Impact of technology on the evolution of sports training

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Abstract. This research work aimed to analyze through research results in some sports how the application of technology affects the diagnosis and planning of sports training. Within the methodology, different types of theoretical methods were used, such as analysis and synthesis, the logical history that, through the findings found in different specialized databases, allowed us to find different positions and theoretical references that allow us to affirm that winning in national and international competitions is the product of conducting a well-planned interdisciplinary work, the use of methods such as quasi-experimental that is based on the pre-test, the pedagogical intervention and the post-test was carried out through the use of the technological implementation used in sport as it is through sport machines such as contact platforms, linear encoders, sports preparation software, tablets, and mobile devices that facilitate the roles of the coach and his interdisciplinary group that through technology demonstrates have better results in the data processing, evaluations, and treatment of injuries of their athletes. The work allows managing evaluative information of different sports disciplines about the level of physical, technical, and tactical preparation and other aspects of sports preparation that access to identify characteristics of sports performance of the athlete. A descriptive and application research approach was assumed that through a training plan allows to capture and generate key information for the identification and characterization of the most important aspects of the control and monitoring of the athlete as they are actors (individual, institutional, corporate), that includes elements of personal data, results of physical, technical, tactical tests and thus, having reliable data that allow us to predict results in different sports competitions. As results the specific requirements expressed in user stories were obtained and the strengths and weaknesses of the athletes understudy taking into account that the social impact is to be able to use sports development mechanisms that help the orientation and selection of sports talent found in the different slums and neighborhoods of the region which will allow through sport a comprehensive education and environmental care through a sports and pedagogical process that allows it to grow economically not only in the sale of services that can be generated with the use of state of the art technology but with the economic projection of what can be worth a high-performance athlete. In conclusion, reliable information was obtained, for the realization and control of different training plans generating inputs for decision-making in the approach of different possibilities seeking to solve very particular aspects of the computerized and disciplinary management of sport, the use of technology applied to sports training represents a significant advance in reducing costs, time and processes in the training of athletes with a view to professional sports.

1. Introduction

The nature of the research problem is that nowadays in our environment technology is rarely used to carry out sports training; this is usually due to the high cost of this material, which is the privilege of
only some clubs and high-performance athletes. the problem occurs in the analysis of the research carried out jointly between Universidad del Valle and Universidad de Pamplona, Colombia, using the technology that these institutions have, applying tests in athletes of popular sports disciplines such as ball sports.

Sports training aims to use complex processes that pursue the optimization of sports performance this is in an evolution where technology, science, innovation, and communication support the achievement of high sports results and this is reflected in the brands of the most important competitions worldwide such as the Olympic games. Every four years is reflected the result of technological research in products such as sports implementation, sports scenarios, communication, television, internet and all software that can provide evidence of the greatness of sport within a contemporary society raised and formed under the great impact of technological advances throughout history were several schools that have founded sports training to start, Matveev [1], who wrote the entire theory of periodization of theoretical training model that serves as a guide to lead training plans and is the theoretical basis for planning structures that are designed from software that facilitates the task of the trainer Bompa [2], this is another of the international authors who have given great productivity especially in the way of organizing strength training. His theory is of great support to guide the different routines used by fitness centers such as gyms. Verkhoschansky [3], structures the blocks from which all that has to do with plyometric and functional training originates, other authors who contributed to the conformation of training theory were: Forteza [4], Villarejo [5], Gómez [6], Arrese [7], Dantas [8], Platonov [9], Palaeloal [10], Villarejo [11], these researchers carry out an investigation that serves as theoretical support to this paper, they contribute the application of protocols, technology and resources for the improvement of the training processes of athletes and coaches. at an academic level, technology is normally used in biomechanics and physiology laboratories. a clear example of this is the functional laboratory of the dina system brand that applies different professional practices in the areas of health and sport, providing creative solutions to present and future professionals who believe that practices based on scientific evidence, leaving room for creativity and controlled innovation using electro-mechanical devices, wireless electronics, ergometers, evaluation and development platforms, tablets and mobile devices, identification cards and station for recording information and user management.

2. Method
In order to achieve the different objectives of the research, the quasi-experimental type of research is used, and a methodological model was designed, which refers to the analysis of antecedents and theoretical frameworks that allow us to identify paradigms related to themes that allow us to theoretically analyze the evolution of sports training with the use of technological aids.

The sports training supports its object of study in the components of the sport preparation looking for the development of the physical, technical capacity, tactical, theoretical and psychological, several authors who from their work have made known different quantitative forms that contribute loads, methods, means, formulas and developments that allow schematizing the training.

