



UNIVERSIDADE CATÓLICA PORTUGUESA

**Implementation of Business Analytics tools
in a padel club - *Quinta de Monserrate***

Bernardo Nuno Alves de Vaz Moreira

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UNIVERSIDADE CATÓLICA PORTUGUESA

Implementation of Business Analytics tools in a padel club - *Quinta de Monserrate*

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BERNARDO NUNO ALVES DE VAZ MOREIRA

under the guidance of

PROFESSORA VERA MIGUÉIS

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Abstract

The purpose of this Master’s Final Assessment (MFA) is to describe the implementation of Business Intelligence and Analytics (BI&A) in the sports industry. In a nutshell, BI&A is a technology-driven process focused on data management solutions, which aims to collect and analyze information to improve the decision-making.

Although many studies were conducted across the sports industry, there is still a lack of investigation on padel. This sport is rising across the globe and is well-known for its strong social component and easiness to play. For instance, since 2011, the number of padel courts in Portugal rose as much as 700%. In Portugal, and similar to other southern European countries, the industry is competitive, and clubs are growing exponentially without any concrete business plans, raising the question, “would they improve any competitive advantage and value added if implementing BI&A?”

This project aims to develop a successful application of analytic tools to improve the decision-making of Quinta de Monserrate (QM), one of the padel clubs pioneers in Portugal, across all their value chain.

From an operational perspective, padel classes are intended to deliver a more complex view of the athletes based on structure data. It was intended to improve the learning process of each individual by reaching new insights about the presences and characteristics of the game.

For this purpose, two different systems were developed, i.e. one regarding the attendance in classes and the other the evaluation of the athletes. Both retrieve

structure data that was then used to create visualization tools and compute deep analysis. This analysis is expected to find subgroups within the training's groups already assemble, according to new insights obtained with the data collected.

As a result of this MFA, the coaches have two reliable systems to control attendance and the evaluation of the athletes that impact the decision-making process and the time wasted in the organization of the systems.

Keywords: Business analytics, Sport, Padel, Quinta de Monserrate, Cluster analysis

Resumo

O propósito deste Trabalho Final de Mestrado (TFM) é descrever a implementação de Business Intelligence e Analytics (BI&A) na indústria do desporto. Resumidamente, BI&A é um processo tecnológico focado na gestão de dados, que têm como objetivo principal, analisar informação para melhorar o processo de decisão.

Embora, já muitos estudos foram feitos na indústria do desporto, ainda existem uma lacuna no que diz respeito ao padel. Um desporto que está a crescer em todo o mundo, e que é conhecido pela sua componente social muito forte e a facilidade de se jogar. Por exemplo, desde 2011, o número de campos em Portugal atingiu um crescimento de 700%. Em Portugal, e igualmente noutros países do sul da Europa, a indústria é competitiva, e os clubes estão a crescer exponencialmente sem nenhum tipo de plano de negócio em concreto, levantando a questão, "será que os clubes ficariam com algum tipo de vantagem competitiva e valor adicional se implementassem BI&A?"

Este projeto têm como objetivo desenvolver uma implementação bem sucedida de ferramentas de análise para melhorar o processo de decisão da Quinta de Monserrate (QM), um dos clubes de padel pioneiros em Portugal, na sua cadeia de valor.

Numa perspetiva operacional, as aulas de padel são destinadas a dar uma visão mais completa dos atletas baseada em dados estruturados. O foco esteve em melhorar

o processos de aprendizagem de cada indivíduo, usando nova informação sobre as presenças e as características de jogo.

Para este propósito, foram construídos dois sistemas diferentes, um que diz respeito a assiduidade nos treinos e o outro a avaliação dos atletas. Ambos formam dados estruturados, os quais foram usados para criar ferramentas de visualização e fazer uma análise mais profunda. Esta análise, teve como objetivo encontrar subgrupos dentro dos já formados grupos de treino, de acordo com nova informação obtida através dos dados recolhidos.

Como resultado deste TFM, os treinadores têm dois sistemas de confiança para controlar a assiduidade e a avaliação dos atletas que têm impacto no processo de decisão mas também no tempo perdido na organização dos sistemas.

Palavras-chave: Business analytics, Desporto, Padel, Quinta de Monserrate, Análise de cluster

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Chapter 1

Introduction

Business Intelligence and Analytics (BI&A) is a tool capable of analyzing and correlating thousands of data points. In padel, when analyzing data, several aspects need to be taken into account. These aspects can range from coaches, position on the field, game score, among many others. The analysis of all of them can hopefully improve the performance of the players.

Every sport has its uniqueness, and when applying analytical tools in this type of industry, it is necessary to understand its dynamics. In this investigation, the sport used as a case study was padel, a racket sport booming worldwide. The sport was created in South America by Enrique Corcuera around the '70s and the idea occurred from the lack of space at home to build a tennis court. As such, he decided to build a similar court surrounded by high walls with a net dividing the court into two equaling sides. This phenomenon quickly spread to Europe and, consequently, to Portugal in 1994.

While some studies were conducted across many other sports such as football, baseball and tennis, research on BI&A and padel tennis remains to be investigated. In this context, this dissertation will focus on the implementation of BI&A in padel with

the goal of improving the quality of padel classes by offering two different systems that contribute to an overview of the athlete based on attendance statistics and the quality of the game. Notably, it is expected that BI&A tools help detect potential failures to enable faster and better improvements. For further reference, the systems implemented were based on a small dataset from a local group of players and coaches called Performance Training Center (PTC). For data protection purposes, the athlete names are covered through this document.

This thesis is divided into six sections:

1. The first one contains the motivation, primary goals, and the structure of this dissertation.
2. The second section includes the literature review about this investigation, and therefore approaches the several fields of analytics inside sports and in particular padel.
3. The third presents the case study QM, where it introduces the company and contextualizes the padel business.
4. Section four describes the methodology used in the construction of the systems and how the computation of the cluster analysis with the data collected from the evaluation system was made.
5. Section five presents the results and discussion, exposing the implementation results, where a quantitative approach and the new features added from the first system will be analyzed, such as the cluster application for the second. Moreover, following this line, it will be shown a comparison between the perception that the coaches have about their athletes and the data analysis that was done.
6. The last section highlights the main conclusions of this investigation and recommendations regarding the future directions to a complete implementation of the solution developed in the entire club.

Chapter 2

Literature Review and Contextualization

Data analytics is the process of collecting and analyzing large amounts of data, enabling the extraction of information which can be applied in multiple sectors, being each application unique thanks to its peculiar feature. With the constant use of innovative technology, big data analytics has gained a significant importance in everyday life and sports analytics are definitely not an exception. This idea was defended by Millington and Millington (2015) emphasizing the impact that the film of Miller (2011) had in the sport performance, and also differentiating the range of usefulness by describing what was done by the Australia's New South Wales Waratahs rugby team. This team adopted an analytical approach to control the level of intensity in each rugby practice, with the goal of decreasing the risk of injury.

2.1 Data in sport field

Basole and Saupe (2016) show that sports analysis uses a great variety of tools based on data to allow organizations, coaches, and players to have a worldwide perspective on the field. Data analysis can result in an improvement of the athlete's performance by adapting the training, and also in progress in terms of competitiveness. Variables such as the number of passes completed, forced errors, and smashes are indicative information for a player which will allow his progression and can also be used to assess the opponent's statistics.

The film of Miller (2011), inspired by the book written by Michael Lewis and based on the true story of the Oakland Athletics (A's) baseball team, is a well-known real-life example of analytics implementation in the sports industry. At the beginning of the season, Oakland A's, a small team compared to Red Socks, was facing a budget constraint, which did not allow them to purchase what was perceived by the market as valuable players. For Billy Beane, the team manager, this situation was an "unfair game", since the team who invested the most money in players would have the highest likelihood to win the championship. In Figure 2.1, the relationship between the soccer team's revenue spending and league position change compared to the previous year is shown. This figure goes accordingly with the Billy Beane argument. One might question across the sports industry if that is why the top 5 teams usually are the same, and that is because higher revenues are associated with a better league position. Nevertheless, for the first time in baseball scouting, Billy decided to use statistical data to analyze and find valuable players disregarded by most teams for intangible reasons, such as poor appearance or weird throwing. This allowed to form an unique team, capable of adapting the training to its players and win games. Since then, the system invented by Billy Beane and Paul DePodesta became revolutionary and widely used.

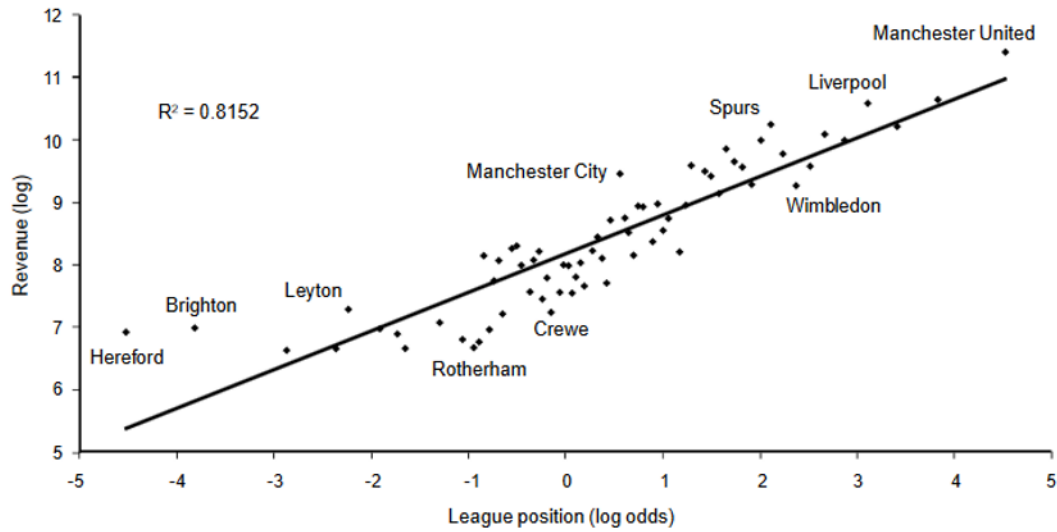


Figure 2.1: Revenue and league position 69 clubs 1996/7 (graphic extracted from Szymanski (1998))

According to most studies, there are two dimensions explored and analyzed in the sports industry: Financial and Sportive performance (Szymanski, 1998). While the first one examines in-depth the business as revenue, profit, and cost of a club, the latter emphasizes the individual analysis of each player or team performance. According to the same author, it seems to exist a positive correlation between the performance and the revenue of a club. For that reason, both dimensions will be described in the next sections.

2.1.1 Business analytics application:

Regarding “sports business analytics”, i.e. the financial dimension, the main goal is to collect meaningful data and reliable information to enable the sports business professionals to make crucial decisions according to the output. An efficient business analytics system should be able to increase revenues, optimize processes, reduce costs, and reduce time wasted on gathering information (Harrison and Bukstein, 2017). Regarding the improvement of sports management, Harrison and Bukstein (2017) referred five business analytics application areas in the sports industry as examples

of the extensive range that this market can have: ticket pricing and sales inventory, customer relationship management, social media and digital marketing, fan engagement and sports event experience, and corporate partnership (Return on Investment (ROI)).

1. *Ticket pricing and sales inventory:*

According to Drayer et al. (2012), most sports played in teams try to increment their attendance during the season and, consequently, their revenues. They mainly focus on collecting data and creating new features that can be decisive for pricing the ticket and fulfilling their revenues and attendance expectation.

An example described by Harrison and Bukstein (2017), was the case of the baseball team “Cleveland Indians”. They brought all the data together about the season ticket and found a decrease in certain premium areas of the stand. Afterwards, they launched a survey to better understand customer priorities and behaviors, considering specific variables such as seat location, food, and ticket-price characteristic. After conducting the survey, they increased 6% in the actual revenue, which according to Gershenfeld (2015) resulted in better price segmentation that gave lower average ticket prices with anticipated growth in attendance.

2. *Customer relationship management:*

A CRM system helps companies to develop a profitable relationship with their customers. The concept can be useful in order to find strategies capable of reaching and interacting with each customer. Generally, companies use historical data to draw profiles and close the gap between company and client, providing an adequate personalized experience for the customer.

Typically, a CRM system tries to find correlations between customer information and purchases to be able to improve the experience. A very interactive example of that was exposed by Sutton (2016). The ice hockey team Tampa Bay Lightning together with the innovative fan engagement company Enthrall Sports created an app that allows evaluating the fan experience in the game. “FanCap” app

allows the club to collect valuable information about the reaction of fans on particular commercials or even by assessing the music library of the cell phone to acknowledge the most popular songs amongst their fans. With this data available, they make sure that all commercials and songs during the game are pleasing to their public.

3. *Social media and digital marketing:*

In the sports industry, organizations focus on analyzing two groups of metrics to evaluate marketing campaigns: impression-based metrics (e.g., website page views, number of likes in their social media account, among others) and attention-based metrics (e.g., measuring the quality, authenticity, and extensiveness of consumer engagement) (Spanberg, 2016). According to the same author, these metrics help sports clubs determine their social media posts and digital marketing campaigns. Nowadays, since we are in a digital era and social media is part of our daily routines, it is a valuable tool when trying to reach customers.

4. *Corporate partnership ROI:*

According to Harrison and Bukstein (2017) there exist several metrics to validate the effectiveness of the sponsorship as being the more known the sponsor cost per consumer money spent. In spite of that, Mondello and Kamke (2014) explained how a corporate partnership still not quantify the expected ROI, in the area of sports.

To conclude, an empirical study reported by Troilo et al. (2016) about the adoption of analytics by professional sports organizations proves that the “Analytics index” (measuring data collection, analysis, and planning) and revenue are correlated. In fact, in this study, it was verified an increase of the revenue by 4.2% in the year following the based analytic decisions. It is essential to highlight that when conducting a business analytics implementation regarding the aforementioned areas, one should expect the results to be highly dependent on the amount of data available, which is a limitation for most of the small and local sports clubs.

2.1.2 Players performance analysis

The analysis of the performance of a given player is an usual topic in sports studies because they predetermine performance and establish a relationship between players and game events that define the course of the game.

According to Ofoghi et al. (2013), performance analysis aims to create and analyze a valid record of athlete performance by using systematic observations. From the point of view of Sands et al. (2017), there are three different purposes of monitoring performance that are mainly connected with feedback information and effectiveness in training. Viru and Viru (2001) referred five principles for training monitoring (listed below), pointing that this process should not overload the athlete with more training but should instead be combined into the athlete's training program:

- * This is a process carried out to increase training efficiency;
- * This supports the changes in an athlete during several stages of training (training session, competition, microcycles of training);
- * This is a highly unique process, that depends on various features as the sport, performance level of athlete, and age/gender differences. Whence, each training control must be made regarding the sport and the athlete;
- * The information provided by the training monitoring must be accurate according with the goals previously settled;
- * Moreover, this information has to be structured and meticulous, to ensure that crucial adjustments can be set;

Regardless of the unpredictability and the evident request of the game's choices, most sports coaches' decisions have been based on what they see and detect during the match and training. Although more experienced coaches may detect a wide range of

errors and give quick feedback on their knowledge in the field, performance analysis leveraged by data may decrease the common mistakes of players and improve their performance.

In the “Moneyball” movie, it is possible to see the difficulty of adapting this type of disruptive idea in the game when multiple stakeholders are involved. On the one hand, the general manager of Oakland Athletics wanted to implement a new way of evaluating players and study their best qualities. However, the coach did not trust the process, since his vision about the game was supported by years of experience on the field. The difficulty in yielding is portrayed with various discussions until the general manager had to force the implementation. The results appeared in the form of twenty consecutive victories, which is in the top three Major League Baseball longest winning streaks until today.

2.2 Padel

Considered one of the fastest-growing sports across Europe, padel is a racket sport, played in pairs in a rectangular field, completely closed by large glasses (20 meters long and 10 meters wide). This sport is having a tremendous development in recent years in countries such as Portugal, Spain, and Argentina.

Padel started to be played in Portugal in the 90s decade by the hand of a Spanish company that built the first padel court in Lisboa Racket Center. Although at first it did not have massive popularity, nowadays, it is spread across the country with more than 80,000 casual and professional players counted by the Portuguese padel Federation in 2019. In Figure 2.2, it can be seen a trend that indicates a positive evolution regarding the number of padel courts in Portugal since 2011.

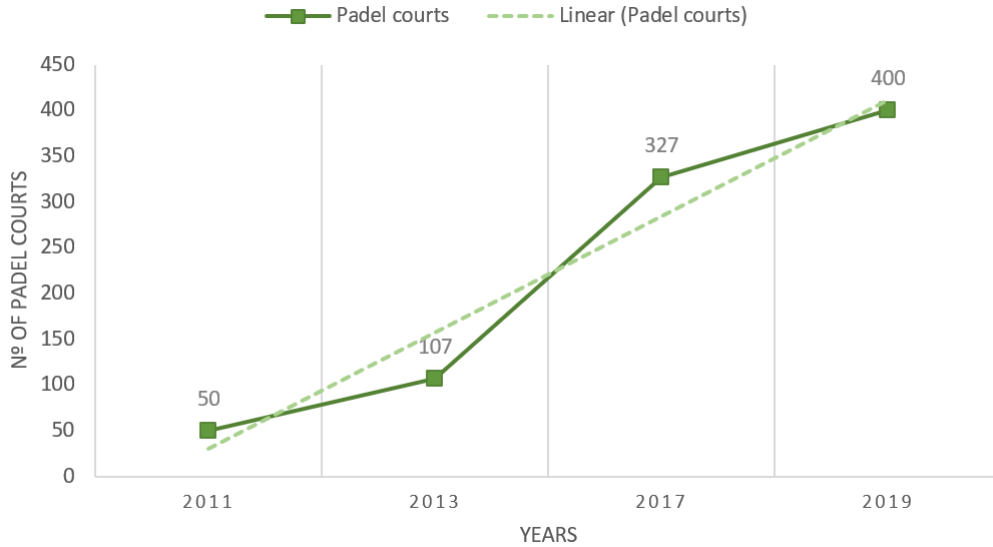


Figure 2.2: Evolution of padel courts in Portugal (data extracted from noa (2014), noa (2019), Duarte (2017))

The attractiveness of the sport has been increasing since then, not only due to the social component, played in pairs, but also due to the easiness of practicing it when compared to tennis, which contributes to a faster improvement. Many professionals consider a “healthy addiction” with a retention rate between 80%-90% (Fernandes, 2013).

