

*Computer system for the evaluation of the effectiveness in the attack of karate fighters*  
*Sistema informático para la evaluación de la efectividad en el ataque de los karatecas*

*Reynaldo Juan Estrada-Cingualbres<sup>1</sup>, Williams Báster-Silva<sup>2</sup>, Ivet Challenger-Pérez<sup>3</sup>*

<sup>1</sup>*Dr.Sc. Titular Professor. Superior School of Sport Science (ESCIDE). Mozambique.*

<sup>2</sup>*Eng. Computing Faculty. Holguin University. Cuba.*

<sup>3</sup>*Ms.Sc. Auxiliary Professor. Holguin University. Cuba.*

**Email:**

[restradac27@gmail.com](mailto:restradac27@gmail.com)

[williansbs@gmail.com](mailto:williansbs@gmail.com)

[ivetcp@gmail.com](mailto:ivetcp@gmail.com)

**Reception date:** January 13, 2023

**Acceptance date:** February 14, 2023

**ABSTRACT**

The evaluation of the effectiveness in the attack of the karateka's is made for the general manually, that causes the loss of records and errors of calculation. This work proposes to solve the previous problem through the creation of a computer system that manages the information regarding the process and evaluates the effectiveness in the attack of the karateka. For the elaboration of the product, different tools and computer technologies are used, such as: Java programming language, JavaFX and Hibernate frameworks, PostgreSQL database manager and the software development methodology Extreme Programming.

**RESUMEN**

La evaluación de la efectividad en el ataque de los karatecas se realiza por lo general manualmente, lo que ocasiona la pérdida de registros y errores de cálculos. Este trabajo propone dar solución a la anterior problemática mediante la creación de un sistema informático que gestione la información referente al proceso y evalúe la efectividad en el ataque de los karatecas. Se emplean distintas herramientas y tecnologías informáticas tales como: lenguaje de programación Java, los marcos de trabajos JavaFX e Hibernate, el gestor de bases de datos PostgreSQL y la metodología de desarrollo de software Programación Extrema.

**Keywords**

Effectiveness; Karate; Computerization.

**Palabras clave**

Efectividad; Karate; Informatización.

## **INTRODUCTION**

In order to materialize the computerization in the sphere of sports, projects are implemented from the headquarters of the Manuel Fajardo Rivera and Oscar Lucero Moya University of Holguín. This work is inserted in the project "Computerization of combat sports in Cuba".

The Manuel Fajardo Rivera university headquarters constitutes the academic structure that directs the improvement and training of sports science and technology. Among the centers served by this headquarters is the EIDE "Pedro Díaz Coello" School of Sports Initiation. The EIDE is the main training ground for high-performance athletes in the province. For this reason, this educational center was chosen as the object of the diagnosis.

In the EIDE, the Karate-Do coaches observe the athletes in combat and collect the information in files that help them to collect data. After the fight is over, the trainer calculates the performance of each karate fighter according to the dimensions and indicators that need to be evaluated. This information is stored in records to later analyze it and be able to develop an individual training plan for each athlete.

With the information registered, the coaches carry out different analyzes from the statistical point of view with the indicators obtained and the performance calculated, such as checking the state of development of the athlete in relation to the stage of preparation in which he is. These analyzes allow them to observe how the athlete is transformed according to his technical mastery and how each of the indicators that make up the performance of the karate fighter in combat are transformed.

For the evaluation of the level of physical preparation, there are means and procedures such as the systematic application of tests where the measurement and assessment of capacities, strength, speed and resistance are supported by a wide variety of tests. But the characterization of the competitive activity in general is not as relevant as the specific characterization of the determining exercise, combat. Determining the performance of the karate fighter in combat is a very complex task where it is possible to measure a large number of factors that affect his performance.

One of the most important factors at present is the effectiveness in the attack. Traditionally, the effectiveness of the karate fighter in combat has been measured, but nowadays, taking into account regulatory changes and the tendency to predict competitive success, it becomes even more important to determine the effectiveness of karate fighters in combat.