Mirella [12], provides a research book where explains the new methodologies of strength training, endurance, speed and flexibility, through theoretical concepts where it takes into account analytical aspects of biological medical nature by applying the functioning of energy lives of lactic type, a good theoretical contribution that defines muscle fibers and fatigue is appreciated, considering a very wide explanation of what the sports training programming is in the short, medium and long term. it determines step by step how the training of strength, endurance, speed, and mobility should be carried out and provides a great variety of tests that allow, simply and reliably, the evaluation of physical and motor skills.

Forteza [4], affirms that the methodology tries to approach the solution of the demands of the sport preparation that responds to the current competitive reality, the sport and its organizations allow to catalog it as one of the greatest social phenomena of the twenty century thanks to the millions of people that follow day by day its exciting manifestations, the relation science and sport has made
possible the development of the sport and its disciplines thanks to the application of the scientific methods, this has allowed to enrich the knowledge of the trainer through the study and to apply the most important elements of the methodology of the investigation to the training process.

It is important to note that this research book provides a wide variety of charts that allow through scales of mathematical assessment to measure the components of the load such as volume, intensity, and density can be appreciated, for example, as high-level athletes dose the one thousand hours of training. In a short summary we can show the evolution of sports training through a historical analysis that begins to gain importance from the nineteenth century called the fundamental period that runs from the eighteenth century to the first olympiad of modern times where training is based on the long duration of effort and the use of technology was very elementary through the use of chronometers and biomechanical analysis through very simple stills. By this time some international events begin to broadcast on television, uniform cyclical methods are applied, in the second stage of improvisation that includes the periods of the first olympiad of one thousand eight hundred and sixteen until the olympic games of Stockholm, even the training was not raised in a systematic way the principle of training with more duration than the time that the competitive specialty lasted, the trainings lacked a scientific foundation that is applied based on empiricism and generally the sportsmen with more physical condition won the competitions, more than by work of the training this was based much on copying the training of the champion at that moment. From one thousand nine hundred twelve onwards, systematic training gave empirical sense to the preparation of the athlete through planned ways of dividing training into different stages of obtaining, maintaining and losing the sport form throughout the cycles of super-compensation through training in which the technique predominated. From the years nineteen twelve to nineteen fifty, the traditional training systems are ordered and classified and most of the methods that are still used appear today, which are classified as continuous, discontinuous and competitive and which consider the principles and contents of the training process.

The scientific period begins from the second half of the XX century, being decisive the results reached between from the year nineteen twelve to the year nineteen fifty in which is given importance to the control of the training by means of a biological medical thought, this period gave, as a result, a great number of scientific publications in diverse places of the world through schools that have been losing their features and have acquired a universal character, all this thanks to the ordered world of the information in this period imperatives the development of computer science, the sport software, communications, the sciences and the technology that allow in a useful way the reproduction and diffusion of knowledge.

Lezterer [13], publishes a book that transforms the traditional thinking of sports training by adding the term “training sciences” adding a broad and well-founded discourse on the use of topics of great relevance such as training within the scientific field through the conceptualization of capabilities, models and control as a separate chapter calls attention to the protocols that are used both in training and in competition through observation processes that are authentically determining the criteria of quality, objectivity, reliability, and validity. Therefore, the control of a training process is optimal when the evolution of the development of training and performance data is described separately, demonstrating connections between the training input and the performance output, therefore the training science is based on statistical interpretation, statistics, mathematics, computer science, biomechanics, medicine, physiology, communication, and technology are areas of knowledge that support the trainer in achieving victory.

At present, there are several companies, universities, and research groups that promote different functional laboratories equipped with the latest technology machines that facilitate the tasks of the technical staff in terms of preparation, control, and projection of sports training.

An example of this, is functional laboratory of Rios [14], through a set of technological implementation of the brand Dyna system pursues the revolution through evolution and innovation through imagination and knowledge, provides creative solutions to professionals of today and the future, who believe that evidence-based practices are possible, leaving room for creativity and controlled innovation. This laboratory creates methodologies associated with health, physical activity
and wellness, capable of reproducing and generating controlled natural movements which allow the realization of any objective of evaluation, recovery, performance, and training, its advanced technology allows precise and constant control of a large number of users, all the information is stored in the servers of the center and thus can be consulted through reports according to the type of scientific study or professional activity that is being carried out, the measurement and control devices will allow determining integrally the usefulness of the session developed in an objective and subjective way, objective evaluation automated follow-up of a complete number of variables related to the internal-external load of each physical activity and for the subjective evaluation within the session this group of variables provides complementary information of internal indicators of intensity, these evaluations correspond to scales of perception of effort, pain, and quality of life. The system conforms to a system of evolutionary follow-up that allows developing a historical one on the perception of effort, the state of mind and fatigue.