2.3 Different market and opportunity of raising

As mentioned before, an analytics implementation inside the sports industry can be related to the business itself and performance, depending on the data collected and their reliability. Considering the exponential growth of padel, clubs can look to an analytics implementation as a tool that can help them to follow this trend and fulfill the customer’s needs.

Considering the similarities between tennis and padel and the lack of research around the economic side of a padel club, the study made by Fernandes (2013), brought

some numbers that can be adjustable. According to the author, tennis lessons can constitute 70% of the revenues in a Tennis Academy. Although the study focuses on a different sport and in a club turned to the academy, in a padel club, the classes must be considered to the success of a club in terms of revenue.

Being padel a new trend emerging across Europe, people are eager to learn it, which leads to an increase in demand for padel lessons, forcing clubs to hire inexperienced coaches while trying to retain quality and capacity. Nowadays, they focus on maintaining capacity by hiring less experienced coaches while keeping quality. According to nº1 and 2 of the Article 35 law 5/2007 of 16/January, all the coaches are required to obtain a certificate issued by the Portuguese Federation to be eligible to provide lessons. Despite the certificate, a difficulty of amateur coaches is to identify the weaknesses and strengths of their athletes.

Until today, it cannot be found a vast number of studies about the performance of a padel player. However, there is some literature centered on studying some aspects of a game, namely the duration of the point/length of the rally and the frequency of each stroke. Were found three different articles that which one focuses on a unique aspect of padel.

Almonacid-Cruz (2011) analyses the frequency of each stroke with great prominence in feminine and masculine competition. In other hand Carrasco et al. (2011), focus in the physiological demand during a padel competition using metrics such as mean oxygen uptake (VO_{2mean}), mean heart rate per min (HR_{mean}). Finally, Cañas and Ibáñez (2014), highlights different aspects during the game like the position on the field during a point and the likelihood to win according to it.

The construction of a training evaluation model, hoping to give coaches more intuitive, reliable, and updated information, may be an enormous input for a padel club. The most recent study about game dynamics in padel, reported by Courel-Ibáñez et al. (2019), introduces a model that allows comprehending player's dynamics according to

technical, spatial, and effectiveness indicators, with data collected through systematic observation.

As referenced by Almonacid-Cruz (2011), the capacity to give reliable information about the players' states is limited to the evaluation made by the coaches, who are able to collect real-time information and do not appeal to a software. Although systematic observation is a popular procedure for the evaluation of performance, it is not reachable for amateur coaches. Thus, remain an opportunity to innovate and increase the quality of their service. Moreover, the software can also be an interesting tool for experienced coaches as a complement to their training.

Chapter 3

Introduction to the case study

Quinta de Monserrate (QM) is a known padel club which was created in 2015 by a group of young Portuguese entrepreneurs who came together to develop an ambitious and innovative project in Porto. They were inspired by what they saw across the borders, mainly in our neighbor country Spain.

Without much competitiveness in the market at the time, the club had a tremendous impact on the evolution of padel in Portugal. The most memorable year for the club was in 2018, when they won the award for the best club in Portugal. Until today they are a reference for the practice of padel, and they already have five different clubs in Porto.

As said in the introduction, the MFA will be focused in the players of the Performance Training Center (PTC). To have a bigger understanding of the studied individuals, a survey to understand their behavior according to their training was done.

In this section, the case study will be presented with a general point of view and then, for the padel business in more detail. Afterwards, the results from the survey will be shown. And finally, the PTC attendance system which in the end of this MFA should be replaced, which will be described.

3.1 Company used as case study

The quality and the know-how about sport are vital elements to face the competitors in a market where the demand is growing exponentially. This is a business where social contact has a great impact on the client, and therefore, the fundamental pieces in a club are the people involved around it.

As an emergent sport, it is not easy to find specific values regarding the market share of the club. Nevertheless, being the second club to open in Porto and already counting with five clubs, it can be deducted that they hold a big percentage in the city market. Another well-established club in Porto is Top padel, which was the first club in Porto. QM club presents different sport activities like padel but also has tennis courts where they have a big academy for young players.

Nowadays, in the club's structure, there are normally three partners and two main departments, i.e. financial and operational. In the financial department, the management of the economic side of the business such as the fees for athletes, the investment in the different courts is controlled. In the operational department, the coordination between athletes, coaches, departments, and with the other remaining clubs is done. These departments work along with four other departments (Figure 3.1).

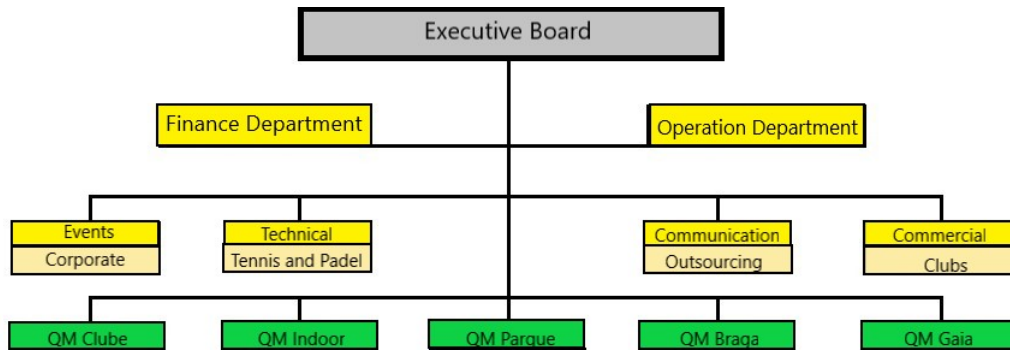


Figure 3.1: Quinta de Monserrate structure

These departments are:

- **Events:** Responsible for all the events that happen in the different clubs. For example, the tournaments in the weekend, team building events, and others.
- **Technical:** Accountable for managing the daily routines of the clubs, for example classes and coaches, the courts and the reservations.
- **Communication:** Liable for the communication of Monserrate. In 2020, the club decided to outsource this department to reinforce its presence in the market.
- **Commercial:** Responsible for the stores that exist in the different clubs, controlling stock and orders.

This project was developed directly with the manager of Quinta de Monserrate Indoor and side-by-side with the technical department to expand the project for all QM clubs and coaches, if possible.

3.2 Padel Business

As said above, our primary focus will be Quinta de Monserrate Indoor, more precisely, the classes process. Firstly, it is essential to understand the impact of this process on the business. For data protection reasons, the club did not give concrete values in terms of revenue, only sharing the total percentage of each revenue source from 2017 until 2020.

Three different sources of revenue are acquired: the classes, rentals of courts, and the material sold in the shop (water, rackets, balls,...).

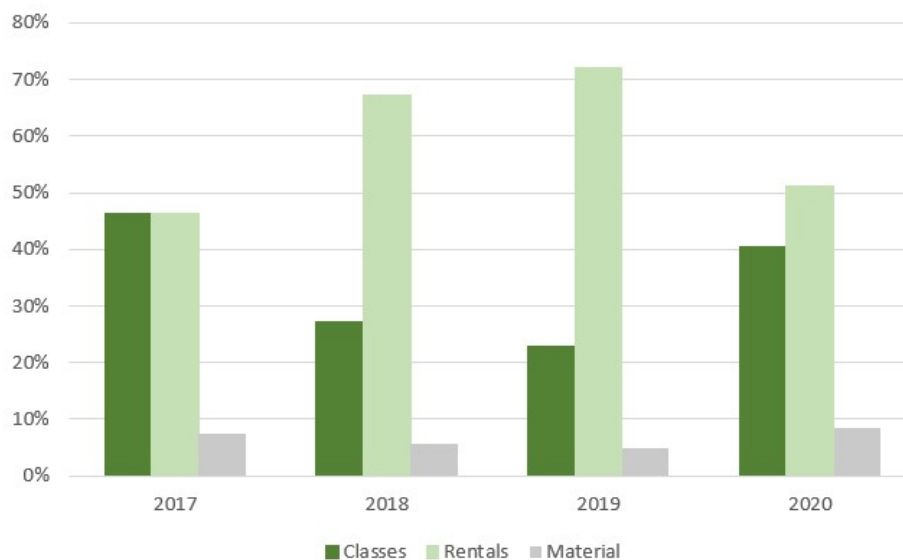


Figure 3.2: Percentage of revenue per source

Figure 3.2, shows that a significant part of the revenue comes from the classes and rentals. It is crucial to notice that in 2018 and 2019, in terms of percentage, the rentals gained a considerable relevance, whereas in 2020, these numbers surprisingly almost became on par with each other, in a year that the social interaction was highly inadvisable, because the pandemic situations. The average rate that the classes have, over these four years, is 34%, which presents an important share of the revenue, being able to impact directly the success of the club.

3.3 Survey & Client Segmentation

The survey aimed to collect information about the profile of the athletes that will be used in this project as a sample, enabling a client segmentation in padel. Only athletes who make part of PTC had the opportunity to respond to this survey, not illustrating the general number of padel players/clients. In total, the survey had 98 respondents, which symbolizes 70% of the PTC players, and can be seen in the Appendix A.

This survey was conducted to add some new insights about the clients that the club has. Firstly, the focus was on personal aspects of the athletes, and it was concluded that there is a male predominance in practices and the majority are players above 30 years old. It could also be noticed that in some cases they already had some previous sportive interaction and in others, who did not have this previous habit, padel proved to be a possible route to become more active.

Secondly, the clients' relationship with the modality and training was also evaluated. Concerning their level of the game, on average, they considered themselves in level 3, on a scale of 1 to 5, where one is the best. On average, they played four times per week, already counting at least one training.

Lastly, the survey had some questions regarding the satisfaction of the client and aspects that can be improved, where the athletes left no doubt that they are satisfied with the service offered by PTC. In Appendix B, one can observe a summary of the characteristics of a typical PTC athlete.

3.4 System previously in use

This section will present the PTC attendance system used since its creation. The adopted system was already used by some coaches of QM. The PTC attendance system uses Google Sheet as a platform, especially because it allows permanent access.

It is important to mention that QM does not have a predefined system for all the coaches in the club, which causes great disparity of the organizational system. This inconsistency impossibilities a quick and easy analysis, especially if the objective is to attempt to perform a historical analysis. In this section, the file that will be presented is the one used currently in PTC, before the implementation of the system developed in this MFA.

The Google Sheet file contains several sheets interconnected with specific rules to try to standardize the filling. To facilitate the explanation of the platform used, the sheets in the file will be presented, followed by a brief description of each one. The club does not perform any in-depth analysis, neither do they use any visualization tool.

In the file, they have five different sheets that are related to the athlete's attendance. They work on several other sheets associated with payments that are not the subject of this project, so they will not be presented. Due to comprehension reasons, the names of the sheets are translated. The relevant ones are:

□ **Fixed Schedule:**

In this sheet, coaches have their fixed scheduled that allows them, normally to create the sheet "*Present week*" where they note the attendances (Appendix C).

❑ **Present Week:**

A specific new sheet is created each week with the scheduled defined in “Fixed schedule” sheet and the presence of the athletes is written. And then, in the following week, this sheet is copied to “Past Attendances” sheet to be used as historical attendance of the previous week for each athlete. They define the presence with the green color, absence with red, and substitution with orange, as it is possible to see in Figure 3.3

	A	B	C	D	E	F	G	H	I	J
1	01 a 05 de Junho									
2	Hora	Segunda	Hora	Terça	Hora	Quarta	Hora	Quinta	Hora	Sexta
3										
4	18h		12h		18h		12h		10h30	
5										
6										
7										
8	19h30		12h		18h		12h		12h	
9										
10										
11										
12	19h30		13h30		19h30		13h30		13h30	
13										
14										
15	4,5 - 0 + 4,5								4,5 - 4,5 + 0	
16			13h30		19h30		18h			
17										
18					6 - 0 + 6					15 Off Peak
19										19,5 Peak
20			18h				18h			34,5 Total
21										
22										
23										
24			19h30				19h30			
25										
26										
27							0 - 4,5 + 4,5			
28			19h30							
29										
30										
31			10,5 - 6 + 4,5							
32										

Figure 3.3: Example of the sheet '01 a 05 de Junho'

❑ **Waiting List:**

In this sheet, they make a waiting list, where they keep the clients who want to practice in PTC but at the moment it is not possible to allocate them to a fixed schedule (Appendix D).

❑ **Past Attendances:**

Here, as briefly previously mentioned, the attendance of the athletes is controlled, by saving all attendance registered in the sheet “Present Week”. Mainly they complete the sheet by copy-pasting the present week under the last one (Appendix E).

□ PTC Analysis:

This sheet regards information related with payments (Appendix F). They agglomerate monthly information to control some business Key Performances Indicators (KPI's). According to the classes, they write down manually the total number of hours obtained from the “*Past Attendances*” sheet for each month.

After the implementation of the new system, developed in the scope of this thesis, they still use this file for payments, and the “*PTC Analysis*” sheet is filled with information of both systems. Regarding payment values, they search in the old system, and regarding the number and hours of practices they already use the new system.

From this established organization, it is possible to pinpoint two major problems in the system used by the club. The first one is related to the way data is stored, which makes attendance analyses very hard and is not practical. The second problem is associated with the continuous use of copy-paste function that, as mentioned by Mann (2006), might seem to make life easier, but it often leads to some inconsistencies and higher possibilities of error which are common when organizations do not automatize the processes.

Chapter 4

Methodology

Due to the lack of usage of analytical tools in padel, a system adapted to the needs of the coaches and club with the aim of gaining better athlete's knowledge and giving support to the training strategies was developed. To perform this implementation, the software used were Google Drive, Excel and the programming language adopted was Python. In the following sections it will be explain the methodology used in the construction of both attendance and evaluation systems.

4.1 Attendance system

The overall goal of this system is to provide a simple tool to the coaches for controlling the athletes' attendance. This system proves to be beneficial for the coaches to better manage the regularity of each athlete and also for the club management since new KPI's are provided, being capable of evaluating the coaches' performance.

In PTC, coaches already used Google Sheet due to the easiness of sharing information and files across the organization. Hence, the same platform was maintained to simplify the integration of the system in the club. Google Sheet is simple and offers a vast number of tools to process the data. Addition of functions and macros in the files, results in the creation of a powerful automatized tool which increases productivity in daily routines and processes.

In the next sections, the implemented system will be explained along with the process of data collection and the construction of a final dashboard.

4.1.1 Implemented system

Considering the previously used system exposed in section 3.4, the system developed in this MFA was built to overcome the limitations and difficulties formerly denoted with the addition of new features such as functions and macros to automatize the process, improving the efficiency.

The focus was to build smaller databases, easier to maintain, with information about the players, coaches and training descriptions which were presented in tables. Afterwards, an ETL which stands for "*extract, transform and load*", was built comprising all the data from the sheets and divided into different databases (DB), depending on the type of information.

The methodology used for this system can be divided in two main parts: data collection and construction of the final dashboard.

4.1.1.1 Data collection

The reconstruction of the system used was performed in order to simplify the work of all the parties involved. For that, a file with nine sheets was created which were divided into the following groups: Daily Use, Database and Analysis. The Table 4.1 shows the different sheets created and the respective descriptions.

Sheets	Segment	Description
Fixed Schedule (Appendix G)	Daily Use	Fixed schedule for a week of practice
Next Week (Appendix H)	Daily Use	Attendances notation for next week
Attendance (Appendix I)	Daily Use	Attendances control for the present week
BD Attendances (Appendix J)	Database	Database related with the attendance of the athletes
BD Coach (Appendix K)	Database	Database related with coaches that help, if necessary.
BD Praticce Descriptions (Appendix L)	Database	Database related with the description and type of classes
Athletes Attendance List (Appendix M)	Analysis	Athletes' attendance of the last and present month
Coach Attendance List (Appendix N)	Analysis	List to control the coach attendance
Monthly Hours (Appendix O)	Analysis	Analyze of practice monthly hours

Table 4.1: Sheets from Attendance file

Three of the sheets from the previous file: “*Fixed Schedule*”, “*Past Attendance*” and “*Present Week*” were reutilized and adapted. Regarding “*Fixed Schedule*”, the only change was to define the time of the day in columns to later on facilitate the data collection. The “*Past Attendance*” sheet was transformed, maintaining its functionality of keeping the past attendance, in order to compute future analysis. Finally, in “*Present Week*” the time was also set in columns, as for the “*Fixed Schedule*” and the attendance registration was transformed. In the old system, the attendance was marked based on a color scheme, as explained in section 3.4, which lead to errors of inserting the wrong colors, inhibiting the automating process. Therefore, two columns: “Pres” and “Fault” were created with a data validation in the cells below to restrict

the values written by the coaches in order to decrease the possibility of redundancy.

Furthermore, more six sheets were created. In the “Daily Use” group, “*Next Week*” sheet was built enabling the scheduling of next practices already defined with prior notice. In the “Databases” group, two more sheets were created with database functions, called “*BD Coach*” and “*BD Practice Descriptions*”. In the group “Analysis”, the different databases previously created are used to perform a brief analysis of the data. The “*Athletes Attendance List*” sheet groups by athlete the number of presences for the last and present month and also contains a column with the number of supposed practices that each athlete should have had in a given month, based on the “*Fixed Schedule*” sheet. This control can also be verified by a conditional formatting, which adds a green tone to the cell when the number of attendances in the present month gets closer to the expected number. Regarding the “*Coach Attendance List*” sheet, it was generated a list of unique values of the “*BD Coach*” sheet and calculate the attendance for each coach. Finally, “*Monthly Hours*” sheet was developed to count the number of practicing hours for each month, divided by off-peak (hours with less demand, 8:00am until 18:00pm) and peak (hours with higher demand, 18:00pm until closing) in each day and also the sum of this values, making the total number of practicing hours.

After defining the sheets, the automation of the system was performed since, as previously mentioned, the use of copy-paste function was recurrent, and it was very limiting. The best solution found inside the Google Drive software, was macros which can be recorded, but also programmed in JavaScript language which allows the addition of more customization features and the computerization of the data flow.

Firstly, a macro call “Daily Process” (Appendix P) was created, aiming to do the role of an ETL process by extracting and transforming the data from the “*Attendance*” sheet and loading to different databases. In Figure 4.1, the process of the design is defined. The script was developed for Monday and then adapted for the rest of the weekdays.