The criterion of effectiveness in the competitions only qualifies the offensive actions, which are ultimately the ones that determine the winner of the combat, hence their importance as a control reference, both in preparation and in the competition itself; The characterization of the karate fighter can result from monitoring the effectiveness, by determining their attack frequency, whether they are

effective or not, assessing the breadth and flexibility of their tactical thinking, the level of development of the physical condition, all of which together with other aspects allows you to model your preparation. After having analyzed the process described and the bibliography related to it, the following insufficiencies are determined:

- The process is done manually, which is cumbersome and difficult for coaches to do.
- There is a tendency to lose records and coaches can make errors in the calculations.
- The data is processed slowly, causing delays in the delivery of reports by the coaches to their superiors.
- The coaches do not have the same level of preparation. Not having the same experience, they carry out the process differently.

The previous insufficiencies lead to the determination of the following scientific problem: how to favor the evaluation of the effectiveness in the attack of the karate fighters?

In order to solve the problem, the following objective was established: to develop a computer system for the evaluation of the effectiveness in the attack of the karate fighters.

In the development of the investigative process, different methods of different levels were used:

Theoretical methods:

Historical - logical: in the contextualization of the problem and its historical evolution; which allowed establishing the background of the process.

Analysis - synthesis: in the study of the information referring to Karate-Do and the tools and technologies used to develop the proposed computer system.

Inductive - deductive: to establish generalizations of the different theoretical tendencies on Karate-Do and for the elaboration of the conclusions and recommendations of the investigation. Modeling: for a simplified reproduction of reality, using the UML modeling language.

Empirical methods:

Review of documents: in the analysis and compilation of the information that allowed the elaboration of the necessary theoretical foundations to develop the proposed computer system.

Interview: it was used to obtain information regarding the analyzed process and the existing deficiencies, as well as to assimilate knowledge from specialists with experience in the subject. In addition, it allowed defining the functional and non-functional needs and requirements to develop the proposed computer system.

Observation: it was used throughout the research process for a more detailed study of the process under study. In addition, Statistical-mathematical Methods were used for the elaboration of statistical graphs and tables.

## **DEVELOPMENT**

### Attack effectiveness

In the Karate-Do of the present century, some elements have been modified in the practical part. For example, you can find many karate fighters from different countries who do not have an acceptable technique (something that in past decades was essential in their teaching) and who have a very effective technical-tactical arsenal; the athlete's carelessness of all technical execution concentrating only on the effectiveness of the blows have turned modern Karate-Do into a sport of effectiveness.

It is fair to recognize that there are coaches whose experience allows them to discriminate the true aptitudes of a competitor regardless of the results achieved by him, but it is suggestive even for this coach, to model a situation and create the same commitments that are defended in the competition, so that the actions that are carried out by the athletes reveal the abilities and skills that have constituted objectives of the preparation, in this way the assessment of the effectiveness of the actions that are carried out during the control, is an indicator of their preparation integral, meaning sports effectiveness, "the way in which the validity of the action carried out is made objective, which can reach a qualitative value that depends on the verdict of the officials in charge of directing the competitive activity.

The criterion of effectiveness in the competitions only qualifies the offensive actions, which are ultimately the ones that determine the winner of the combat, hence their importance as a control reference, both in preparation and in the competition itself; the characterization of the karate fighter can result from monitoring the effectiveness, by determining their attack frequency, whether they are effective or not, assessing the breadth and flexibility of their tactical thinking, the level of development of the physical condition, all of which together with other aspects allows you to model your preparation. Traditionally, the statistical control of effectiveness in Karate-Do, for preparation and research tasks, has been based on the calculation of the percentage of effective attacks over the total number of attacks made, which gives a quantitative measure of the relationship which is established between the total number of attacks made and the number that is effective, this is obtained through the following formula:

$$\% \text{ effectiveness} = (\text{num. Ae} \times 100) / \text{total Ar}$$

Formula 1: Percent Effectiveness Formula.

According to the prominent researcher of judo and combat sports in general, Dr. M. Copello Janjaque, the previous formula is insufficient because a statistical analysis between two opponents in a combat where the opponent A) wins by a wide advantage of points could be the same as the percent effectiveness to B). Therefore, he suggests including in the effectiveness the Qualitative Index of effectiveness which takes into account the score as a variable [7].

$$Ice = \left( \sum_{i=1}^n (Ae \times Va) \right) / n$$

Formula 2: Effectiveness Index Formula.

