased accuracy in the results), which made them sought after by the sports market.

The researcher here suggested designing a technological medium in line with the global trend in using this technology in the mathematical field to measure these variables and contribute to their improvement where “**Muhammad Shehata Ibrahim**” (1997) explains that the concerned means are one of the tools and methods by which we can provide players with sensory experiences and physical, kinetic and skillful training situations to acquire a specific and skillful kinetic duty to help clarify the relationships to facilitate performance.

"**Abd al-Haq Emad & et.**" (2005) argue that the greater the sense of movement or skill, the better it can be performed, which leads to a marked increase in the level of performance.

"**Eileen Wadia**" (2007) indicates that the use of kinetic-oriented devices and methods that restrict the movements that are performed in an extreme and wrong way among the players. These devices may be useful in the early stages of kinetic learning, as they help to understand what the movement's shape and boundaries should be, thus starting the right path when learning kinetic performance and has the same amount that manual reinforcement does by the trainer.

In general, these devices can be useful for some players who have trouble communicating with their coaches. Thus, this helps to learn the kinetic skills of tennis better and faster. Also, the diversity in the use of appropriate devices and methods for each level and age encourages the player to train while excluding the factor of fear and failure.

"**Eileen Wadia**" (2007) explains that each of the strokes in tennis is linked to a set of kinematic rules to which the movement of the human body is subjected in an appropriate manner, as the hitting movement of any tennis player must be characterized by a smooth rhythm and this rhythm is an important factor in the process of learning the skill to be taught.

"**Fathi Ahmed Al-Saqqaf**" (2010) points out that most table tennis experts agree that the athlete's success depends on the player's mastery of the basic skills of table tennis. "**Suhaib Adel Al-Jaafra**" (2013) believes that the game of table tennis is governed by specific movement paths that depend entirely on the link between mental awareness and kinetic performance.

Both "**Ahmed Sobhi Salem**" (2004) and "**Sherif Fathy Ahmed**" (2001) agree that the sport of table tennis has a distinctive character as it includes special skills that distinguish it from other sports activities. As it depends in its practice on the use of a racket of a special nature and a ball with special specifications in terms of size, weight, etc., within the limits of a small court that differs in its legal specifications from the rest of the games, which requires a high degree of compatibility between the movement of the hitting arm and the control of the racket and the movement of both the body and the legs with the eyes, which cannot be separated among these movements.

Within the limits of the researcher's knowledge through his work as a demonstrator and assistant lecturer for racket sports at the Faculty of Physical Education at the University of Benha, with comparing the researches that deal with training programs within Egyptian institutions and international institutions, it was found international institutions, especially in Europe, use technology in sports training because of their great influence on Skill development in proportion to the current high level of skills. The study of mechanical sciences has an impact on development and improvement of the performance, The modern technological devices have the merit in this upgrading skill level. For the Egyptian institutions it was found that most of the research deals with traditional training programs to raise the level of skill performance, and to know the impact of many variables on the extent of their contribution to improve performance of skills. In the table tennis sport as well as tennis, no one has touched the use of technology and modern devices in the field of racket sports in general, and table tennis and tennis in particular. This on the one hand, and on the other hand through the researcher's passion for seeing everything new and his work as a coach in the Egyptian clubs as an eyewitness to the level of Players; how high they are, and in what ways contribute to their high level. He found that coaches spend a lot of effort and time with the players in order to provide them with skillful performance, especially the part of the domain arm. This encouraged him to implement the idea of designing a device to improve some of the kinematic variables, which is a simple and easy-to-use device that is placed on the palyer's racket and the player's arm.

Here the researcher raises a question: Can a technological medium be designed to help us to improve and measure the kinematic variables in some basic skills in table tennis and tennis?

The researcher will try to conduct a scientific research to reach the answer of this question?

Research Importance:

The scientific importance is as follows:

- The research is one of the scientific attempts that serve the sports field, especially table tennis and tennis
- Directing the attention of those in charge of table tennis and tennis on the importance of using wearable technology devices in the training process.

The application importance is represented in the following points:

- The benefit of those in charge of training table tennis and tennis from the indicators of this method to contribute to the training process
- This method helps coaches easily discover weaknesses in performance of players.
- Saving time and effort for the coaches who train these sports
- The use of this method increases the motivation of training for both sexes.
- The designed method is considered as an individual training one.