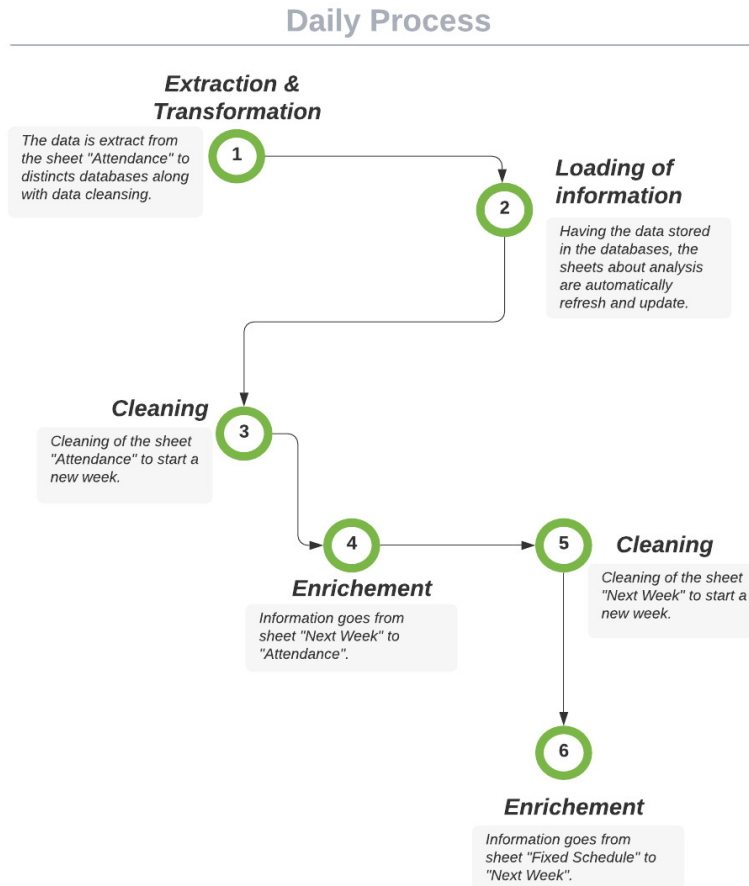


Figure 4.1: Daily process

These macros can be activated manually or by triggers previously defined in the definitions of Google Sheet. A trigger for each day of the week was created, to automate the ETL process. The triggers were activated every Saturday morning in order to assure the correct attendance registration by the coaches. Having assemble the process and the triggers, the three databases are updated once a week as the analysis sheets. In case the coach does not register in time, a macro for each day of the week, which can be activated manually, was added by defining the date forgotten and clicking in the drop down menu button "Update". This menu was developed also in Javascript and contains five options, one for each day.

Other than the process of data collection, it was created two more macros to simplify the use of the file: "Athlete" and "Copypaste". "Athlete" macro creates a unique list of athletes that are in "Fixed Schedule" sheet and place it on "Athlete Attendance List"

sheet, to determine the athletes in which attendance will be controlled. “Coppypaste” builds a list, helping in the data validation process of the sheets “*Next Week*” and “*Attendance*”, confirming the spell of the athletes’ names.

To conclude, the Google Sheet file counts with 9 different sheets, seven macros that run based on a chosen time and 5 more that can be triggered manually.

4.1.1.2 Performance dashboard

After designing the skeleton of the created automated system, the dashboard with the most important KPI’s to control the attendance and others aspects regarding the practices was created. The dashboard was built in an Excel file, due to the limited storage of a Drive and since it is a simple type of tool to use. Tools more sophisticated for this type of jobs, such as Power BI and Tableau, were considered. However, the price presented an obstacle for the total and effective implementation of the system.

This excel has two functions: to clean and show an overview of the data collected, facilitating the analysis of the information and it contains all the data acquired in the Drive.

The excel file contains twelve sheets of an index, dashboard, databases and pivot tables. The connection between the drive and the excel is done by the functionality that allows the importation of data from a wide variety of data sources, including Google Sheets. However does not exist any specific functionality for this data source, but by clicking on “Data” tab on Excel, following “From web” button, just need to insert the share link from the drive and it is possible to have access to the data. The result from this process take us to the Figure 4.2, for later on transform the data on Power Query.

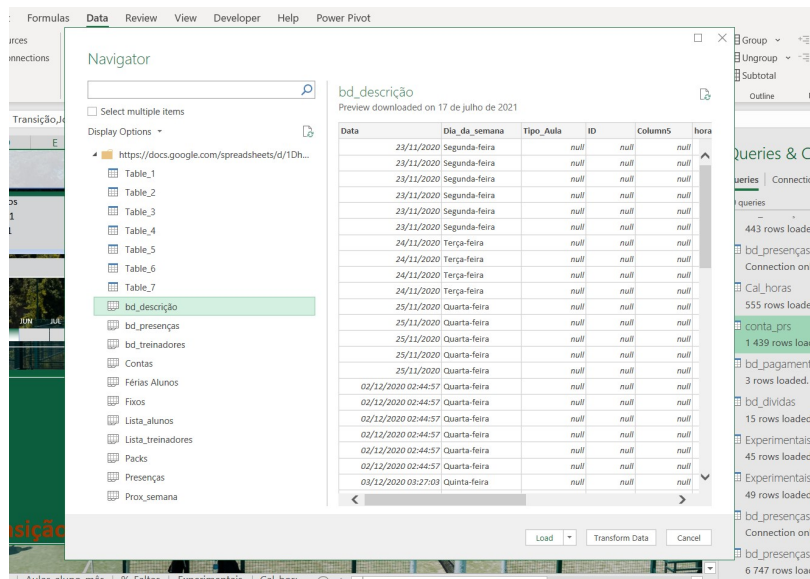


Figure 4.2: Data importation

Having the data already transformed, all the pivot tables were build to next assemble all the information in a dashboard.

To facilitate this process of collection of data, it was created a macro in Visual Basic for Applications (VBA) which enables the activation of the update not only for the connection between the Excel and Google Sheets, but also of the pivot tables that enrich the dashboard. This activation can be done, with a simple click on the logo of the club, that is displayed on the final dashboard.

4.1.2 Challenges

During the development of the solutions, one considerable challenge was the adaption to a software that we were not familiar with, not only due to the difference between the language of Excel and Google Sheet in terms of formulas but also concerning the construction of macros that were built with Java Script programming language. Despite the difficulties that were faced in the adaption to this working tool, this

was an important step for a successful implementation, in order not to dramatically change their working routines.

Another challenge was the redundancy on the data that were collected, mainly, in the names of the athletes. As the coaches, are always writing and eliminating names from the “*Attendance*” sheet, those names rarely came identical. To overcome these difficulties, it was used a data validation tool as explained above to validate all the names that were written in the sheet.

The last challenge was the process of detachment from the previous system to the new one. In the first month of implementation, which was the phase of adaption, they did not fully use the new tool created. In fact, the old one was mainly used due to reliability the coaches felt. As times goes by, they are increasingly letting go the old system to fully use the implemented system in the MFA.

4.2 Evaluation system

These days coaches give practices based on their knowledge, vision and experience of the game. When these latter are professional, the athletes’ performance is not compromised. However, when amateur coaches work, this can be a limitation and an incomplete training may occur. Hence, the creation of a tool which uses structure data to assess and analyze a game would be the most beneficial.

Unlike the system previously explained, which assists the club on an organizational level, the evaluation system contributes to an individual improvement of the athletes. The evaluation system is a reliable tool capable of improving the training quality by analyzing and characterizing the game performed by the athletes and with a deep analysis of the data, as done in this MFA, is possible to form subgroups of athletes evaluated which will allow a more adequate strategy of practicing.

The construction of this system and analysis of the data collected, was divided into three different stages:

- ⇒ **Data collection:** The construction of a tool that allows the data collection of the characteristics and features of the game;
- ⇒ **Clustering analysis:** Using a clustering algorithm to find out training groups, according to their characteristics in the game;
- ⇒ **Characterization of the clusters:** Analyzing each group to be able to present a report focusing on the necessities of each group

In this section, it will be presented the methodology following the three steps in order to create the Evaluation System and perform a cluster analysis.

4.2.1 Implemented system

For this system three different software were used to store and analyze the data. As in the previous system, Google Sheets was chosen as the platform to store the data and Google Form, for collection of the data by the coaches. Finally, Python was used for clustering analysis.

It is important to emphasize that all the athletes evaluated, are from PTC with which the coaches have daily contact. In almost every training routine, there is at least 15 minutes, which normally are used for a game with no restrictions, enabling the collection of the data.

4.2.1.1 Data collection and storage

The Google Sheet file has five sheets: two for daily use (“*Evaluation*” and “*Athletes*”), two for analysis (“*Games*” and “*Athletes analysis*”) and one for the storage of the data (“*BD Points*”) as can be seen in Table 4.2. Moreover, six different macros were developed to automatize all the process.

Sheets	Segment	Description
Evaluation	Daily Use	Where they prepare the game
Athletes	Daily Use	List of every player in the system
Games	Analyse	List of every game that pass through the system
Athletes analysis	Analyse	Detail information about each athlete in terms of stroke or number of erros and winners
BD Points	Database	Database where each point is stored

Table 4.2: Sheets from Evaluation file

The principal sheet to be used by the coaches, in the data collection process is the “*Evaluation*” sheet. In the right part of the sheet, Figure 4.3, the design of a padel court is presented, composed by four cells with a lighter green where the name of the athlete playing is introduced. These cells have a data validation connected to the “*Athletes*” sheet, that contains a list of all the players of PTC, allowing the further analysis of the game. In case the athlete’s name is not included in the list, the analysis is not performed until the addition of the name to the list is performed. After correctly defining the players, the type of game played is defined (normal game, super tie-break or short-set) and the training starts after pressing the “check” on the cell below. This check box is connected to a macro, that automatically displays a link to open a Google Form. The left part of this sheet, will be presented in the “Result and discussion”.

The figure shows a Google Form interface for recording tennis points. At the top is a diagram of a tennis court with a dashed center line. The court is divided into four quadrants by a horizontal line and a vertical center line. The quadrants are labeled with numbers: 1 (bottom-left), 2 (top-left), 3 (top-right), and 4 (bottom-right). Each quadrant has a light green horizontal bar with a dropdown arrow, indicating where to select the position of the point.

Below the court diagram are two tables:

Tipo de Jogo	Super tie-break ▾
Começar Jogo	<input type="checkbox"/>
Url	
Final do Jogo	<input type="checkbox"/>

STATUS		
ID	Momento	Resultado
40	Finalizado	0 - 1

Figure 4.3: Evaluation Sheet

The Google Form created serves to collect structured information from the practices and to directly insert the data into the Google Sheets file (Appendix R). Each answer of the form represents the ending action of a point. The form displays six multiples choices to define the type of action (winner, forced error, unforced error), the position on the field, the type of stroke (forehand and backhand), the stroke and the direction which the point was played. By request of the coaches, a section of comments has been added in the end. This data is then stored in “*BD Points*” sheet, separately, in each line.

Afterwards, the data acquired were cleaned and treated to be analyzed and readable by a padel coach. Five macros were developed, each one related to a type of game where the ID of the game, the final score, the stroke played, type of game, and the players were attributed. The code of the macro that was built, in case of a "normal game", can be seen in Appendix Q.

In Appendix S, an example of a sheet after a game is shown (with the names of the players covered for data privacy). The columns with green outlining are the ones added by the macro. Moreover, the same macro is able to define the athletes playing, assigning the name of the players according to a number, previously established in the sheet “*Evaluation*”.

In total, the coaches evaluated 121 players by recording 1545 points through 64 different games from April to June by using the system developed during this MFA.

Regarding the two sheets in the segment Analysis, the more crucial one is “*Athlete analysis*” that will be presented in the section “Results and Discussion”.

4.2.1.2 Clustering analysis

Considering the goal of homogenizing the training groups according to the variables collected with the system, an extraction of the data from the sheet “*Athlete Analysis*” was made and inserted in Python where the clustering analysis was computed. Unsupervised learning was utilized since the data does not contain historic information about the target variable which means that the results cannot be compared to the true labels to measure the efficiency of the algorithm.

The package “pandas profiling” enabled the development of a complete report about the data, which has 37 variables: one categorical which defines the name of the athlete and the others are numeric that corresponds to the statistics. For the clustering analysis, only some of the variables were used. In total there are 121 observations that are related to the number of athletes evaluated.

The variables used in the cluster analysis are:

- ☞ **Athlete:** Name of the athletes;
- ☞ **Average of forced errors by game (EF):** These are the errors forced by the opponents good play, therefore is more merit of the rivals than own fault. This variable can be calculated dividing the total number of forced errors made by the player by the total number of games that he has been evaluated;
- ☞ **Average of unforced errors by game (UNF):** These are the mistakes that are entirely committed by their own failure rather than skill of the opponent. The average can be calculated by dividing the total number of enforced errors made by a players by the total number of games that he has been evaluated;
- ☞ **Average of winners by game (W):** Winner is a excellent shot that cannot be return by the opponent. The average can be calculated by dividing the total number of winners made by the player by the total number of games that he has been evaluated;

In order to perform a clustering analysis, the program was developed by using only athletes that have at least two games evaluated, avoiding having athletes evaluated, based only on one game, which may not be sufficient to characterize an athlete. Rankings of Portuguese ranking federation (FPP) confirmed that for these athletes the existence of 4 levels for men and 2 for girls which could be grouped. These rankings are particular for each gender and the athletes are classified according to the results in each tournament.

In our project, clustering was used to create several training groups according to the variables previously determined. Although there are many methods of cluster analysis, there is never a clear path as to which to choose. In this investigation, two of the most well-known were used and studied:

- ▼ **Centroid-based:** These types of algorithms, are sensitive to the parameters set before the application and are very efficient. They separate data points based on multiple centroids in the data and each data point is assigned to a cluster based on its square distance from the centroid.
- ▼ **Hierarchical-based:** These algorithms create a decomposition of the data objects based on hierarchy. This approach can be used in two different ways depending on the direction: Top-down or bottom-up.

A normalization procedure was done on the data by using a “Min-Max Normalization” method that standardizes the data in the interval between $[0 ; 1]$, 0 being the minimum and 1 the maximum value.

With the data ready to analyze, a centroid-based approach was applied using K-means. This algorithm assigns to each data point, a cluster according to the sum of the squared distance of the point and the cluster centroid. Before the application of this type algorithm, is necessary to define the number of clusters. For that reason, 3 different methods were applied:

- **Elbow Method:** Also called “knee of a curve” is the most popular approach to discover the optimal value of clusters, although sometimes doubts may arise regarding the assertiveness of the results. “Elbow method” uses K-means for a range of 1 to 15, that indicate the number of clusters, and for each value, determine the sum of squared distance from each point to its assigned center. By plotting the distortions (Figure 4.4), the point of inflection on the curve shows the optimal number of clusters according to the dataset.

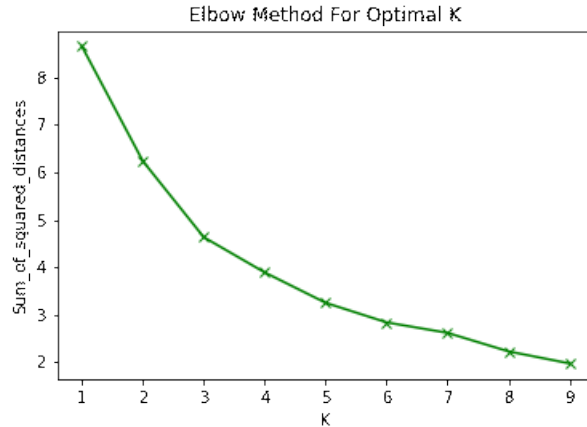


Figure 4.4: Elbow Method

- **Silhouette Score:** This method use the mean of the intra-cluster distance, which is defined by the distance among points of clusters, and the mean of nearest-cluster distance, which is the distance of a point to the nearest neighbour clusters. By calculating the “Silhouette score” for a range of clusters [2:9], the goal is to discover the maximum score for the chosen range (Figure 4.5).

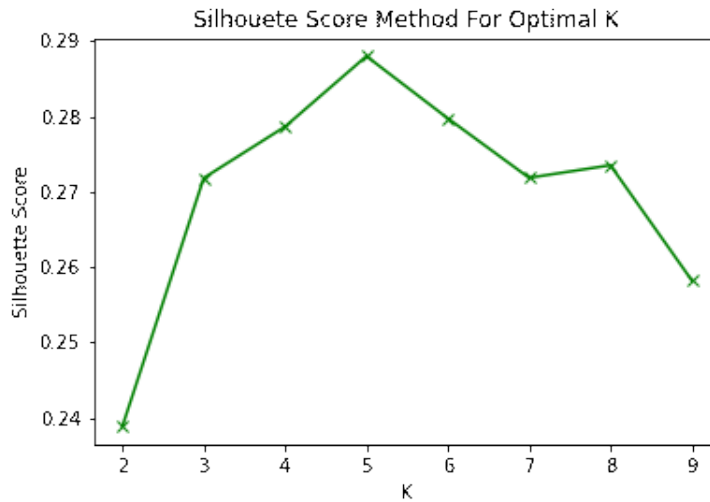


Figure 4.5: Silhouette Score

- **Davies Bouldin:** A validation metric that is defined as a ratio between the intra-cluster dispersion and the separation between the clusters, that result in the average of similarity of each cluster with a cluster most similar to it. The lower this average is, the more separate are the cluster from each other and

better the result of the clustering analysis (Figure 4.6).

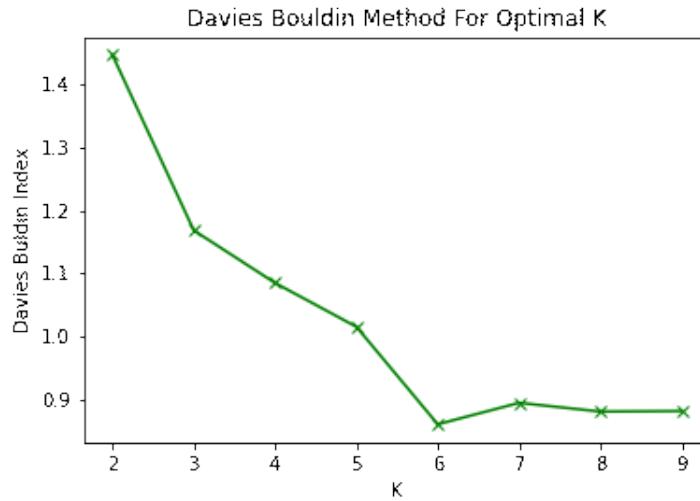


Figure 4.6: Davies Bouldin method

Regarding the results of the Figure 4.4, the elbow is not very clear, but the curve seems to have an inflection when K is equal to 3, indicating that this can be the optimal number of clusters. In the other hand, the “Silhouette Score” in Figure 4.5, indicates that 5 clusters lead to the highest silhouette score in a range of [2:9], meaning that potentially is the optimal number of clusters according to this method. Finally, “Davies Bouldin”, seems to indicate that the number of optimal clusters for this data is 6, reaching the minimum Davies Bouldin index. In conclusion the optimal number of cluster used in K-means was 5. In “Results and Discussion” section, the K-means clusters will be analyzed in more detail.