Where: Ice = Qualitative index of effectiveness Ae = Effective attacks Va = Assigned value n = Total effective attacks. This last formula expresses more objective information about reality, by taking into account the value assigned to each of the scoring methods. For the Effectiveness Index Formula, it is necessary to know that the assigned value depends on your score according to the World Karate Federation as shown.

The scores are as follows:

- a) IPPON Three points
- b) WAZA-ARI Two points
- c) YUKO One point

The use of the above two formulas to assess and analyze effectiveness is called comprehensive effectiveness analysis.

### **Tools and technologies to develop the proposed computer system.**

The studies carried out made it possible to verify that in the country there is no computer system to evaluate the effectiveness of the attack by karate fighters. Therefore, a computer system is proposed for the evaluation of the effectiveness in the attack of karate fighters with the use of the following tools and technologies.

### **Information management systems.**

Data and information management is one of the most important aspects of any computer system. Therefore, information management covers different activities such as collection, storage, recovery, dissemination to indicated places and people, as well as the use made of them for various activities within an organization.

A system is a set of interacting elements. This is its basic definition. An important nuance can be added to this definition and that is that behavior as a whole arises from their interactions. For this reason, it is

important to bear in mind that the systems present a certain character of a more or less organized totality.

Systems that work with “informative” elements (data, documents, objects, information) are called information systems. According to Buckland, “a system is an information system if it is used as an information system; especially if it has been designed to be used as an information system”.

This definition clearly expresses that information systems respond to the satisfaction of needs of an organization or of an individual or group. Therefore, they are designed to respond to specific objectives and in their operation, they constantly try to verify their degree of efficiency. Therefore, the vital element of an information system is its use. According to Muñoz Cruz "an information system is a set of elements or components related to information that interact with each other to achieve an objective: to facilitate and/or retrieve information".

For these reasons it is considered that the proposed solution must be based on an information management system and be considered as such; Thus constituting a pillar for its development with the set of tools, technologies and models based below.

### **Java programming language.**

The most popular programming languages today are: Java, C and Python among others. This is confirmed by the TIOBE Index in its last update in January 2019. This index is very useful if you want to make a strategic decision regarding which language to use to build certain software. For the development of the computer system, version 1.8.0\_162 was chosen. This language was selected for the following characteristics:

Its readability and simplicity makes it one of the most widely adopted programming languages. Since 2001 it has remained in the top positions, reaching number two as the lowest of all in March 2014 and currently number one on the list.

Java is a general-purpose, concurrent, object-oriented programming language that was specifically designed to have as few implementation dependencies as possible. Its intent is to allow app developers to write the program once and run it on any device. Java applications are generally compiled to bytecode (Java class) that can run on any Java Virtual Machine (JVM) regardless of the underlying computer architecture. In addition, for other characteristics such as:

- Broad support from the open source community.
- Fully object-oriented programming: Java's conception of treating any component as an object, so it has a high level of reusability.

- Safe: Security barriers were implemented in the language and in the execution system in real time.
- Portable: Specifies the sizes of its basic data types and the behavior of its arithmetic operators, so that programs are the same on all platforms.

## Frameworks

### Hibernate

Hibernate is an ORM (Object-Relational Mapping) system that allows application objects to be stored in relational database system tables using metadata that describes the relationship between the objects and the database, and does so in a transparent and autonomous. For this project, the Hibernate 5.4.1. final version and its JPA (Java Persistence API) implementation were chosen. JPA is the persistence API (Application Programming Interface) developed for the Java EE platform (specification, informally considered a standard).

Hibernate is based on a philosophy of mapping Java objects, also known as “POJOs” (Plain Java Objects). With Hibernate it is not necessary to write specific code in our objects or make them inherit from certain classes. One of the main features of Hibernate is its flexibility, wrapping everything under a common framework.

According to the Hibernate Official Page [12] its main features are:

- Language persistence. In its operation, hibernate generates the SQL sentences (domain-specific language that gives access to a relational database management system) and frees the developer from manual handling of the data resulting from the execution of said sentences, maintaining portability between all databases with a slight increase in execution time.
- High performance. Hibernate has a double cache system which allows for high performance.
- It is scalable, it has a double-layer cache architecture ready to grow without losing quality in the services offered.