This laboratory is made up of electro-mechanical devices that allow the control of the functional capacity of the resistors and their different manifestations, the wireless electronic devices are used for the control of movements with external isoinertial resistors, free weights and elastic bands, the ergometers through running machines. bicycles, paddles with electromechanical control allow the development of functional capacities integrally and the specific evaluation of the force is made through the use of accelerometers, goniometers, cutting cells, platforms, gas analyser, and strings, the tablets are used to track the level of technical efficiency and training programs with feedback of tactical situations in the game the use of identification allows automatic control of users during different training sessions, in the centre station of information registration and user management the flow of athletes can be controlled, allowing the reception in real-time of all the information generated during all the training programs, allowing the self-administration of reports according to the professional needs of each specialist, providing the evaluation data of each athlete.

With reference to research can be cited the article Ortega [15], presents a novel form of evaluation in football through a geographic information system, through a software that obtains data through a gps device; recording, storing and analysing the data in real-time, this allows the trainer to synchronize all the devices with the computer in such way that the system receives in real-time the data of each player generating a geographic database that implies a process of abstraction to pass from the complexity to the simplified and affordable ordering of the information through the use of a model based on the geographic information, vectorial, raster and orientation of objects. For this investigation we will take as examples, the measurements applied to sportsmen randomly of the most popular sport disciplines of our country which are indoor soccer, basketball and volleyball for which we used a sample of ten athletes for each sport discipline using as an example the most popular functional tests and for the writing we will take two variables to evaluate strength by jumping using squat jump. the jump is performed with the two lower extremities at the same time, after maintained flexion of 90 ° of the knees, from which ascends vertically without any type of counter-movement or rebound, making a maximum vertical jump. and counter movement starting from a knee extension in standing position, this type of jump consists of carrying out a fast flexo-extension movement of the knees up to an angle of 90°, to consecutively and without any pause carry out a maximum vertical jump by means of the use of an ergo Jump triaxial strain-meteric force platform, similar to that used in previous studies of Lopez [16]. This platform has a sensitivity of 0.1 N in the vertical force register and a maximum sampling frequency of two thousand Hz. the platform was calibrated before the beginning of the study, following the manufacturer's instructions, using for it a range of known weights that were placed on top of it, for the example of the intermittent resistance variable, the Lriger test [17], was applied by means of the use of computer pc and software for its development, is an intermittent test with increase of the intensity and allows to determine the Vo2 max as an important indicator to quantify the level of resistance.

3. Results
This paper will measure two variables (squat jump and countermovement jump) and intermittent resistance, statistical techniques were used to check each of the variables selected from the research: analysis of squat Jump in centimeters pre-test takes 1 and post-test takes two taking as random sample sportsmen of indoor soccer, basketball, and volleyball of popular sports of our country.

In the sportsmen object of study, we can observe a significant improvement when comparing the results of the pre-test vs post-test improving the execution of power in the accomplishment of movements that involve the execution of jumps emphasizing a better result on the part of the volleyball players and in a minor level but with little significant differences the indoor football players (Table 1). This is due to the own characteristics of the game actions of the sports where volleyball and basketball use more jumping than soccer. Analysis of counter-movement jump in centimeters pre-test takes 1 and post-test takes two taking as sample random athletes of indoor soccer, basketball, and volleyball of popular sports of our country (Table 2).

| Table 1. Squat jump. |
|---------------------|
| Sport | pre-test (cm) | post-test (cm) |
| Soccer  | 34 | 35 |
| Basketball  | 35 | 42 |
| Volleyball  | 42 | 43 |

Table 2. Counter-movement jump.

| Sport | pre-test (cm) | post-test (cm) |
|-------|---------------|---------------|
| Soccer  | 85 | 99 |
| Basketball  | 40 | 44 |
| Volleyball  | 72 | 106 |

The same can be seen in the jump of counter movement where volleyball gets the best results determining an improvement in comparing pre-test results vs post-test (t1 vs t2) also improving the levels of stability and power in the lower limbs.

Regarding the values of Vo2 Max given in ml/kg/min a description with very positive values can be analyzed considering in the evaluation scale starting from 53 ml/kg/min the levels of resistance are very good, which will allow to carry out game actions without fatigue, it can be appreciated that the best results were obtained by the indoor soccer players, thanks to the intensity and intermittence this sport is played (Table 3).

| Table 3. Analysis of Vo2 Max through the leger test. |
|-------------|
| Sport | Average (ml/kg/min) |
| Soccer  | 53 |
| Basketball  | 47 |
| Volleyball  | 49 |

4. Conclusions
With the use of technological aids such as contact platforms, spirometers, heart rate monitors and sports software, it was shown to have better results in the dosing and evaluation of sports processes in the athletes under study.

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