The latter approach to be applied was the hierarchical-based, using hierarchical clustering, which means building a hierarchy of clusters following one of these types:

- ✗ **Agglomerative:** A bottom-up strategy, which starts with each data point as an individual cluster and, in each step, merges to the closest pair of clusters;

✗ **Divise:** A top-down strategy, which starts as one cluster, meaning that all data points are together inside the same cluster and, at each step, the algorithm splits the cluster until there is only one cluster for each individual observation.

The most significant difference between the two approaches is the parameters needed to be applied. Hierarchical agglomerative clustering is the most commonly used. Instead of assuming a particular number of clusters, this algorithm requires the definition of a distance matrix, which influences the calculation of the distance between the different clusters. This parameter can be defined through different techniques such as single link, average link, complete link, ward's, among others. In this MFA, the distance matrix was obtained from the "Ward's" method, which is the closest method to the K-means algorithm. The "Ward's" model defines a new cluster until the minimal variance, measured by the sum of squares, is reached by iteration. The selection of a new cluster is done after the measure of all combinations possible. Hence, this technique is heavier than the other ones.

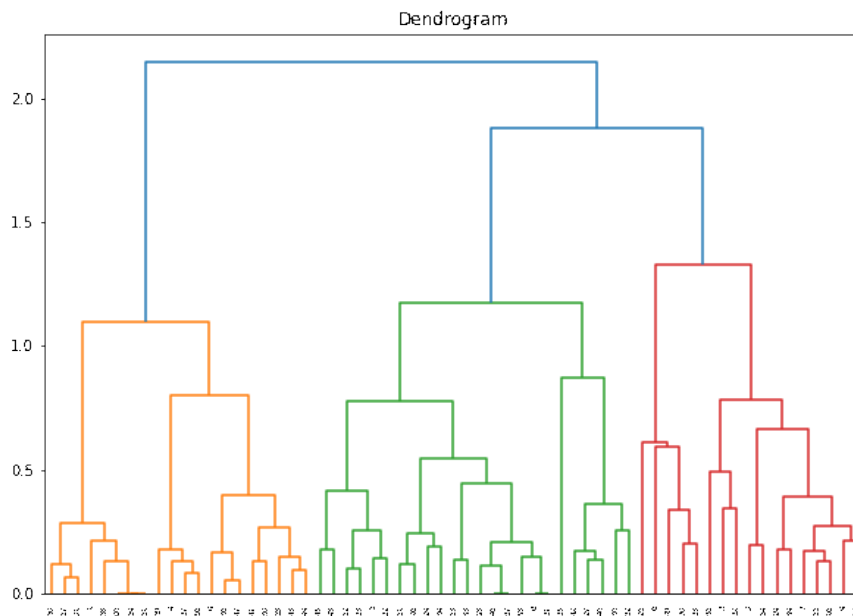


Figure 4.7: Dendrogram to Hierarchical algorithm

After defining the threshold of the distance to merge, a dendrogram was plotted to study the number of clusters. Based on Figure 4.7, 3 seems to be an appropriate number of clusters. As the previous algorithm applied, in the “Results and Discussion” section, the clusters of the Hierarchical method, will be observed.

4.2.1.3 Cluster Profiling

Cluster Profiling results in the accurate description of each group created. Thus, the training of the athletes may be adapted with a higher depth-insight to improve the athletes’ performance. The use of classification algorithms was tested for the introduction of more features such as number of errors in attack and defence and the number of winners in attack and defence, which are related to characteristics of the athlete.. The definition of a target variable, named “Cluster”, leads to the implementation of supervised learning. For the classification algorithm, clusters were created with the K-means since is easier to manipulate and lead to a more accurate number of clusters.

Five different classification algorithms, which tend to be the most recurrent, were tested. The dataset was split into training data (70%) and testing data (30%) which allows the training of the model and the verification of the classification.

K-Nearest Neighbors (KNN)

K-Nearest Neighbors is a supervised machine learning algorithm that assumes that similar items are closer to each other. These can be used for classification and regression problems. The higher barrier is to correctly calculate the distance between two data points since it is time consuming.

Decision tree

A decision tree is a support decision tool that can help in classification and regression problems. The resulting tree becomes an input for the decision making process by discovering new insights about the data. The algorithm starts by inserting all values on a top root and then splitting them into different branches according to their similarities in the values. A parameter that can differentiate different decision trees is the split criterion chosen before computation.

Random Forest

This algorithm is constructed based on a multiple decision tree to provide solutions to regression and classification problems. It consists of the combination of many decision trees, creating a forest capable of classifying according to the majority of votes each tree attributes for each object. In general, the accuracy of the classification performed with random forest increases with the augmentation of the number of trees considered.

Naive Bayes

Naive Bayes is a machine learning algorithm that uses probabilities to classify and is inspired by the Bayes theorem. The probability of an event happening is calculated based on the occurrence of a previous event. The algorithm assumes independence between the features, which in reality is not valid in a real-life situation. There are three types of Naive Bayes algorithms: Gaussian (assumes a normal distribution), Multinomial (used mainly for discrete features), and Bernoulli (useful if the features are binary).

Support Vector Machine (SVM)

This algorithm tries to define the hyperplane which maximizes the distance between points of different classes, called margin. The hyperplane is a simple line. When the data is in two dimensions, it is called the decision boundary: the side where the data point is will define its class.

The comparison between the different employed algorithms was made by using a classification report function from Python. The "True positive" (TP), that evaluates when the model predict correctly the positive class, "True negative" (TN), that evaluates when the model predict correctly the negative class, and the "False positive" (FP), that evaluates when the model predicts incorrectly the positive class, and "False negative" (FN), that evaluates when the model predict incorrectly the negative class, were used. Moreover, the following measures were considered:

- ✓ **Accuracy:** Which describes the number of correct predictions divided by the total number of predictions. This results in the accuracy of the predictions performed by the model;

$$\frac{TP + TN}{TP + FP + FN + TN}$$

- ✓ **Precision:** Which describes the accuracy of the prediction of a TP which is the classification of an object in a class where it really belongs. It will be calculated as the number of TP divided by the total number of predictions;

$$\frac{TP}{TP + FP}$$

- ✓ **Recall (Sensitivity):** Which describes the number of correct predictions to a class inside the real number of observations in that class. It gives us the

accuracy of the model in recuperating.

$$\frac{TP}{TP + FN}$$

The results of the 5 algorithms for each of this variables, will be analyzed in the “Results and Discussion” section, as well the choice of the most suitable algorithms for this dataset, aiming the cluster profiling.

4.2.2 Challenges

After the acquisition of some knowledge in handling both Google Sheets and JavaScript, a difficulty in the development of this second system was the design of an accessible tool suitable to padel and the coaches. For that, the first task was to define the collection data timing method. In a professional competition, the regulation of World Padel Tour, best international competition, conceded 20 seconds between services. After acquiring some data during practices, the average time between services obtained was 13 seconds during the practice. According to these two measures, it was concluded that the notes taken by the coaches need to be adjusted to the game (practice vs competition). Hence, the tool developed, the Google Form, is needed to assure a quick and easy completion. In average, the forms created took 16 seconds in a first phase. In practice, this value is believed to decrease significantly.

An enormous challenge was to assure the commitment of the coaches which, regardless of recognizing the utility of this tool to improving their training’s methods, applying it was not as smooth as wanted in the first stage. Nevertheless, after a period of familiarization, the use is being more frequent.

Chapter 5

Results and discussion

The developed systems were assessed in order to determine their suitability by using qualitative and quantitative approaches. The final product should improve the quality of the service and the user experience. For the attendance system, coaches gave feedback and for the evaluation system, the quality of the clusters formed was also assessed.

5.1 Attendance system evaluation

The attendance system developed was in accordance with the requests of the coaches, being able to surpass the limitations of the previous system used. The addition of new features allowed to obtain of a complete platform for the practices.

In this section, will be presented the features added, that culminates on the final dashboard and a quantitative and qualitative analysis, respectively.

5.1.1 New features & Final Dashboard

As previously explained in section 4.1.1, the improvement of features used in the previous system and the inclusion of new ones, allowed the improvement of the tool's efficiency.

The main feature added was the automation of some parts of the system that was possible with the creation of 13 macros, capable of updating the system, build databases and create easier interactions. Thus, manual processes, which took several minutes, were replaced, increasing the overall process efficiency.

Another feature added in the Drive was the “*Next Week*” sheet (Appendix H, which notes the following week's planning of attendance in advance. Previously, this control was made manually by notes on their phones. However, this action was recurrently forgotten and overlaps between athletes happened, proving to be extremely unprofessional, which led to a discontent of the player.

Also in the Drive, was added the option to control the coaches attendances, by the creation firstly of a database related with the coaches and then the analysis done in the “*Coach Attendance List*” sheet. According to the financial department, this new

functionality was needed to better control the monthly payments that is supposed to do, since the majority of part-time coaches receive by number of practices. Previously the coaches used their mobile to take notes of the practices done which led to some uncertainty.

Finally, another principal feature added to the attendance system, is the final dashboard that contains all the historical information, and can be seen in the Figure 5.1.

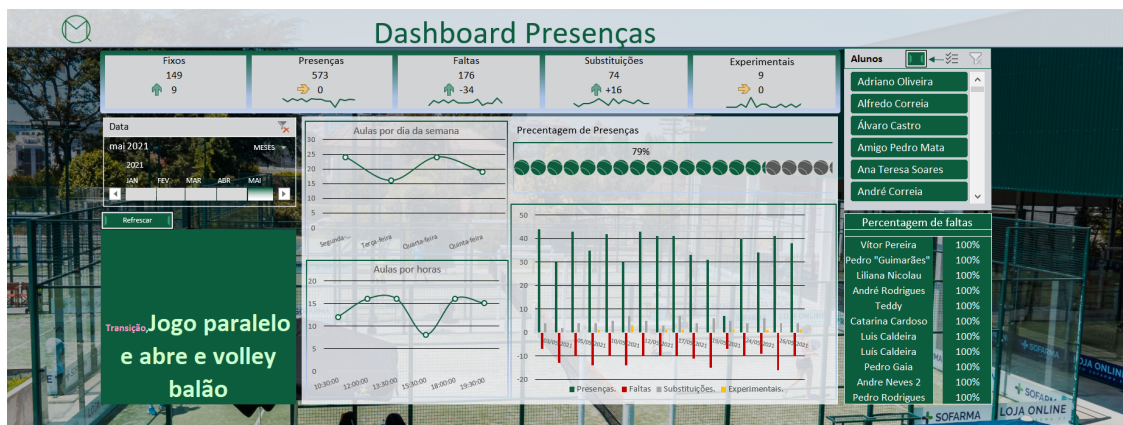


Figure 5.1: Final dashboard

The dashboard is a simple way to present meaningful information with long term insights presented with graphics, important numbers, filters and a short list of athletes. The filters have an important role since it makes the dashboard more interactive. Two different filters were produced, one is a timeline which allows to visualize a specific day, month, quarter or year and the other one is a slicer that lists all the names of the athletes enabling the selection of a given athlete with the data corresponding to him. The selection of multiples athletes and display of the insights through the dashboard is possible by pushing a green button on the slicer. This button is connected to a macro, that overcome the problem of selecting multiple athletes at the same time.

The KPI's such like number of fixed athletes, presences, faults, substitutions and experimental athletes are exposed in the top of the dashboard with the respective total number of athletes in that specified month and a comparison of that data with

last month. Using the timeline slicer, the selection of more than two months, shows the comparison between the oldest and newest month. For example, in Figure 5.1, the month selected was May, where minus 34 faults were added when compared to April. In “Experimentais”, the second value is related to the number of athletes that tried PTC and stayed. Below the numbers, there is a spirkline that show the fluctuation over the time selected.

Next, four distinct graphs were plotted. The distribution of classes can be seen by days of the week (top-left) and by hours of the day (bottom-left). On the top right graphic, the percentage of the athletes’ attendance is plotted and, as an example of analyzes, in May the athletes had 79% of attendances. Lastly, the main graphic shows the distribution of presence, faults, substitution, and experiments by day.

In the low right corner, an analysis of the top athletes with the highest percentage of faults can be made. This table was asked by the coaches and the club to decide which athlete should have their practices replaced. In particular, this tool can be very useful in July and August, during summer, where the percentage of attendance is lower.

In the low left corner, it was added a special feature with a computed “word cloud” to highlight the type of practices more frequent and relevant in a period of time. This was possible with the development of a macro which agglomerates the practices descriptions by athlete and calculates the frequency of each type of training. Resulting in the plot a maximum of 5 types of practices and varying the size of the letter from 10 to 25, depending on the frequency. This “word cloud” can only be activated manually, pushing the button “Refrescar”. This tool can avoid monotony in the practices. The VBA code used in the computation of this macro can be seen in Appendix T.

5.1.2 Quantitative analysis

In order to compare quantitatively both systems, the new and the previously used, the effectiveness was determined by comparing the same features, not taking into consideration the new characteristics added.

The improvement of the attendances' historical with the creation of differently structured databases, allowed immediate analysis of attendance for the athletes. This allows, improving several of their processes, for example, a search into a specific athlete on a particular day. In the new system, to find the history of a given player, 9 seconds, on average, were required whereas in the previous one, it took 21 seconds. The difference of 12 seconds can be significant on a daily routine, where the information of several players is often needed.

Structured databases bring rapidity to the processes and allow the use of visualization tools capable of processing the data stored. Three sheets were created to see specific data throughout the month: "*Athletes Attendance List*", "*Coach Attendance List*" and "*Monthly Hours*". These new groups of sheets designed, replaced manual actions performed previously. The "*Athletes Attendance List*" sheet, as was explained before, is the total number of attendances of an athlete in the current month, which is automatically refreshed by the database. This process for only one athlete, in the old system, took, in average, 37 seconds, which corresponds to a total of 1h15 for the 121 athletes in PTC. For the "*Monthly Hours*", the hours of practice per month is automatically calculated, reducing the time spent and avoiding redundancy. Previously, the data treated manually by calculating the monthly hours and adding to the "*PTC Analysis*" sheet. These actions took, on average, about 20 minutes.

The attendance system created was based off the old one to confirm suitability for the user. An essential variable of this system is the quickness and effectiveness in the daily experience, always maintaining the focus on delivering reliable information.

For that reason, the variable used to compare both systems was the average time of filling the presences (AFP) by the coaches in a single day of the week. Comparing both systems, the old one had better results than the new, with a difference of 33 seconds. This difference can be explained since the attendance sheet created is, normally, a copy-paste of the fixed schedule which is already filled by default with colors, not needing to be completed from scratch. However, this can have some disadvantages because errors with the oblivion of maintaining the sheet updated are made, increasing the redundancy of the data.

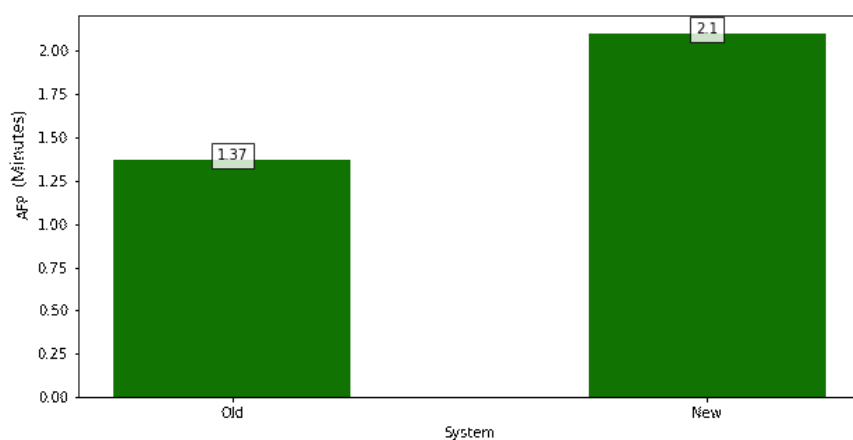


Figure 5.2: Comparison between AFP of both systems

5.1.3 Qualitative approach

After the evaluation of the system in a quantitative way and the description of the added features, the system was verified by their users. Coaches answered a Google Form with questions related with the adaption and the suitability of the tool. The form approached several aspects, that were felt necessary to evaluate, as adaptability (to search difficulties in the period of adaption), usefulness (to check if the system is in line for the role by having the adequate parameters) and some generalities questions.