### JavaFX

JavaFX is a set of graphics and communication packages that enable developers to design, build, test, debug, and deploy rich Internet application applications that seamlessly operate across various platforms. For the development of the proposed computer system, the JavaFX version 8.0.162 was chosen due to the following characteristics:

- Makes an abstraction of the layers through the use of the MVC pattern (Model View Controller) allowing to take advantage of this pattern.



- The appearance of JavaFX applications can be customized with the use of Cascading Style Sheets (CSS) that separate the appearance and styling of the application logic so that developers can concentrate on the code.

### **PostgreSQL database management system.**

A database manager is a system that allows the creation, management and administration of databases, as well as the choice and management of the necessary structures for storing and searching for information in the most efficient way possible. Among the most used at present, PostgreSQL and MySQL stand out. Of these two managers, PostgreSQL version 9.6 was chosen due to the following characteristics:

- Wide variety of native data types.
- Extensible, the source code is available to everyone at no cost.
- It implements the use of rollback (an operation that returns the database to some previous state), subqueries and transactions, making it work much more efficiently, and offering solutions in fields where MySQL could not.
- Stability and Reliability in contrast to many commercial database systems, it is extremely common for companies to report that PostgreSQL has never crashed in several years of busy operation.

### **NetBeans Integrated Development Environment (IDE)**

An IDE is a programming environment that has been packaged as an application program, that is, it consists of a code editor, a compiler, a debugger, and a graphical interface builder. IDEs can be stand-alone applications or they can be part of existing applications. [fifteen]

NetBeans IDE version 8.0 was chosen to develop this project because it has the following features:

- Integration with Version Control Systems.
- Syntax Recognition.
- Extensions and Components for the IDE.
- Integration with Hibernate Framework and JavaFx.
- Debugger.
- Import and Export projects.
- User Manual and Help.

There is also a significant number of modules to extend the NetBeans IDE. In addition, it is a free and free product with no restrictions on use.



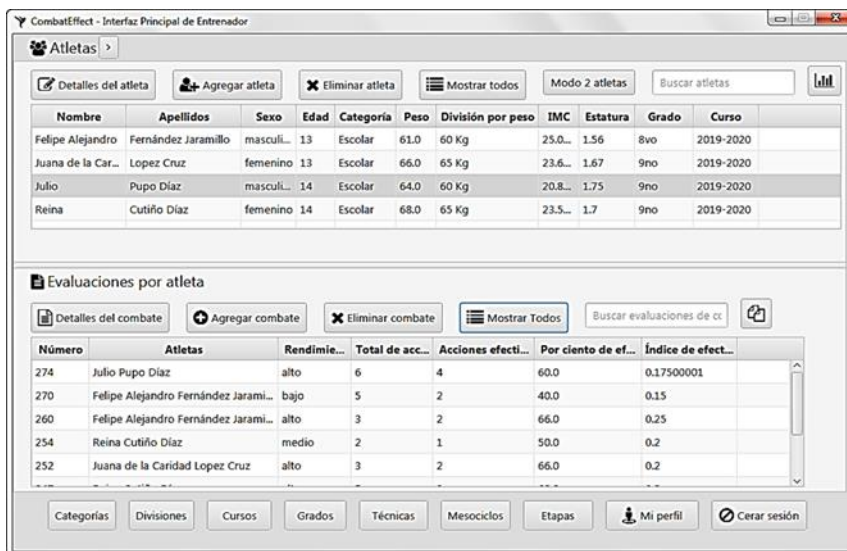


Figure 1. Main graphic interface of the trainer user.

When opening the application, the first interface displayed is the authentication interface. From this interface, the user is authenticated with his username and password. If the trainer type user accesses the main trainer interface with all its functionalities. This interface is shown in Figure 1. In the first row of buttons there are the buttons that allow you to manage the athlete's data, a button to activate the two athletes modality that is described later and a text field that immediately when typing filters the athletes whose first and last names match the written text. Below the athlete table there is another button bar that allows you to manage the data of the athletes' fights and a text field allows you to filter the fights according to the name or surname of an athlete. Below the table of evaluations by athletes there is a horizontal group of buttons that allow access to other graphic interfaces such as: categories, divisions, course, my profile, close assignment, among others.