Research objective:

The research aims to design a technological medium to improve some of the kinematic variables of some racket sports skills through: -

- Determining the kinematic variables necessary for these skills, which are the angle of the head of the racket at the moment the ball is struck and the speed of the head of the club
- Designing a wearable technological medium to measure and clarify these kinematic variables for these skills along with designing a computer program dedicated to it to display and record the outputs
- Knowing the statistical significance differences between the pre and post measurements after using the medium
- Knowing the percentage of improvement between measures of players after using the designed medium in training

Research hypotheses:

- There are statistically significant differences between the pre and post measurements in favor of the post measurement in the skill tests under investigation.
- There are rates of improvement for the skills under investigation, after using the designed method.

Research Methodology:

The researcher used the experimental method by the method of pre and post measurement method for one group for each sample of tennis and table tennis.

Research Community and Sample:

The sample participating in the research was deliberately chosen from tennis and table tennis youth, in the age group of men under 18 years for tennis and for table tennis, as the sample population reached (13) players divided into (7) players in tennis in the Smart Village Club and (6) Players in table tennis at Toukh Sports Club. The total number of clubs participating in the research was (2) divided into (1) a tennis club, which is the Smart Village Club, and (1) a table tennis club, which is Toukh Sports Club, and the basic sample size was (10) players divided into (5) tennis players and (5) table tennis players.

Actions of the research:

The design of the technology method took more than a year from December 2018 to March 2020 AD, where a survey was made on how to design this method and what the appropriate physical components for the nature of its work are, as well as its programming to extract results and data directly from it.

Designed method calibration:

The researcher calibrated the method designed at the National Institute for Measurement and Calibration in Al-Haram District in order to identify the results of the method whether it was logical or not through the institute's laboratories. Indeed, the method was calibrated and the method's results proved to be logical, but with an error rate in estimating the calculation of angles that did not exceed 5% and this ratio was taken into account during the application of the research.

Basic study:

The researcher applied his study again upon the return of activity on the first of July 2020 AD, where he used the training program in tennis in the Smart Village Club, beside using the designed method and the program was for a period of two months consisting of 24 training units at 3 units per week

Where he took a pre-measurement in tennis on Saturday 4/7/2020 AD.

Then the researcher conducted a tracer measurement after the end of the first month of the program on Wednesday 5/8/2020 AD to find out the level of the players after the first month of the program or whether there was a need to make adjustments in the training program or not.

finally, the post measurement on Wednesday, 2/9/2020 AD

As for table tennis, the researcher conducted his study in parallel with the study of tennis immediately after the return of sporting activity in sports facilities. The researcher used the training program for the Table Tennis Academy at Toukh Sports Club, where he conducted the pre-measurement for the research sample on Sunday 5/7/2020 AD, next the tracer measurement on Thursday 6/8/2020 AD, then the post measurement on Thursday 3/9/2020 AD.

Methods of data collection:

Tools used in measurement:

- Tennis Court
- Legal yellow scale tennis balls
- Tennis rackets
- measure tape
- cones
- Table tennis table
- Legal table tennis balls size 40 mm
- Table tennis rackets
- Sticky tape
- Registration forms

Devices used in measure

- Medical scale to measure weight
- The designed technological medium used in the research
- A laptop computer

Forms for recording the results of the tests used in the research, attach (3)

Conclusions:

- 1- The designed method can be used to improve the performance of the skill in the research.
- 2- The use of the designed method in the training process contributes to saving time and effort for the trainers, by which it is possible to identify weaknesses in performance and work to improve them instantaneously.
- 3- The use of the designed method can attract players to the training process, as it differed from the traditional training process.
- 4- The designed method provided the opportunity to perform many repetitions in the court.
- 5- The designed method can provide the opportunity to monitor the performance inside the court.

Recommendations:

The researcher recommends the following:

- 1- Directing the attention of those in charge in the training process to the interest and use of technological means in the training process.
- 2- Using the method designed to improve the skills of various racket sports.
- 3- Take advantage of the measurements resulting from the method designed to find out the weaknesses and strengths of the players' performance.
- 4- The use of wearable technology to help reduce the problems of traditional methods of performance monitoring such as photography, placing the player in the kinematic analysis laboratories and restricting his movement.
- 5- Conducting scientific studies and researches on the use of technology in the field of sports training because of its great impact on the training process.