In total, there were 7 questions and a section for comments:

1. Were there problems in the adoption of the new system? (5 being none and 1 being over ten)

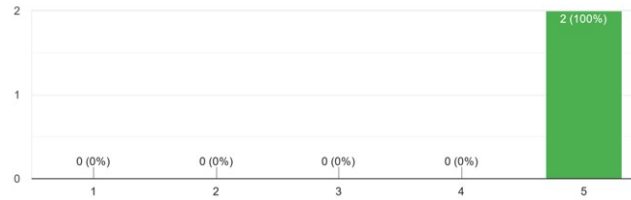


Figure 5.3: 1 question of attendance form

2. Were there any difficulties in daily use? (1 being none and 5 being over ten)

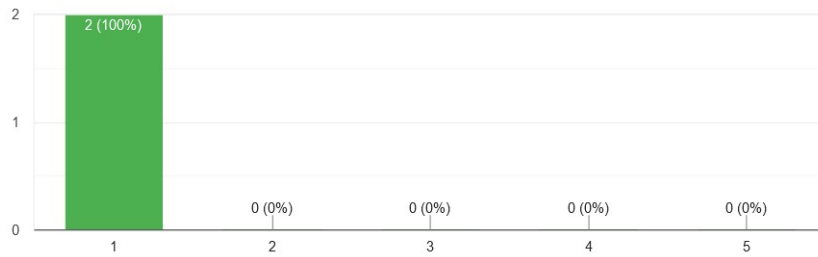


Figure 5.4: 2 question of attendance form

3. What is the utility of the new tools? (Databases, athletes list...) (1 being useless and 5 being super useful)

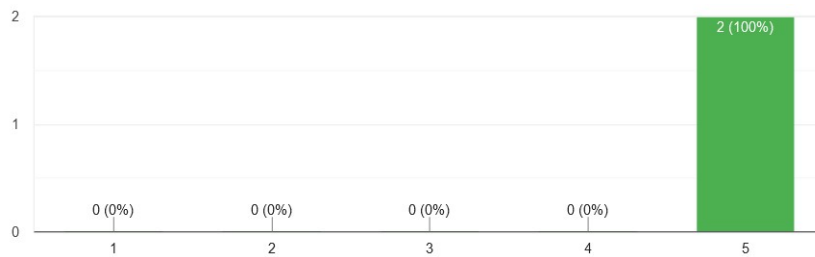


Figure 5.5: 3 question of attendance form

4. Does the system covers all the needs required? (1 being none and 5 being all)

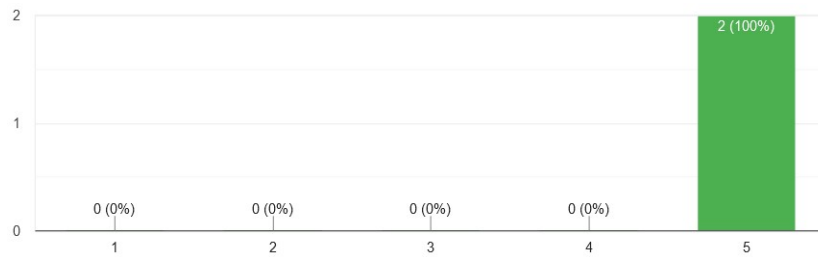


Figure 5.6: 4 question of attendance form

5. Do all the features have easy and perceptible use?

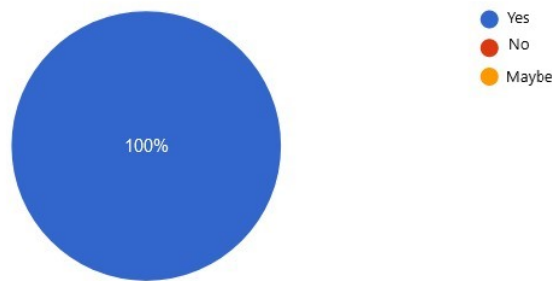


Figure 5.7: 5 question of attendance form

6. Is there any tool missing in the system? If "yes", write down which.

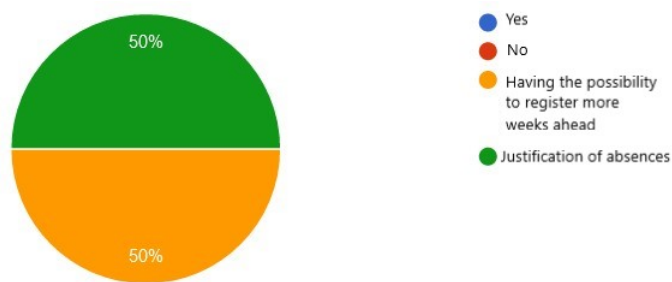


Figure 5.8: 6 question of attendance form

7. Are all the tools from the new system used? (1 being NO and 5 being YES)

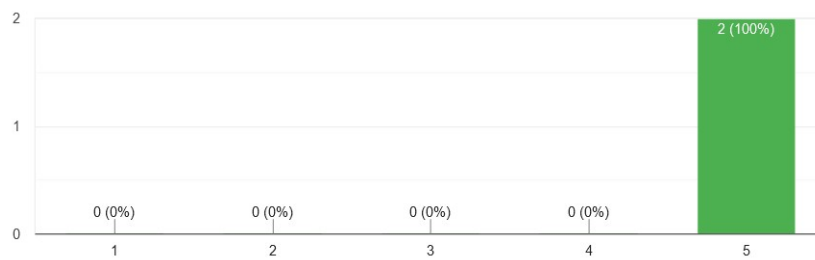


Figure 5.9: 7 question of attendance form

Under each question, graphics that allow a better comprehension of the answers to these questions are presented. The first three questions, more oriented towards the adaptability of the system, proved that no difficulties were found, showing to be a quite perceptible tool. Questions four and five, oriented towards the usefulness of the system, demonstrated that the new tools implemented are being successfully used and the needs were covered by the system. The last two were more general and had a positive feedback. Some suggestions were made for the creation of new features to further improve the system, such as the planning of several weeks in advance and the possibility to justify the absences.

5.2 Evaluation system

As mentioned previously, in this section, will be presented the main sheets of this system, following by the evaluation of each cluster that will be done by the assessment of tables, graphics and a decision tree. Afterwards, the coaches' perceptions on the training groups are presented by the answers given a to an survey made in Google Form.

5.2.1 Principal sheets

As said in section 4.2.1.1, one main sheet of this system is “*Evaluation*”, because not only is related with data collection but also is a visualization tool to analyze statistics about the games evaluated. In Figure 5.10, is possible to see the KPI’s that are extracted from the raw data that is shown in Appendix U. For each athlete, is displayed, the percentage of winners, forced errors and unforced errors, the strokes that had errors and winners caused, respectively. In the bottom of the sheet, there is a section that group all the comments, by athlete, that were done during this specific game.

Statística Geral	
Resultado Final	12 - 10
Tipo de Jogo	Super tie-break
Dupla Vencedora	Dupla 1
% Winners	27.27%
% Erro Forçado	13.64%
% Erro não forçado	59.09%

Statística dos jogadores				
	Dupla 1		Dupla 2	
	Marco Carvalho	Manuel Leitão	Diogo Magalhães	Pedro Alves
Winners	38% 3	25% 1	20% 1	20% 1
Erros Forçados	25% 2	0% 0	0% 0	20% 1
Erros Não Forçados	38% 3	75% 3	80% 4	60% 3
Pancada + erros	Saida de Parede Direita	Bandeja 2	Smash 2	Saida de Parede Direita 2
Pancada + winners	Smash 2	Saida de Parede Direita	Smash 1	Saida de Parede Direita 1

Comentários				
	Smash Mau balão Pedro		Smash a cair para trás	Half-volei Direita levou com bola nos pes depois de servir
Saida de Parede Direita apanhou muito em baixo		Direto Direita Resposta falhada		

Figure 5.10: Evaluation Sheet

Another principal sheet is “*Athlete analysis*”, where the information about each athlete is stored. The sheet is divided on 4 different segments: Errors, Winners, Average per game, Average per point. In the first two segments, are discriminated all the details about the strokes that the system collect, for example, indicating the exact number of errors in the forehand the athlete did in the sum of games evaluated. In the two last segments an analysis of an athlete’s performance is done by calculating the average percentage of errors and winning points by game and by point. Unfortunately, there is not a clear print to do, in order to demonstrate all the information in the sheet, but in Figure 5.11, one can observe the two last segments, for the first 15 athletes.

Alunos	Jogos	Media de erros forçados por jogo	Media de erros não forçados por jogo	Media de winners por jogo	Pontos	Media de erros forçados por ponto	Media de erros não forçados por ponto	Media de winners por ponto
João Oliveira	1	2	3	2	7	28.57%	42.86%	28.57%
Miguel Folhadela	2	0	2	0	5	0.00%	80.00%	0.00%
Gastão Andrade	2	0	0.5	2	5	0.00%	20.00%	80.00%
João Peixoto	4	0.25	3.75	3	29	3.45%	51.72%	41.38%
Diogo Resas	2	1	5.5	3	19	10.53%	57.89%	31.58%
Rodrigo Sá	3	0.3333333333	3.333333333	1	14	7.14%	71.43%	21.43%
Gatarina Almeida	4	0.5	5.25	3.5	37	5.41%	56.76%	37.84%
Alfredo Correia	3	0.3333333333	2	1.666666667	12	8.33%	50.00%	41.67%
Pedro Fernandes	3	0.6666666667	2.333333333	1	13	15.38%	53.85%	23.08%
Nuno Pinho	3	0.3333333333	3.333333333	2	17	5.88%	58.82%	35.29%
Graham Heydorn	5	0	2	0.6	14	0.00%	71.43%	21.43%
Betina Sousa	1	1	3	3	8	12.50%	37.50%	37.50%
Marcos Carvalho	7	0.8571428571	2.285714286	1.428571429	34	17.65%	47.06%	29.41%
Juliano Raimundo	3	0.3333333333	2.333333333	0.6666666667	12	8.33%	58.33%	16.67%
Ricardo Pinto	4	0.5	1.25	2	15	13.33%	33.33%	53.33%

Figure 5.11: Athletes analysis Sheet

5.2.2 Cluster evaluation

As said in section 4.2.1.2, the data used for the cluster analysis was from the sheet “*Athlete analysis*”, previously observed. On this data, that was applied K-means and Hierarchical algorithms.

To compare the results of both methodologies, K-means and Hierarchical clusters, two tables were created (Table 5.1 and Table 5.2) with the average values obtained for each parameter.

Variables	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Forced Error	0.195	0.597	0.309	0.140	0.180
Unforced Error	0.131	0.405	0.830	0.486	0.301
Winner	0.078	0.251	0.547	0.219	0.570

Table 5.1: Kmeans clusters

Variables	Cluster 1	Cluster 2	Cluster 3
Forced Error	0,477	0,136	0,125
Unforced Error	0,433	0,276	0,453
Winner	0,264	0,105	0,543

Table 5.2: Hierarchical clusters

According to the Table 5.1, the cluster 3 have in average the highest number of unforced errors and winners compare to the others clusters. For the Hierarchical clusters, the same can be observed in cluster 3, which indicates a similarity between the two levels. Also for this last methodology, cluster 2 have the lowest average of unforced errors and winners, identically for the cluster 1 of the K-means clusters, that also suggest a resemblance among this clusters. In Figure 5.12 and 5.13 that are the distribution of the values previously analyzed, is possible to confirm this similarity, by the shape of the clusters. K-means cluster 1 correspond to Hierarchical cluster 2, and K-means cluster 3, correspond to Hierarchical cluster 3.



Figure 5.12: Distributions of K-means clusters

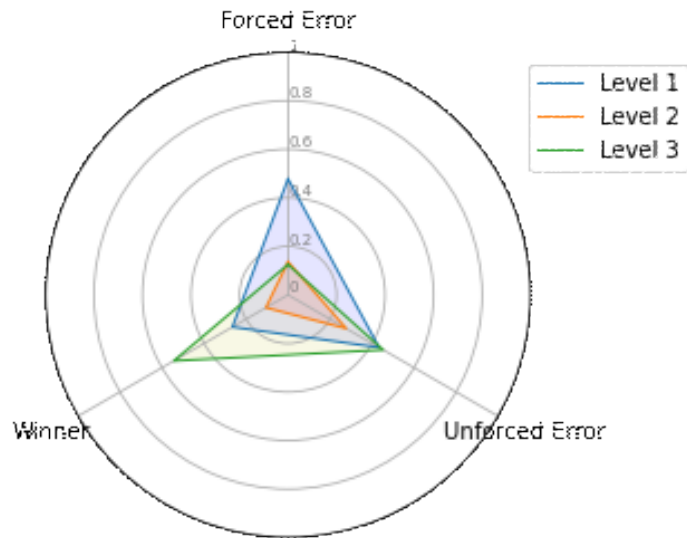


Figure 5.13: Distribution of Hierarchical clusters

As defined in the section , the chosen clusters to analyze in more detail is from K-means algorithm. Therefore, the optimal number of clusters for our dataset is 5, according to the average of several methods tested (Elbow method, Silhouette Score and Davies Bouldin method). As such, clusters 1, 2, 3, 4 and 5 will be named the FPP levels of the game - Level 1, Level 2, Level 3, Level 4, and Level 5 respectively.

Considering the Figure 5.12, the profile of the different levels, where each color represents one of them, was drawn. Similar to any other sport, the best padel player is defined by combining the lowest number of unforced errors and the highest number of winners per game. This combination means that the player is able to adjust accordingly to the adversary, being capable of recognizing opportunities of point and the need of defense.

The evaluation of the different levels, leading to the description of each profile was performed, as can be seen:

→ **Level 1 (observations: 10):** In terms of distributions of the three variables, this Level has a similar performance to the Level 2. This cluster presents high average of forced errors compared to unforced errors and winners, than can be related with bad positioning but also with the opponents that they faced during the evaluation.

Probably, this group need to train with athletes more alike their level. To complete they should practice more the positioning on the field with the goal of reducing the number of times that is caught out of position.

→ **Level 2 (observations: 15):** This level, on average, has the highest number of forced errors during a game compared to the other clusters, and as said above, can be related to a wrong positioning or strong opponents. The athletes in this group have a low average of winners and high average of unforced errors. These values are also in accordance with strongest opponents, where they take unnecessary risks in their strokes, when should play more defensively.

For this group, it is advised that the training is more attack-oriented to make the athlete know how to read the game with special attention on the positioning inside the padel court;

→ **Level 3 (observations: 7):** This level is related with a beginner player in which the type of game is risky, and that explains the highest average of unforced errors and an average of winners also higher than majority of the clusters. In addition, they have the second-highest forced errors associated with their positioning in the pitch in which the opponent can take advantage easily. Assuming that it is a beginner group, the training must be separated into two main parts, one related more with the positioning according to the moments of the game, and the other with the repetition of stroke. It is important to do a parallel growth between both to obtain the fundamentals of the game;

→ **Level 4 (observations: 21)**: This level, statistically, seems to the level 3 but with lower average in the three variables. A type of game to risky for their abilities, which is translate in an excessive number of errors, not only in unforced errors but also in forced errors.

Another beginner group, that should practice every part of the game, as for example the different moments of the game (defence, transition and attack), all the strokes and also the positioning.

→ **Level 5 (observations: 8)**: This level has the highest average of winners per game and the second-lowest average of unforced errors. That means that they are very offensive players and have an aggressive game and most of the times successfully.

According to that, it is the strongest group, where the type of training for this should be more through repetition, to improve their different strokes. For this level, also it is important combining several game situations according to the moments of the game.

5.2.3 Cluster Profiling Results

With the goal of choosing the most suitable algorithm for cluster profiling, it was analyzed the results of each algorithm previously explained in section 5.2.2. The Table 5.3 was built to compare the differences between the metrics defined: Accuracy, Precision, Recall.

	Accuracy	Precision	Recall
Algorithm			
Random Forest	0,14	0,20	0,16
K-Nearest Neighbors	0,21	0,35	0,26
Decision tree	0,41	0.45	0,37
Naïve Bayes	0,29	0,30	0,26
SVM	0,24	0,30	0,26

Table 5.3: Classification algorithms results

This table showed the accuracy of the models is in average 25%, ranging from 14% for the random forest model to 41% set by the Decision tree. In terms of precision, the models reached in average 32%, ranging from the lowest value of 20% obtained for random forest to 45% for the decision tree. Finally, in the recall, the average value is 26% and the values varied between 16% for the Random Forest to 37% for the Decision tree. Hence, the Decision tree was the model chosen to be used in the next steps of this classification problem.

After the selection of the model, the design of a decision tree was performed, to become an input for the decision-making process since it is capable of discovering new insights about the depicted data, in our case, of each cluster. Since the goal is to discover new insights, this classification algorithm was applied with four distinct variables, two related to the number of mistakes by defensive and attack strokes, and two for the winners, with the same logic.

As mentioned previously, an important parameter defined for the Decision tree is the split criterion chosen. The most used split criterion's are:

- ☆ **Gini Impurity:** Which measures the impurity of the nodes by calculating the Gini Index, that is defined by the probability of picking two distinct elements. The dataset is more heterogeneous and easier to select different datapoints when the Gini Index is as much higher as possible. Gini Impurity is calculated by the subtraction of the Gini index to one. Higher degree of purity, meaning better classification, and as results in a Gini Impurity value close to one;
- ☆ **Information Gain:** Which uses entropy to calculate the homogeneity of a sample. The lower the entropy, the more the sample is homogeneous, and the opposite is also true. The information gain is built on the decrease of the entropy, which means that the construction of a tree is based on finding the variables with lowest entropy, that results in higher information gain.

There exist other parameters as max depth that is described as the longest path from the tree until the leaf, or min samples split that is the minimum sample for splitting the node. To choose the suitable parameters, a Python function (GridSearchCV) that can give the split criterion to use and the max depth was used. Regarding the split criterion, the function recommended applying the Information Gain and a max depth of 2. Setting these parameters, the tree plotted was significantly reduced.

After performing a more macro evaluation in section 5.2.2), a Decision tree enabled an analysis more complete of each cluster. The resulting tree can be seen in Figure 5.14.

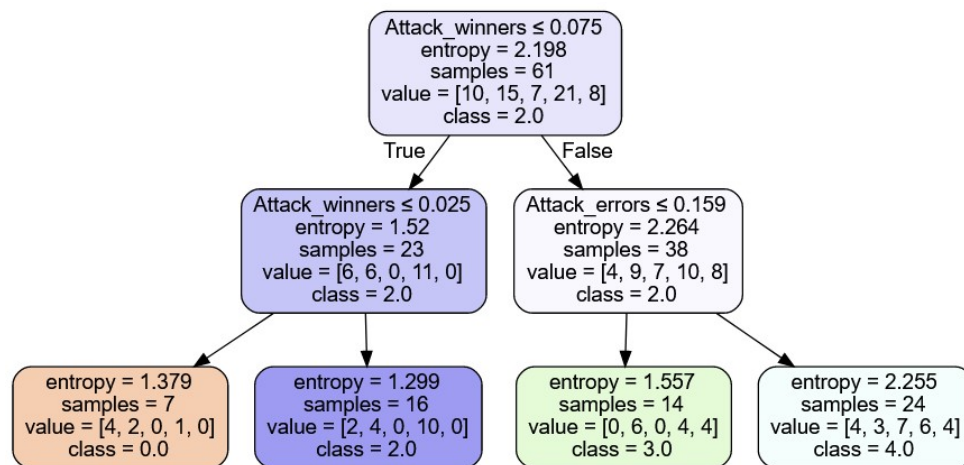


Figure 5.14: Final Decision tree

The final Decision tree depict 4 clusters, instead of the 5 previously detected. Here, class 0 is equivalent to level 1, class 2 as level 4, class 3 as level 2 and class 4 as level 3. Level 5 is not described by a class, since their observations are not enough to lead a node.

Having plotting the tree, the first thing to analyze is the variables that are in the nodes. In this case the variables are only from attack, which indicate that the major difference between the levels is related with attack strokes.

Secondly, in the first node, the winners made with attacking strokes, separate class 0 and 2 which represent level 1 and 4 to the left side of the tree and the class 3 and 4 that corresponds to level 2 and 3.

Regarding the second node, in the left side, class 0 and 2 which represent level 1 and 4, respectively, are separated since they are differentiated by the number of winners with attacking strokes, which are less in level 1. Relating this results, with the ones previously studied with Figure ??, this analysis make some sense since the difference of average of winners between the two levels is 0.141. The conclusion is that the two levels, have some problems related to winners, more concretely in the attack winners compare to the others, what justifies a attack-oriented practice.