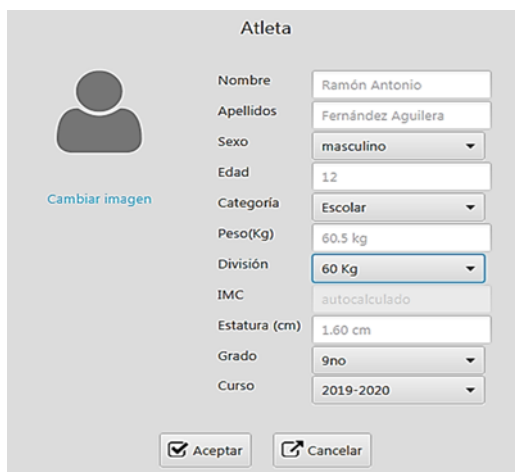


Figure 2. Athlete interface.

In the Athlete graphic interface, the coach has the possibility of creating an athlete with the attributes that he establishes. By clicking on the accept button, if you fill in the data correctly, the athlete and his attributes are inserted into the database. This interface is also used to modify the data of an athlete.

In the main interface, the coach user selects an athlete and clicks on the create combat button, the combat description interface is displayed as shown in figure 4. From this interface, the techniques applied by the athlete are established, in this case a single athlete. Clicking on the accept button saves the combat data as well as the evaluations and techniques applied by this athlete.

In the main interface, the coach user can select the mode “2 athletes mode” which shows a second table of athletes below the first table of athletes. In this modality it is possible to choose two athletes as participants in a match. By selecting two athletes, one in the first table of athletes and the other in the second table of athletes, by pressing the add combat button, the athletes are loaded in the combat description interface. The combat description interface is shown below in Figure 5.

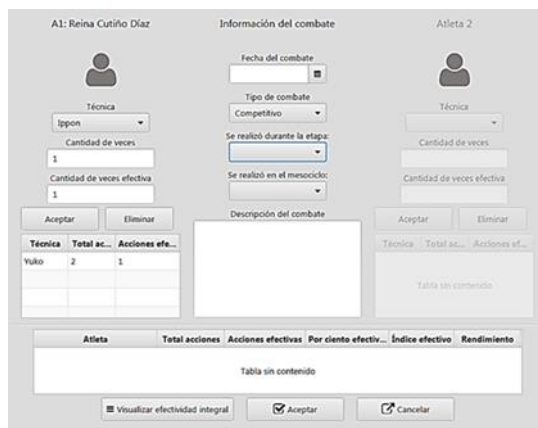


Figure 3. Combat description interface for an athlete.

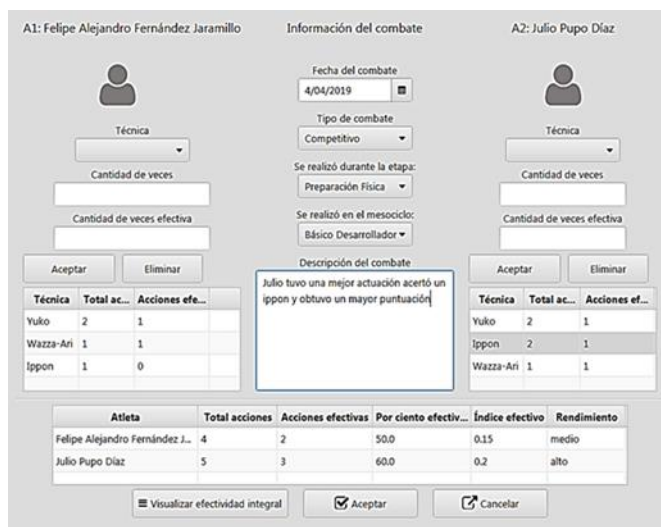


Figure 4. Two-athlete mode combat description interface.

Nombre de técnica
Ippon
Wazza-Ari
Yuko

Figure 5. Techniques interface.

As can be seen in this interface, there is the first selected athlete and his techniques applied in the combat, with the accept and delete buttons above the small tables of the applied techniques, it is possible to delete and add applied techniques of that athlete to the current combat. In the middle panel, between the two athletes is the information of the fight in general. In the lower part there is a table that will initially be empty but it is possible to fill it with the calculated data (total actions, performance, effectiveness) referring to the actions carried out by each athlete when pressing the button display integral effectiveness. To save the changes, click the accept button. If you are not interested in saving the data, close the interface with the cancel button.