Regarding the second node of the tree on the right side, the variable used to differentiate is the number of errors with attacking strokes. The results obtained were in accordance to the ones previously found in which level 2, the equivalent of class 3, has the highest number of winners. The tree analysis shows that this level can settle a good balance between the errors and winners in attacking strokes. Moreover, class 4 which is level 3 is also present in this side of the tree with a number of errors with attacking strokes higher then 0.159, connecting with a high number of winners also with attacking strokes mean that, unlike level 3 cannot differentiate the moments of the game, regarding the attacking strokes. Still, on this side, note that the level 5 that is not depict by a class, but is also presented, divided by the leaf nodes, showing that some of the players on this level have the same problems that level 4 and 2.

5.2.4 Data vs Coach

This section has the goal to compare the perception that the coach has of their athletes and the results of the cluster analysis.

From the cluster analysis, two summary tables were created: Table 5.2 and Appendix U. Table 5.2 compares the frequency of the three variables: forced error, unforced error, and winner between each cluster. Appendix U compare the means of the others variables used such as errors and winner with attacking and defensive strokes, in order to precisely define where the errors and winners were committed. Using both tables, a summary was made here in Table 5.4:

Cluster	More frequent	Location Errors	Location Winners
1	Forced error	Defense	Attack
2	Forced error	Defense	Attack
3	Unforced error	Defense	Defense
4	Unforced error	Defense	Defense
5	Winner	Defense	Defense

Table 5.4: Clusters summary table

After this analysis, a survey was given to the coaches (Appendix V) with four questions for each cluster: one regarding the frequencies of ending actions, two regarding the type of strokes with more errors and winners, and one related to the homogeneity in each cluster.

Regarding the frequencies, the coaches answered that the more frequent between the three variables in all clusters is the *Unforced Error*. According to the data, this was not verified for cluster 1 nor 2, being *Forced Error* more frequent for this clusters and to cluster 5 being *Winner*. By analyzing the average scores, the coaches and the cluster analysis are 40% of the times tuned.

Concerning the type of stroke for each cluster, for cluster 1 the opinion was divided between errors in the defensive and attack, being defensive the more frequent, ac-

ording to the data. Furthermore, coaches' opinion was identical to the system with the winners being mostly made by attacking strokes. For the second cluster, coaches defined that errors were mainly made with attacking strokes whereas the analysis showed that errors were mostly done with defensive strokes. With regard to winners, both parties defined that the mostly used was attacking strokes. In the third and fourth cluster, both point that the errors made are higher with defensive strokes, but for winners, coaches refer attack strokes whereas the analysis showed defensive strokes. Finally in cluster 5, similarly to the cluster 1, the opinions was divided in the errors, but the analysis defined defensive errors more frequent. According to the attack strokes, the analysis showed that defensive winners were more frequent unlike the coaches that decided that attacking strokes. Making a statistic analysis, 47% of the times both sides have the same opinion.

The data treated was collected for two months, having only 61 players to be divided between the different clusters with an average of 15 points assessed. The scarcity of data can affect the quality of the results and explain the heterogeneity of each group, which can explain the difference of analysis between system and coaches.

The overall score regarding the questions related to the homogeneity of the clusters showed that the clusters remained very heterogeneous. Coaches determined that each cluster could be sub-divided into other levels which is not in accordance with the analysis of this MFA. In a future development of the system, more features may be added to better characterize the clusters.

Chapter 6

Conclusion

In this investigation, two systems were implemented to improve the attendance and evaluation of the athletes in a padel club. Using the data collected and processed by the evaluation system, a cluster analysis aiming to identify subgroups in the PTC was performed.

Regarding the attendance system, the biggest challenge was the transfer between systems. Nevertheless, after the first impact, the developed system had a positive impact on the daily routines of the coaches, being more effective and automatic.

Concerning the evaluation system, with the performed variable selection method, it was seen that K-means suggest that exist 5 levels of athletes inside PTC, with the data collected by the system. Afterwards, a more detailed analysis was able to describe the clusters created with the use of a classification algorithm. Thus, with this analysis the next conclusions were gathered:

- ↳ The **Level 1** seems to have the same characteristics of the cluster 2, with an average of *forced errors* highest compare to the others variables; In the decision tree, was observed that this level have problems related with winners, what

justifies a more attack-oriented practice;

- ↳ **Level 2** has the higher average of *Forced Errors*. This group seems to have a consistent game, whose errors are not committed by their own fault. Moreover, the decision tree showed that the major part of the athletes had a good balance between errors and winners with attacking strokes;
- ↳ **Level 3** has the higher average of *unforced errors* and the second highest of *forced errors*. This level is related with beginners athletes since the errors represented a major part of the ending points;
- ↳ The **Level 4** is similar to level 3 in terms of variance but with the lowest average of *forced errors*. Moreover, this group has the highest number of observations (21);
- ↳ The **Level 5** has the higher average of *winners* and an reduced number of *unforced errors*. These numbers are related with strongest athletes with a more risky and offensive game;

The system created was able to improve the quality of service of the club, being automatized and accessible for all coaches. Further studies could be performed in order to understand if the analysis observed on this MFA, regarding the clusters, can have impact on the performance of the athletes. Using a test group that guides their practices by the cluster analysis and a control group that continues with the same type of practice, an initial and final evaluation can be made to quantify the impact on the athlete.

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Appendixes

A Google Form to PTC athletes

Formulário - PTC

Este questionário foi desenvolvido no âmbito da tese de mestrado do treinador Bernardo Moreira em colaboração com a Quinta de Monserrate.

Este questionário dirige-se SOMENTE a alunos do PTC e visa recolher informação que possa permitir conhecer os perfis dos atletas, bem como, melhorar os treinos de forma significativa. Este inquérito é anónimo. O registo das respostas ao inquérito não contém qualquer informação sobre a sua identidade.

O tempo de preenchimento é de aproximadamente 4 minutos.

A informação recolhida é de extrema importância, de forma que se solicita a maior sinceridade nas respostas.

*Required

Perguntas pessoais

1. Género: *

Mark only one oval.

Feminino

Masculino

2. Indique qual é a sua faixa etária? *

Mark only one oval.

Menos de 20 anos

Entre 21 e 30 anos

Entre 31 e 40 anos

Entre 41 e 60 anos

Mais de 61 anos

3. Indique qual é o seu estado civil atual:

Mark only one oval.

- Solteiro/a
- Casado/a
- União de facto
- Divorciado/a
- Víuvo/a

4. Nacionalidade: *

Mark only one oval.

- Portuguesa
- Espanhola
- Francesa
- Inglesa
- Other: _____

5. Indique qual é o seu grau máximo de educação? *

Mark only one oval.

- Ensino secundário
- Licenciatura
- Mestrado
- Doutoramento

6. Indique qual é a sua situação profissional atual: *

Mark only one oval.

- Trabalhador por contra de outrem
- Trabalhador por contra própria
- Estudante
- Desempregado
- Reformado

7. Qual o seu rendimento líquido mensal?

Mark only one oval.

- Até 1000 €
- 1000 a 2000 €
- 2000 a 3000 €
- 3000 a 5000 €
- Mais de 5000 €
- Não aplicável

8. Para além de si, quantas pessoas integram o seu agregado familiar?

Mark only one oval.

- 0
- 1
- 2
- 3
- 4 ou mais

9. Qual o rendimento líquido mensal do agregado familiar?

Mark only one oval.

- Até 2000 €
- 2000 a 3000 €
- 3000 a 4000 €
- 4000 a 6000 €
- Mais de 6000 €
- Não aplicável
- Não sei

Perguntas sobre desporto

10. Qual a sua relação com o desporto? *

Mark only one oval.

- Profissional
- Recreativa
- Outra

11. Nível de atividade desportiva semanal: *

Mark only one oval.

- Pouco ativo - aproximadamente 1 vez
- Ativo moderado - entre 1 e 3 vezes
- Ativo - entre 3 e 6 vezes
- Muito Ativo - mais de 6 vezes

12. Diversidade de desportos que já praticou ou pratica ao nível de competição:

Mark only one oval.

- 0
 1
 2
 3 ou mais

13. Diversidade de desportos / atividade física que pratica regularmente: *

Mark only one oval.

- 1
 2
 3 ou mais

Perguntas sobre padel

14. Qual é o seu nível de jogador?

Mark only one oval.

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. Qual a mão que usa para jogar?

Mark only one oval.

- Direita
 Esquerda

16. Pessoalmente, considera-se um jogador de:

Mark only one oval.

- Direita
- Esquerda
- Ambos
- Não sei

17. É federado? *

Mark only one oval.

- Sim
- Não

18. Se é federado, quantos torneios realiza em média por ano?

Mark only one oval.

- 0
- Entre 1 e 3
- Entre 4 e 7
- Entre 8 e 13
- Mais que 14

19. Quantas vezes pratica em média padel semanalmente? (considerando os treinos): *

Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- Mais que 10

20. Quantos jogos faz em média semanalmente? (à parte dos treinos) *

Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- Mais que 10

21. Qual é a sua relação com o padel?

Mark only one oval.

Profissional

Recreativa

22. Como classificaria a importância de cada um dos fatores na sua motivação para jogar padel: *

Mark only one oval per row.

	Muito pouco importante	Pouco importante	Moderadamente importante	Importante	Muito importante
Praticar exercício físico	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contacto social	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Imagem corporal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entertimento	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Competição	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Desanuiar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trabalho	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

23. Como classificaria a importância dos seguintes fatores na escolha do local onde treinar? *

Mark only one oval perrow.

	Muito pouco importante	Pouco importante	Moderadamente importante	Importante	Muito importante
Qualidade do treino	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Qualidade dos parceiros de treino	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preço	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Horários disponíveis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Treinadores	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clube	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Localização	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

24. Para além de si, quantos membros do seu agregado familiar jogam padel?

Mark only one oval.

- 0
- 1
- 2
- Mais que 3

25. Em que fase do dia prefere / pode jogar padel?

Tick all that apply.

- Manhã
- Hora de almoço
- Tarde
- Final da Tarde
- Noite

26. Customa jogar non-stops? *

Mark only one oval.

- Sim
- Não
- Muito de vez em quando

27. Se sim, quantos non-stops joga em média mensalmente?

Mark only one oval.

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- Mais que 10

31. Como classificaria a qualidade do serviço nas seguintes dimensões? *

Mark only one oval per row.

	Muito mau	Mau	Razoável	Bom	Muito bom
Competência dos <input type="radio"/> treinadores	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Conhecimento técnico dos <input type="radio"/> treinadores	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Clareza nas respostas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rigor nos horários	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapidez de avisos prévios <input type="radio"/> ao treino	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

32. Recomendaria o PTC a um amigo? *

Mark only one oval.

- Impossível
- Pouco Provável
- Nem improvável, nem provável
- Muito provável
- Certo

33. Quantas vezes treina no PTC semanalmente? *

Mark only one oval.

1

2

3

4

5

34. Se estivessem disponíveis mais horários, qual ou quais das seguintes ações tomaria? *

Tick all that apply.

Mudaria o meu horário de treino

Treinaria mais vezes

Não mudaria nada

Other: _____

35. Na sua opinião, o que se deveria adicionar aos treinos?

Tick all that apply.

Mais cesto

Mais situação de jogo

Mais jogo normal

Físico

Nada

Other: _____

36. Em que medida concorda ou discorda na sua necessidade em treinar os seguintes aspectos de jogo? *

Mark only one oval per row.

	Discordo totalmente	Discordo em parte	Não concordo nem discordo	Concordo em parte	Concordo totalmente
Defesa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ataque	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transição	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bolas especiais (amorti, contra parede...)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

37. Como classificaria a importância de um sistema de avaliação dos alunos (ex: % erros não forçados, winners, pancada que falha mais...): *

Mark only one oval.

	1	2	3	4	5	
Muito pouco importante	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Muito importante

38. Se tiver algum comentário a fazer sobre o PTC, faça-o por favor de seguida:

Type your text

B Athletes segmentation table

Gender	Male
Age	41 to 60 years old
Education	Graduate
Social Class	Medium / High
Weekly Sport Activity	3 to 6 times
Moment of the Day	Late afternoon
Number of Weekly Training	1
Federated	Yes
Preferred hand	Right
Side of the pitch	Right

C Print of old system: "Fixed Schedule" sheet

Fixo									
Hora	Segunda	Hora	Terça	Hora	Quarta	Hora	Quinta	Hora	Sexta
10h30	Ines-Couveiro	12h00	Cato-Vilela	12h00	Bruno-Vaizente	10h30	Mari-Pereira	9h00	1
	Aidé		José-Bosinger		Luis-Gouto		Rui-Amaral		2
	Luis-Cardosa		Bruno-Teixeira		João-Oliveira		Lilam-Bot		3
	Jaime		Edas		Rui-Nuno-Pereira		Ines-Couveiro		4
	Marco		Zé-Rui-Pinto		Luis-Cardosa		João-Bagonha		5
	Lilam-Bot		Pedro-Malheiro		Cristina-Gomes		Graham-Heydom		6
	Tatiana-Santos		Pedro-Cruz		Sofia-Machado		Joana-Ribeiro		7
	Keke		Diogo-Santos		Alfredo-Corral/Pedro-Fernandes		Luis-Cardosa		8
12h	Pedro-Mota	13h30	Marco-Carvalho	13h30	Vitor-Pereira	12h00	Pedro-Nieto	10h30	1
	Graham		Ricardo-Pinto		Nuno-Pinho		Domingos-Paciencia		2
	Gustavo-Diegues		Diogo-Martins		Ana-Teresa		Jorge-Dias		3
	Joana-Ribeiro		Betina-Sousa		Pedro-Nieto		Filipe-Silva		4
	Xano		João-Poveiro		Hugo-Cardoso		Cato-Vilela		5
	Nuno-Ferreira		João-Brito		Francisco-Barbosa		José-Bosinger		6
	Adriano-Oliveira		Manuel-Leitão		Andre-Navas		Bruno-Teixeira		7
	Carlos-Oliveira		Raimundo-Diogo-R		Emanuel-Guimarães		Pedro-Cruz		8
13h30	Miguel-Bagulho	18h00	Filipe-Teixeira	15h30	Carlos-Dutra	13h30	Zé-Rui-Pinto	12h00	1
	Pedro-Pinto		Pedro-Saravá		João-Couto		Manel-Pereira		2
	Luis-Machado		Diogo-Cerqueira		Bruno-Ribeiro		Diogo-Santos		3
	João-Oliveira		Filipe-CC		Cato-Vilela		Diogo-Magalhães		4
	Francisco-Barbosa		Nuno-Ferreira		Bo-Morais		Tatiana-Ferreira		5
	Nuno-Pina		Miguel-Teixeira		Ivo-Nascimento		João-Alvim		6
	Pedro-Rodrigues		Inês-Couveiro		Mário-Pacheco		Diogo-Yu		7
	Carlos-Leitao		Andre-Rodrigues		5		8		8
18h	Catarina-Almeida	19h30	André-Rodrigues	18h00	6	18h00	Rodrigo-Sá	19h30	5
	Carlos-Almeida		Luis-Machado		7		Ricardo-Pinto		6
	Vitor-Pereira		Antonio-Oliveira		8		Nuno-Montenegro		7
	Nuno-Pinho		Catarina-Almeida		Pedro-Lobato		João-Sousa		8
	Paulo-Cardoso		Vasco-Barras		António-Ferreira		Maria-D-Coستا		1
	Pedro-Nieto		Tiago-Pimentel		Patrícia-Rodrigues		Tiago-Bonifacio		2
	Miguel-Guarmações		Rui-Especial		Miguel-Foihadeira		Ricardo-Lemos		3
	Cato-Vilela		Diogo-Mota		Paulo-André-Correira		Maria-Perry		4
19h30	Be-Morais	19h30	Nuno-Ranillo	19h30	Ulisses-Machado	19h30	Neto	19h30	5
	Ivo-Nascimento		Andre-Oliveira		Toddy		Rui-Rufo		6
	Mário-Pacheco		5		Castão-Andrade		Ricardo-Barras		7
	6		João-Lobato		Pin		8		
	7		Evandro		Carlo-Saeres		Sofia-Silva		1
	8		Catarina-Almeida		Fred-Gomes		Jorge-Rocha		2
	André-Correira		Bruna-Anjos		Diogo-Rosas		Luz-Nogueira		3
	Rodrigo-Sá		Bruno-Silva		Luis-Magalhães		Elsa-Morgado		4
19h30	Miguel-Corraldes	19h30	Diogo-Janeiro	19h30	Rodrigo-Sá	19h30	Ronata-Silva	19h30	5
	Nuno-Montenegro		Rodrigo-Sá		Filipe-Cruz		Pedro-Silva		6
	Jony		Francisco-Vieira		Evandro		Diana-Sousa		7
	Tiago-Silva		Carlo-Saeres		Pedro-Pereira		Susete-Correia		8
	Diogo-Rosas		André-Correira		Guallar-Talxerra		Helena-Barbot		1
	Inês-Morais		Heider-Lopes		Diogo-Rosas		2		
	Marta-V-Mendes		Diogo-Rosas		Inês-Morais		3		
	Maria-Perry		Diogo-Rosas		Marta-V-Mendes		4		
Henrique-Rocha	Diogo-Rosas	Marta-V-Mendes	5						
Ricardo-Ribeiro	Diogo-Rosas	Marta-V-Mendes	6						
Ricardo-Branquinho	Diogo-Rosas	Marta-V-Mendes	7						
Fábio-Oliveira	Diogo-Rosas	Marta-V-Mendes	8						
Miguel-Quintas	Diogo-Rosas	Marta-V-Mendes	1						
Miguel-Teixeira	Diogo-Rosas	Marta-V-Mendes	2						
Fernando-Delindro	Diogo-Rosas	Marta-V-Mendes	3						

D Print of old system: "Waiting List" sheet

NOME	Observacoes	Nivel de jog	Estado
Filipe Lima	4f 18h		solucionado
Miguel Sá	?	M3/2	
Tiago Janeiro	4f 19e30 ?????	M3/2	solucionado
Patricia Fontes	3f 19e30h		solucionado
Tiago Pimentel	seg 19e30h		solucionado
Miguel Beguibo	?	M3/4	solucionado
Rui Nuno Pereira	4f 13e30h		solucionado
Inec Peivoto	?	F2	solucionado
Jose Pereira	?		
Jose Rui Magalhães	?	M3	solucionado
Rui Especial	a partir das 18h ou 19h30	M2/3	Solucionado
Filipa Portinho	a partir ?	F3	
Henrique Rocha	Medico Horario variavel	M3/4	solucionado
Rita Portugal	a partir 19e30h	F3/4	solucionado
Alfonso Lencastre	4f 13e30h a partir de Outubro	M3/4	solucionado
Mariana (amiga da Anita)	Turma F3 9h	F3/4	
Diogo Pedrosa	a partir das 19e30h	M3/4	Solucionado
Rita Eleuterio	A partir das 19h	F2 Fpp	Solucionado
Bruno Tomé	a partir das 18h ou 19h30	nivel Vasco Sar	solucionado
Tiago Benigno	a partir das 18h ou 19h30	nivel Vasco Sar	solucionado
João Duarte	disponibilidade total, nao por na turma do ricardo lemos	M3/4	
Joaquim Duarte	disponibilidade total, nao por na turma do ricardo lemos	M3/2	solucionado
Rui Caramalho			enviado msg
Joana Martino Mendes	Hora de almoço ou até as 20	F3	nao tenho turma
Alexandre Portugal	Preferencia de Manha Disponibilidade Total (Exceto 3ª e 5ª Feiras)	M3	solucionado
Vasco Manhos		M3	Solucionado
Bartolomeiz	seg durante dia	M4	solucionado
Daniel Boteta	Segunda 19 e 30 (4 pessoas)		NÃO É PARA PT
Francoeo Lupi	Segunda e Quinta 19 e 30	m2	Nao Ha Vaga pa
Ze Correia das Neves			
Nuno Montenegro	A partir das 18 e 30 , todos os dias da Semana	M4	solucionado
Nuno Machado	Qualquer dia Manhãs	M4	solucionado
Ulisses Machado	Qualquer dia depois das 17h30	M4	Terça Feira as 18
Ines Moreira	qualquer dia depois das 18h	F2	
Eduardo Pires	Quarta As 18	M4	solucionado
Xico Ze	qualquer dia depois das 19h	M2	
Diogo Santos	Segunda as 12	M3	solucionado
Pedro Lobato - Amigo	2a e 4a depois das 19	M3	
António Costa		M4	
Marta Guimarães??			Quinta 19 :30
Vasco Barros??			Terça Feira as 18
Antonio Valente	Disponi bilidade total	m4 com facilidade	Solucionado
Tiago Silva			Solucionado
Alfredo Correia	Disponibilidade 12 H (Principio da semana)		Pedro Ficou de t
Amigo Tiago			
Eurico da Fonseca	1 a 2x as 18h30	M4	
Jose Neves	19 :30	M2/M3Alto	
Fabio Oliveira	Segundas Terças Quartas 19 :30	m4	por colocar
Fernando Delindro	Segunda Quinta Sexta 19 :30	m4	
Hugo Araujo	Segunda a Sexta 19 :30	m4	
Tó Neves	Segunda a Sexta 19 :30	m4	
Rui Lopes	Todos os dias 19 :30	m4	por colocar
Jose Pimenta	Falei com e so pode as 19 e 30	m4	por colocar

E Print of old system: "Past Attendances" sheet

04 a 08 de Maio									
Hora	Segunda	Hora	Terça	Hora	Quarta	Hora	Quinta	Hora	Sexta
12h		12h		18h		12h		12h	
18h		13h30		18h		13h30		13h30	
18h		18h		19h30		18h			3 - 3 + 0
19h30		19h30			4,5 - 0 + 4,5		4,5 - 3 + 1,5		
19h30		19h30							10,5 Off Peak
									16,5 Peak
									27 Total
	7,5 - 1,5 + 6		7,5 - 3 + 4,5						
10 a 15 de Maio									
Hora	Terça	Hora	Quarta	Hora	Quinta	Hora	Sexta	Hora	Sábado
12h				18h		10h30		10h30	
12h				18h		12h		10h30	
13h30					3 - 0 + 3	12h		12h	
18h						13h30		12h	
19h30							6 - 6 + 0		6 - 0 + 6
19h30									10,5 Off Peak
									13,5 Peak
									24 Total
	9 - 4,5 + 4,5								

F Print of old system: "PTC Analysis" sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M
		Setembro	Outubro	Novembro	Dezembro	Janeiro	Fevereiro	Março	Abril	Maio	Junho	Julho	Agosto
1													
2	NP Aulas	280,5	281	283,5	301	145,5			282,5	318	276	216	
3	Valor em Dívida												
4	Valor Recebido Clube												
5	Valor Relativo ao Mês												
6	Valor Recebido												
7	Valor a Receber												
8	Total Clube/Mês												
9	Total Clube/Valor												
10	Total Clube Hora/Recebido												
11	Total Clube Hora/Relativo												
12	Percentual para Clube/Mês												
13	Percentual para Clube/Valor												
14	Número de Pagantes												
15	Número de Utilizadores												
16	NP Pessoas < Mensalidade												
17	Número de Desistências												
18	Número Novos Alunos												
19	NP horas Off-Peak	147	130,5	142,5	161,5	87			142,5	159	157,5	108	
20	NP horas Peak	133,5	130,5	141	139,5	58,5			120	148,5	118,5	108	

G Print of new system: "Fixed Schedule" sheet

Segunda-feira						
Turma 8	Turma 12	Turma 8	Turma 4	Turma 12	Turma 12	
Nível	Nível	Nível	Nível	Nível	Nível	
10:30 12:00	12:00 13:30	13:30 15:00	15:30 17:00	18:00 19:30	19:30 21:00	
Inês Couceiro Raquel Rebelo Keke Pedro Mata Liliam Boti Joana Ribeiro Jorge Dias	Nuno Ferreira Adriano Oliveira Miguel Baguinho Luís Machado Graham Heydom Nuno Pinho	Carlos Leitão Catarina Almeida Carlos Almeida Miguel Guimarães Paulo Cardeno Pedro "Guimarães" Vitor Pinho Joana Vasconcelos	Catarina Vieira Mário Pacheco	André Correia Rodrigo Sá Bruno Silva Miguel Ceráides Nuno Montenegro João Silva Tiago Silva Miguel Teixeira Evandro Pedro Pereira Gualter Teixeira	Helder Lopes Diogo Rosas Inês Moreira Marta V. Mendes Maria Perry Henrique Rocha Ricardo Ribeiro Ricardo Branquinho Fábio Oliveira André Botelo Pedro Silva Fernando Delindro	
✓	✓	✓	✓	✓	✓	
Terça-feira						
Turma 8	Turma 12	Turma 12	Turma 12			
Nível	Nível	Nível	Nível			
12:00 13:30	13:30 15:00	18:00 19:30	19:30 21:00			
Catarina Vieira José Bosingwa Bruno Teixeira Filipe Silva Zé Rui Pinto Pedro Malheiro Pedro Cruz Diogo Santos	Marco Carvalho Ricardo Pinto Diogo Martins Manuel Leitão João Peixoto João Brito Betina Sousa Juliano Raimundo Diogo Radzinski Filipe Felgueiras João Alvim Marta Gomes	Tiago Cerqueira João Oliveira Rui Carneiro Inês Couceiro Ana Teresa Soares Luís Machado Francisco Barbosa João Reis Sofia Machado Samuel Mota Alfredo Correia Helder Leites Carlos Pereira	Catarina Almeida Vasco Barros Tiago Pimentel Rui Especial Diogo Mota Nuno Ranilo Bernardo Moreira André Oliveira Manuel Pereira Francisco José Tomás Veloso			
✓	✓	✓	✓			
Quarta-feira						
Turma 8	Turma 8	Turma 8	Turma 4	Turma 12	Turma 12	
Nível	Nível	Nível	Nível	Nível	Nível	
10:30 12:00	12:00 13:30	13:30 15:00	15:30 17:00	18:00 19:30	19:30 21:00	
Liliam Boti Inês Couceiro Teimo Santos Joana Ribeiro Jorge Dias Domingos Paçoência Álvoro Castro	Patrícia Rodrigues Nuno Pinho Rui Nuno Pereira André Neves Pedro Pinto Graham Heydom Rui Pedroiro Pedro Fernandes	Hugo Cardoso Carlos Dutra Emanuel Queirós Alfredo Correia Ricardo Ribeiro Jaime Linhares Pedro Rodrigues Carlos Oliveira	Catarina Vieira Mário Pacheco Ivo Nascimento Miguel Ramos	António Ferreira André Neves 2 Nuno Ferreira Paulo André Correia Ulisses Machado Alberto Santos Castelo Andrade Miguel Baguinho Filipe Lima Tiago Cerqueira Evandro Miguel Teixeira	Carlos Soares Catarina Almeida Rui Rosas Diogo Rosas Luís Magalhães Rodrigo Sá Tiago Janeiro Francisco Martins Papo Ribeiro Gustavo Martins Zé Rui Magalhães	
✓	✓	✓	✓	✓	✓	
Quinta-feira						
Turma 8	Turma 8	Turma 8	Turma 12	Turma 12		
Nível	Nível	Nível	Nível	Nível		
10:30 12:00	12:00 13:30	13:30 15:00	18:00 19:30	19:30 21:00		
Liliam Boti Pedro Mata Elsa Morgado Gabi Machado	Catarina Vieira José Bosingwa Bruno Teixeira Bárbara Ferreira Zé Rui Pinto Édies Santa Diogo Santos Óscar Pereira	Pedro Alves João Peixoto Luís Simões Helder Leite Luís Gomes Diogo Magalhães Guilherme Brochado Tomás Marques	Rodrigo Sá Ricardo Pinto Nuno Montenegro João Sousa Maria D. Costa Tiago Benigno Ricardo Lemos Maria Perry Manuel Leitão Juliano Raimundo Marco Carvalho	Rui Sofia Silva Jorge Rocha Francisco Pereira Renata Silva Filipe Cruz Emanuel "Cerqueira" Lucibel Joana Almeida		

J Print of new system: "BD Attendances" sheet

Nome	Data	Dia_da_Semana	Tipo	ID	Hora2	Hora	Presença	Falta	Fixos
Inês-Gouveiro	2021/01/04	Segunda-feira			0,44	10:30:00	P		1
Aidé	2021/01/04	Segunda-feira			0,44	10:30:00	P		1
Luís-Caldeira	2021/01/04	Segunda-feira			0,44	10:30:00		F	1
Jaime	2021/01/04	Segunda-feira			0,44	10:30:00		F	1
Keke	2021/01/04	Segunda-feira			0,44	10:30:00	P		1
Marco	2021/01/04	Segunda-feira			0,44	10:30:00		F	1
Liliana-Boti	2021/01/04	Segunda-feira			0,44	10:30:00	P		1
Telmo-Santos	2021/01/04	Segunda-feira			0,44	10:30:00		F	1
Álvaro-Bigodes	2021/01/04	Segunda-feira			0,44	10:30:00	S		0
Pedro-Mata	2021/01/04	Segunda-feira			0,44	10:30:00	P		0
Graham-Hoydorn	2021/01/04	Segunda-feira			0,44	10:30:00	S		1
Gustavo-Diognes	2021/01/04	Segunda-feira			0,44	10:30:00	S		0
Joana-Ribeiro	2021/01/04	Segunda-feira			0,44	10:30:00	S		1

K Print of new system: "BD Coach" sheet

Nome	Data	Dia_da_Semana	Hora
Pedro-Martins	2021/01/04	Segunda-feira	12:00:00
Mário-Correia	2021/01/07	Quinta-feira	19:30:00
Pedro-Martins	2021/01/11	Segunda-feira	10:30:00
Pedro-Martins	2021/01/13	Quarta-feira	12:00:00
Diogo-Santos	2021/04/12	Segunda-feira	18:00:00
Diogo-Santos	2021/04/12	Segunda-feira	19:30:00
Mário-Correia	2021/04/08	Quinta-feira	18:00:00
Diogo-Santos	2021/04/14	Quarta-feira	18:00:00
Diogo-Santos	2021/04/15	Quinta-feira	18:00:00
Diogo-Santos	2021/04/19	Segunda-feira	18:00:00
Diogo-Santos	2021/04/19	Segunda-feira	19:30:00
Diogo-Santos	2021/04/20	Terça-feira	19:30:00
Diogo-Santos	2021/04/21	Quarta-feira	18:00:00

L Print of new system: "BD Practice Description" sheet

Data	Dia_da_semana	Tipo_Aula	ID	hora	Tipo	Descrição
2021/01/11	Segunda-feira			10:30:00	Transição	Jogo paralelo e abre e volve
2021/01/11	Segunda-feira			12:00:00	Transição	Jogo paralelo e abre e volve
2021/01/11	Segunda-feira			13:30:00	Transição	Jogo paralelo e abre e volve
2021/01/11	Segunda-feira			15:30:00	Transição	Jogo paralelo e abre e volve
2021/01/11	Segunda-feira			18:00:00	Transição	Jogo paralelo e abre e volve
2021/01/11	Segunda-feira			19:30:00	Transição	Jogo paralelo e abre e volve
2021/01/12	Terça-feira			12:00:00	Transição	Jogo paralelo e abre e volve
2021/01/12	Terça-feira			13:30:00	Transição	Jogo paralelo e abre e volve
2021/01/12	Terça-feira			18:00:00	Transição	Jogo paralelo e abre e volve
2021/01/12	Terça-feira			19:30:00	Transição	Jogo paralelo e abre e volve
2021/01/13	Quarta-feira			12:00:00	Transição	Jogo paralelo e abre e volve
2021/01/13	Quarta-feira			13:30:00	Transição	Jogo paralelo e abre e volve
2021/01/13	Quarta-feira			15:30:00	Transição	Jogo paralelo e abre e volve

M Print of new system: "Athletes Attendance List" sheet

Alunos	Presenças	Substituições	Faltas	Total presenças	Total supostas no mês	Mês passado
Inês-Couceiro	2	0	11	2	12	2
Raquel Rebelo	1	0	3	1	4	5
Keke	0	4	4	4	4	3
Pedro Mata	1	0	8	1	8	4
Lilham Boti	5	0	7	5	12	3
Joana Ribeiro	2	2	6	4	8	6
Jorge Dias	2	3	6	5	12	9
Nuno Ferreira	2	0	6	2	8	5
Adriano Oliveira	2	0	2	2	4	3
Miguel Bagulho	2	1	6	3	8	6
Luis Machado	2	0	2	2	8	3
Graham Heydorn	8	0	0	8	8	6
Nuno Pinho	4	0	4	4	8	5

N Print of new system: "Coach Attendance List" sheet

Treinadores	Janeiro	Fevereiro	Março	Abril	Maió	Junho	Julho	Agosto
Mário Correia	1	0	0	5	7	0	1	0
Pedro Malheiro	0	0	0	0	1	1	5	8
Pedro Martins	3	0	0	0	0	2	3	0
Diogo Santos	0	0	0	13	20	31	32	10
Mário Pacheco	0	0	0	0	0	1	11	2
Diogo Moreira	0	0	0	0	0	0	1	0
Vasco Barros	0	0	0	0	0	0	1	0
Pedro Perry	0	0	0	0	0	0	2	0
Gatarina Vilela	0	0	0	0	0	0	0	2
Nuno Moreira	0	0	0	0	0	0	0	22

O Print of new system: "Monthly Hours" sheet

Abril		2021/04/05	2021/04/06	2021/04/07	2021/04/08	2021/04/12	2021/04/13	2021/04/14	2021/04/15	2021/04/19	2021/04/20	2021/04/21	2021/04/22	2021/04/26	2021/04/27	2021/04/28	2021/04/29		
Contagem Off peak		6	6	12	9	10,5	6	10,5	9	9	7,5	10,5	9	12	7,5	10,5	7,5	0	0
Contagem Peak		6		4,5	7,5	9	6	7,5	7,5	9	7,5	7,5	9	9	7,5	7,5	9	0	0
Total Off peak		142,5																	
Total Peak		120																	
Total Mês		262,5																	

Mai		2021/05/03	2021/05/04	2021/05/05	2021/05/06	2021/05/10	2021/05/11	2021/05/12	2021/05/13	2021/05/10	2021/05/17	2021/05/18	2021/05/19	2021/05/20	2021/05/24	2021/05/25	2021/05/26	2021/05/27	2021/05/31
Contagem Off peak		12	6	10,5	9	10,5	7,5	10,5	9	10,5	12	6	10,5	10,5	10,5	7,5	10,5	9	12
Contagem Peak		9	7,5	9	7,5	9	9	9	9	9	9	9	6	10,5	9	9	9	9	9
Total Off peak		174																	
Total Peak		155																	
Total Mês		330																	

Junho		2021/06/01	2021/06/02	2021/06/03	2021/06/07	2021/06/08	2021/06/09	2021/06/10	2021/06/14	2021/06/15	2021/06/16	2021/06/17	2021/06/21	2021/06/22	2021/06/23	2021/06/24	2021/06/28	2021/06/29	2021/06/30
Contagem Off peak		13,5	13,5	9	9	7,5	12	6	9	6	12	6	9	7,5	13,5	0	6	7,5	10,5
Contagem Peak		4,5	7,5	0	9	9	9	0	9	7,5	7,5	9	9	9	3	0	9	7,5	9
Total Off peak		157,5																	
Total Peak		118,5																	
Total Mês		276																	

Julho		2021/07/01	2021/07/05	2021/07/06	2021/07/07	2021/07/08	2021/07/12	2021/07/13	2021/07/14	2021/07/15	2021/07/19	2021/07/20	2021/07/21	2021/07/22	2021/07/26	2021/07/27	2021/07/28	2021/07/29	
Contagem Off peak		7,5	0	0	7,5	4,5	4,5	6	10,5	6	9	6	10,5	4,5	9	6	10,5	6	0
Contagem Peak		9	0	0	6	6	7,5	7,5	7,5	9	7,5	6	9	9	6	6	7,5	4,5	0
Total Off peak		103																	
Total Peak		103																	
Total Mês		216																	