There are several interfaces that can be accessed from the main interface, such as the Techniques Interface in Figure 6. From this interface, coaches can perform technique management operations: create a technique with its value, update the data of a technique and eliminate it by means of the buttons of the same name. You can return to the main interface by pressing the go to main button.

Nombre de la etapa
Competitiva
Preparación Física
Transición

Figure 6. Stages interface.

The Stages Interface is also accessed from the Main Interface. In the Stages Interface, as shown in Figure 7, the management operations of the same are carried out in correspondence with the respective buttons create technique, update changes and delete.

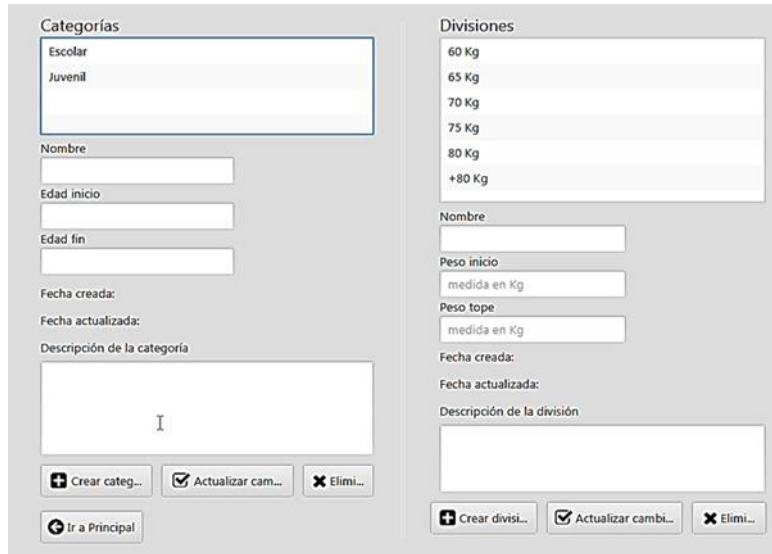


Figure7.Category-Division Interface.

The Category and Divisions interface in Figure 8 is accessed from the main interface by clicking on the category button or the division button. From this interface, the trainer user can add categories, delete them and update their data. In addition, it allows you to manage the divisions, delete them and update their data.

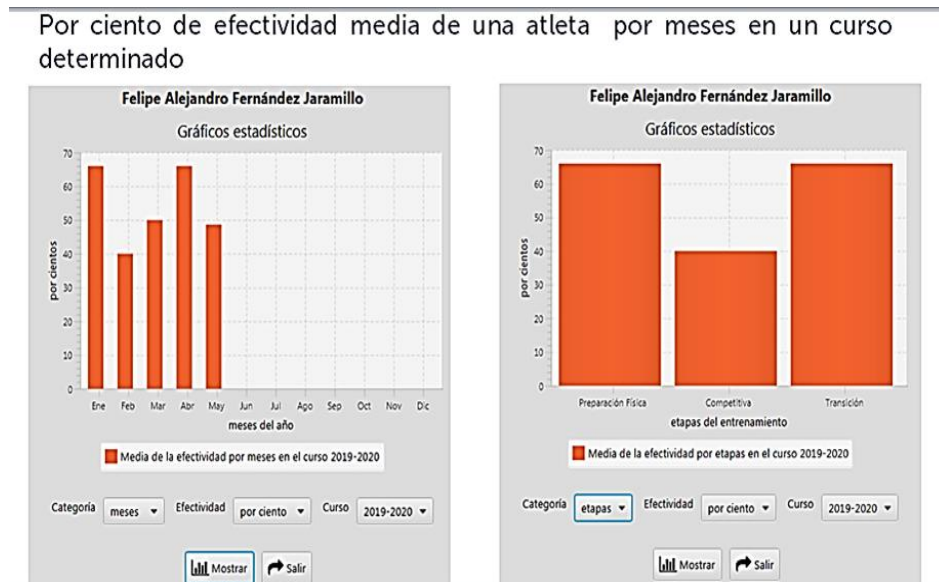


Figure 8. Statistical graphics of effectiveness by stages, months and courses.

Through the statistical graphs, the group of requirements is fulfilled, show statistical graphs. It allows coaches and supervisors to obtain valuable information on the effectiveness of athletes in combat such as: The average effectiveness percentage and the average effectiveness rate of an athlete by stages and by months in a given course.

## **CONCLUSIONS**

1. The analysis of the consulted bibliography and previous works allowed us to determine the referents that support the theoretical framework of the investigation.
2. In the diagnosis made to the process of evaluating the effectiveness in the attack of the karate fighters, it was possible to verify that there are several insufficiencies that constitute limitations in carrying out the process.
3. Through the use of the Java programming language, the Hibernate-JPA framework, the PostgreSQL database manager, the graphical interfaces built with JavaFX and following the phases of the XP methodology, a computer system for the evaluation was implemented and implanted. of the effectiveness in the attack of the karatecas.
5. The results of the tests together with the opinion of the EIDE trainers "Pedro Díaz Coello" allowed to corroborate that the computer system satisfies the requirements determined by the client, and in this way the objective of the investigation was fulfilled.

## **BIBLIOGRAPHIC REFERENCES**

- F. R. Oscar, “¿Cómo marcha el proceso de informatización de la sociedad cubana \_ Cubadebate,” Cubadebate, 2018?
- J. L. González Ramírez, “Sistema Informático para Evaluar La Preparación Física de los Taekwondistas Juveniles del Sexo Masculino De La Provincia de Holguín.,” 2009.
- S. F. Teruel Fernández, “Software de gestión del entrenamiento de los judokas de la Escuela de Iniciación Deportiva Escolar de Holguín,” Universidad de Holguín, 2018.
- I. Sánchez Nodarse, “Control y evaluación de la preparación táctica del karateca de alto rendimiento,” 2012. [Online]. Available: <http://www.efdeportes.com/>. [Accessed: 10-Dec-2018].
- G. Funakoshi, KARATE-DO KYOHAN, Primera Ed. Japón: Kodansha International, 1973.
- I. Sánchez Nodarse, Programa Integral de Preparación del Deportista de Karate Do. Cuba: 2013.
- M. Copello Janjaque, “El Judo \_ control del rendimiento táctico.” Revista Digital -Buenos Aires, 2003.
- WKF, Reglas de competición de kumite y kata. Madrid, España: Federación Mundial de Karate, 2018.
- G. Ponjuan and M. Mena, Sistemas de Información: Principios y Aplicaciones, no. 2015. La Habana: Universidad de la Habana, 2015.

“TIOBE Index for January 2019.” [Online]. Available: <https://www.tiobe.com/tiobe-index/>. [Accessed: 14-Jan-2019].

Los 10 lenguajes de programación más populares en la actualidad.” [Online]. Available: <http://noticias.universia.com.ar/consejos-profesionales/noticia/2019/02/22/1136443/conoce-cuales-lenguajes-programacion-populares.html>. [Accessed: 14-Jan-2019].

Your relational data. Objectively. - Hibernate ORM,” 2019. [Online]. Available: <http://hibernate.org/orm/>. [Accessed: 15-Jan-2019].

“JavaFX,” 2018. [Online]. Available: <http://www.oracle.com/javase/javase-clienttechnologies>. [Accessed: 20-Jan-2018].

G. Cuba Ricardo, POO Conferencia visual JavaFX. Holguín, Cuba: 2017.

“NetBeans,” 2018. [Online]. Available: [https://netbeans.org/index\\_es.html](https://netbeans.org/index_es.html). [Accessed: 15-Jan-2019].

Selecting a development approach. Centers for Medicare and Medicaid services, 2008, pp. 1-10.

P. Letelier and C. Penadés, Metodologías ágiles para el desarrollo de software: eXtreme Programming (XP). 2003.

I. Sommerville, Ingeniería de Software, NOVENA ED. México: Pearson Educación de México, 2011.

R. S. Pressman and D. Ph, Ingeniería del software. Un enfoque práctico, 7th ed. 2010.

K. Beck and A. Cynthia, Extreme Programming Explained: Embrace Change, Segunda Ed. Massachusetts, Estados Unidos: Pearson Education, Inc, 2005.