P "Monday Process" macro code

```
1
2 function monday() {
3     var app = SpreadsheetApp;
4
5
6
7
8
9
10    var F = app.getActiveSpreadsheet().getSheetByName("Fixos");
11    var P = app.getActiveSpreadsheet().getSheetByName("bd_presencas");
12    var S = app.getActiveSpreadsheet().getSheetByName("Presencas");
13    var bd2 = app.getActiveSpreadsheet().getSheetByName("bd_descricao");
14    var Prof = app.getActiveSpreadsheet().getSheetByName("bd_treinadores"
15        );
16    var alunos = app.getActiveSpreadsheet().getSheetByName("Lista_alunos"
17        );
18
19
20
21    /* Variaveis */
22
23
24        /* Variaveis das presencas */
25    var P_linha_1, P_linha_2,P_linha_3, P_coluna_fixa,
26        P_coluna_variavel;
27    var P_segunda_valor, P_descricao_valor;
28    var P_dif_linhas;
29    var P_dia;
30    var P_ultima_coluna, P_ult_colu_valor, P_coluna_3,
31        P_coluna_descricao;
32    var P_hora_linha, P_primeira_linha, P_segunda_linha;
```

```

32
33     /* Variaveis dos fixos */
34     var F_linha_1, F_linha_2, F_coluna_fixa, F_coluna_variavel;
35     var F_segunda_valor, F_terca_valor;
36     var F_dif_linhas;
37     var F_hora, F_hora, F_hora_linha;
38     var F_ultima_coluna;
39     var F_filtro;
40
41
42     /* Variaveis da base dados das presencas */
43     var bd_ultima_linha, bd_ultima_coluna;
44
45
46     /* Variaveis da base dados das descricoes */
47     var bd2_ultima_linha, bd2_ultima_coluna;
48     var bd2_filtro;
49
50     /* Variaveis da base dados dos Prof */
51     var Prof_ultima_linha, Prof_ultima_coluna;
52     var Prof_filtro;
53
54     /* Variaveis da da lista de alunos */
55     var alu_ultima_linha, alu_linha_variavel;
56     var alu_fixo;
57
58
59     /* Variaveis de datas */
60     var data_atual, data_inteira;
61
62
63     /* Variaveis de recolha dados */
64     var Dia_semana, hora_1, hora_2, Nome, Presenca, Falta, data;
65     var tipo, descricao;
66     var tipo_aula, id;
67
68

```

```

69     /* Variaveis de informacao */
70     var ultima_linha, cell_atual, ultima_coluna;
71     var source;
72
73     /* Variavel para contar o tempo do script*/
74     var today = new Date();
75
76
77
78
79
80     /* Criacao de limites */
81
82
83
84         /* Criacao de limites de linhas da pagina presencas */
85
86
87         P_linha_1 = 1
88         P_coluna_fixa = 2
89         P_linha_2 = 1
90
91     do {
92
93         P_segunda_valor = S.getRange( P_linha_1, P_coluna_fixa
94             ).getValue()
95
96         P_linha_1++
97
98     } while (P_segunda_valor != "Segunda-feira");
99
100     P_linha_1 = P_linha_1 +2
101
102
103     do {
104

```

```

105         P_descricao_valor = S.getRange(P_linha_2 , 1).getValue()
106
107         P_linha_2++
108
109     } while (P_descricao_valor != "Descricao");
110
111
112     /* Criacao de limites de linhas da pagina fixos */
113
114
115         F_linha_1 = 1
116         F_linha_2 = 1
117         F_coluna_fixa = 1
118
119
120     do {
121
122         F_segunda_valor = F.getRange(F_linha_1, F_coluna_fixa)
123             .getValue()
124
125         F_linha_1++
126
127     } while (F_segunda_valor != "Segunda-feira");
128
129     F_linha_1 = F_linha_1 +2
130
131     do {
132
133         F_terca_valor = F.getRange(F_linha_2, F_coluna_fixa).
134             getValue()
135
136         F_linha_2++
137
138     } while (F_terca_valor != "Terca-feira");
139
140     F_linha_2--

```

```

140      /* Criacao de limites de colunas da pagina Presencas */
141
142
143      P_ultima_coluna = 50
144
145      do {
146
147          P_ult_colu_valor = S.getRange(P_linha_1 ,
148              P_ultima_coluna).getValue()
149
150          P_ultima_coluna--
151
152
153      } while (P_ult_colu_valor != "Falta");
154
155
156          P_ultima_coluna = P_ultima_coluna + 4
157
158      /* Criacao de limites de colunas da pagina Fixos
159
160          F_ultima_coluna = 50
161
162
163          do {
164
165              F_ultima_coluna--
166
167
168          } while (F.getRange(F_linha_1-1 , F_ultima_coluna).
169              getValue() != "Nivel");
170
171          F_ultima_coluna++*/
172
173
174          F_ultima_coluna = 0

```

```

175         a=0
176
177         F_coluna_variavel = 1
178
179         do {
180             if (F.getRange(F_linha_2-1,F_coluna_variavel).
181                 getValue() == true) {
182                 F_ultima_coluna = F_ultima_coluna +2
183                 a = 0
184             }
185
186             if (F.getRange(F_linha_2-1,F_coluna_variavel).
187                 getValue() == false) {
188                 a++
189             }
190
191             F_coluna_variavel = F_coluna_variavel +2
192
193
194
195         }while(a < 10 )
196
197         if (F_ultima_coluna == 0) {F_ultima_coluna = 2}
198
199
200
201         /* Criacao de limites de linhas na lista de alunos */
202
203
204         alu_ultima_linha = 1
205
206         do {
207
208             alu_ultima_linha++
209

```

```

210
211         } while (alunos.getRange(alu_ultima_linha, 2).
                getValue() != "");
212
213
214
215     /* Verificar o numero de linhas das presencas em comparacao com fixos
        */
216
217
218
219     P_linha_1 = P_linha_1 + 2
220     P_linha_2 = P_linha_2 - 1
221
222
223     F_linha_1 = F_linha_1 + 2
224     F_linha_2 = F_linha_2 - 1
225
226
227     P_dif_linhas = P_linha_2 - P_linha_1
228     F_dif_linhas = F_linha_2 - F_linha_1
229
230
231
232
233
234
235     do {
236
237         if ( P_dif_linhas <= F_dif_linhas +1) {
238
239
240             S.insertRowAfter(P_linha_2 - 1);
241
242
243             P_dif_linhas++ }
244

```

```

245
246     }while (P_dif_linhas <= F_dif_linhas + 1 )
247
248
249
250
251
252     /* Remover filtro */
253
254     /* Da base dados presencas */
255
256     F_filtro = P.getFilter();
257
258     if (F_filtro != null) {
259
260         F_filtro.remove()
261     }
262
263     /* Da base dados Descricao */
264
265     bd2_filtro = bd2.getFilter();
266
267     if (bd2_filtro != null) {
268
269         bd2_filtro.remove()
270     }
271
272     /* Da base dados Professores */
273
274     Prof_filtro = Prof.getFilter();
275
276     if (Prof_filtro != null) {
277
278         Prof_filtro.remove()
279     }
280
281

```

```

282  /* Inserir data do dia */
283
284      data_atual = new Date();
285
286      data_inteira = new Date();
287
288      data_inteira.setDate(data_atual.getDate()-5);
289
290
291
292
293  /* Passar os dados das presencas para base de dados */
294
295
296      P_dia = P_linha_1 - 3
297      P_linha_1 = P_linha_1
298      P_coluna_variavel = 1
299      P_coluna_3 = 3
300
301      alu_linha_variavel = 1
302
303
304
305
306
307      do {
308
309
310
311          do {
312
313              Dia_semana = S.getRange(P_dia-2,P_coluna_fixa).getValue()
314              hora_1 = S.getRange(P_dia + 1 , P_coluna_variavel).
315                  getValue()
316              hora_2 = S.getRange(P_dia + 2, P_coluna_variavel).
317                  getValue()
318              Nome = S.getRange(P_linha_1, P_coluna_variavel).getValue

```

```

    ()
317     Presenca = S.getRange(P_linha_1, P_coluna_variavel + 1).
        getValue()
318     Faltas = S.getRange(P_linha_1, P_coluna_variavel + 2).
        getValue()
319     data = data_inteira
320     tipo_aula = S.getRange(P_dia , P_coluna_variavel).
        getValue()
321     id = S.getRange(P_dia , P_coluna_variavel+1).getValue()
322
323     if (tipo_aula == "Turma") {id = ""}
324
325     if ( Presenca == "P" || Presenca == "S" || Presenca == "
        E" || Faltas == "F" || Faltas == "L" ) {
326
327     do {
328
329         alu_fixo = alunos.getRange(alu_linha_variavel, 2).
            getValue()
330
331         if (alu_fixo == Nome){alu_linha_variavel =
            alu_ultima_linha -1}
332
333         alu_linha_variavel++
334
335     } while (alu_linha_variavel < alu_ultima_linha)
336
337     alu_linha_variavel = 1
338
339
340     bd_ultima_linha = P.getLastRow()
341
342     cell_atual = P.getRange(bd_ultima_linha,1).activate()
343
344
345     cell_atual = cell_atual.offset(1,0)
346     cell_atual = cell_atual.setValue(Nome)

```

```

347         cell_atual = cell_atual.offset(0,1)
348         cell_atual = cell_atual.setValue(data)
349         cell_atual = cell_atual.offset(0,1)
350         cell_atual = cell_atual.setValue(Dia_semana)
351         cell_atual = cell_atual.offset(0,1)
352         cell_atual = cell_atual.setValue(tipo_aula)
353         cell_atual = cell_atual.offset(0,1)
354         cell_atual = cell_atual.setValue(id)
355         cell_atual = cell_atual.offset(0,1)
356         cell_atual = cell_atual.setValue(hora_2)
357         cell_atual = cell_atual.offset(0,1)
358         cell_atual = cell_atual.setValue(hora_1)
359         cell_atual = cell_atual.offset(0,1)
360         cell_atual = cell_atual.setValue(Presenca)
361         cell_atual = cell_atual.offset(0,1)
362         cell_atual = cell_atual.setValue(Falta)
363         cell_atual = cell_atual.offset(0,1)
364         if (alu_fixo == Nome) {cell_atual = cell_atual.setValue(1)
           } else {cell_atual = cell_atual.setValue(0)}
365
366
367         P_linha_1++
368
369     } else if (Presenca == "T") {
370
371         Prof_ultima_linha = Prof.getLastRow()
372
373         cell_atual = Prof.getRange(Prof_ultima_linha,1).
           activate()
374
375         cell_atual = cell_atual.offset(1,0)
376         cell_atual = cell_atual.setValue(Nome)
377         cell_atual = cell_atual.offset(0,1)
378         cell_atual = cell_atual.setValue(data)
379         cell_atual = cell_atual.offset(0,1)
380         cell_atual = cell_atual.setValue(Dia_semana)
381         cell_atual = cell_atual.offset(0,1)

```

```

382         cell_atual = cell_atual.setValue(hora_2)
383         cell_atual = cell_atual.offset(0,1)
384         cell_atual = cell_atual.setValue(hora_1)
385
386         P_linha_1++
387
388     } else {P_linha_1++}
389
390
391 } while (P_linha_1 != P_linha_2 );
392
393
394         P_linha_1 = P_dia + 3
395
396         P_coluna_variavel = P_coluna_variavel + 3
397
398         P_coluna_3 = P_coluna_3 + 3
399
400
401 } while (P_coluna_3 != P_ultima_coluna);
402
403
404
405 /* Passar os dados das descricoes das aulas para base de dados */
406
407         /* Recriacao de limites de linhas da pagina presencas */
408
409         P_linha_1 = 1
410         P_linha_2 = 1
411
412     do {
413
414         P_segunda_valor = S.getRange( P_linha_1,
415                                     P_coluna_fixa).getValue()
416
417         P_linha_1++

```

```

418     } while (P_segunda_valor != "Segunda-feira");
419
420     P_linha_1 = P_linha_1 +2
421
422     do {
423
424         P_descricao_valor = S.getRange(P_linha_2 ,1).getValue()
425
426         P_linha_2++
427
428     } while (P_descricao_valor != "Descricao");
429
430
431     /* Passagem dos dados da descricao */
432
433     P_linha_1 = P_linha_1 - 1
434     P_coluna_variavel = 1
435
436     P_coluna_descricao = 2
437
438     do {
439
440
441         Dia_semana = S.getRange(P_dia-2,P_coluna_fixa).
            getValue()
442         hora_1 = S.getRange(P_dia + 1 , P_coluna_variavel).
            getValue()
443         hora_2 = S.getRange(P_dia + 2, P_coluna_variavel).
            getValue()
444         tipo = S.getRange(P_linha_2, P_coluna_descricao).
            getValue()
445         descricao = S.getRange(P_linha_2, P_coluna_descricao
            - 1).getValue()
446         data = data_inteira
447         tipo_aula = S.getRange(P_dia , P_coluna_variavel).
            getValue()
448         id = S.getRange(P_dia , P_coluna_variavel+1).

```

```

449         getValue()
450
451         if (tipo_aula == "Turma") {id = ""}
452
453         if (tipo != "" || descricao != "") {
454
455             bd2_ultima_linha = bd2.getLastRow()
456
457             cell_atual = bd2.getRange(bd2_ultima_linha,1).
458                 activate()
459
460             cell_atual = cell_atual.offset(1,0)
461             cell_atual = cell_atual.setValue(data)
462             cell_atual = cell_atual.offset(0,1)
463             cell_atual = cell_atual.setValue(Dia_semana)
464             cell_atual = cell_atual.offset(0,1)
465             cell_atual = cell_atual.setValue(tipo_aula)
466             cell_atual = cell_atual.offset(0,1)
467             cell_atual = cell_atual.setValue(id)
468             cell_atual = cell_atual.offset(0,1)
469             cell_atual = cell_atual.setValue(hora_2)
470             cell_atual = cell_atual.offset(0,1)
471             cell_atual = cell_atual.setValue(hora_1)
472             cell_atual = cell_atual.offset(0,1)
473             cell_atual = cell_atual.setValue(tipo)
474             cell_atual = cell_atual.offset(0,1)
475             cell_atual = cell_atual.setValue(descricao)
476             cell_atual = cell_atual.offset(0,1)
477
478             P_coluna_descricao = P_coluna_descricao + 3
479
480             P_coluna_variavel = P_coluna_variavel + 3}
481
482     else {
483

```

```

484     P_coluna_descricao = P_coluna_descricao + 3
485
486     P_coluna_variavel = P_coluna_variavel + 3}
487
488
489 } while (P_coluna_descricao != P_ultima_coluna - 1);
490
491
492
493
494
495
496 /* Limpar a pagina das presencas do dia */
497
498
499 /* Limpar alunos*/
500
501     P_ultima_coluna = P_ultima_coluna - 3
502
503     S.getRange(P_dia + 3,1,P_dif_linhas,P_ultima_coluna)
504         .clearContent();
505
506 /* Limpar horas */
507
508     P_coluna_variavel = 1
509     P_coluna_3 = 1
510
511 do {
512
513     S.getRange(P_dia +1, P_coluna_variavel).clearContent();
514
515
516     P_coluna_variavel = P_coluna_variavel + 3
517
518     P_coluna_3 = P_coluna_3 + 3
519

```

```

520
521
522 } while(P_coluna_3 != P_ultima_coluna +1);
523
524
525     /* Limpar tipos de aulas e id */
526
527     S.getRange(P_dia ,1,1,P_ultima_coluna).clearContent();
528
529     /* Limpar todas as descricoes de aulas */
530
531     S.getRange(P_linha_2,1,1, P_ultima_coluna).clearContent()
532
533
534
535
536     /* Verificacao de numero de colunas */
537
538     /* Recriacao de limites de linhas da pagina presencas */
539
540
541     P_linha_1 = 1
542     P_coluna_fixa = 2
543     P_linha_2 = 1
544
545     do {
546
547         P_segunda_valor = S.getRange( P_linha_1, P_coluna_fixa).
                    getValue()
548
549         P_linha_1++
550
551
552     } while (P_segunda_valor != "Segunda-feira");
553
554     P_linha_1 = P_linha_1 +2
555

```

```

556     do {
557
558         P_descricao_valor = S.getRange(P_linha_2 , 1).getValue()
559
560         P_linha_2++
561
562
563     } while (P_descricao_valor != "Descricao");
564
565
566
567     /* Unmerge cells */
568
569
570     if( S.getRange(P_linha_1 - 3,2).isPartOfMerge() ) {
571
572         var range = S.getRange(P_linha_1 - 3,2).getMergedRanges()[0];
573
574         P_primeira_linha = range.getLastColumn();
575
576         var myRange = S.getRange(P_linha_1 - 3 ,2,2,P_primeira_linha)
577
578         var breakRange = myRange;
579
580         breakRange.breakApart();
581
582     }
583
584
585
586     /* Por ou retirar colunas as presencas em funcao dos fixos */
587
588
589
590     F_ultima_coluna = F_ultima_coluna /2
591
592     F_ultima_coluna = F_ultima_coluna * 3

```

```

593
594
595     do {
596         if ( P_ultima_coluna < F_ultima_coluna ) {
597
598             source = S.getRange(P_linha_1-1,P_ultima_coluna - 2,
599                                 P_dif_linhas + 5, 3)
600
601             var destRange = S.getRange(P_linha_1-1 ,P_ultima_coluna
602                                         +1)
603
604             source.copyTo (destRange);
605
606             P_ultima_coluna = P_ultima_coluna + 3 }
607
608         else if (P_ultima_coluna > F_ultima_coluna &&
609                 F_ultima_coluna >= 3 ) {
610
611             if(F_ultima_coluna == 3) {
612
613                 source = S.getRange(P_linha_1-1,7, P_dif_linhas + 5,
614                                     P_ultima_coluna)
615
616                 source.clearContent()
617
618                 source.clearDataValidations()
619
620                 source.clearFormat()
621
622                 source.setBackground("white")
623
624                 S.getRange(P_linha_1 - 3, 7, 2, P_ultima_coluna).
625                     setBackground("white")
626
627                 P_ultima_coluna = 3
628

```

```

625     }else {
626
627         source = S.getRange(P_linha_1-1,P_ultima_coluna - 2,
628             P_dif_linhas + 5, 3)
629
630         source.clearContent()
631
632         source.clearDataValidations()
633
634         source.clearFormat()
635
636         source.setBackground("white")
637
638         S.getRange(P_linha_1 - 3, P_ultima_coluna - 2, 2, 3).
639             setBackground("white")
640
641         P_ultima_coluna = P_ultima_coluna - 3}
642
643     }
644 }while (P_ultima_coluna != F_ultima_coluna    )
645
646     if(F_ultima_coluna == 3) { P_ultima_coluna = 6}
647
648
649     /* Merge cells */
650
651     S.getRange(P_linha_1 - 3 ,2,2,P_ultima_coluna-1 ).merge();
652
653
654     /* Passar os dados dos fixos para presencas */
655
656
657
658     /* Recreacao dos limites das presencas */
659

```

```

660     P_linha_1 = 1
661
662         do {
663
664             P_segunda_valor = S.getRange( P_linha_1, P_coluna_fixa).
                getValue()
665
666     P_linha_1++
667
668     } while (P_segunda_valor != "Segunda-feira");
669
670     P_linha_1 = P_linha_1 +2
671
672     /* Recreacao de limites da pagina fixos */
673
674     F_linha_1 = 1
675     F_linha_2 = 1
676
677         do {
678
679             F_segunda_valor = F.getRange(F_linha_1,
                F_coluna_fixa).getValue()
680
681             F_linha_1++
682
683     } while (F_segunda_valor != "Segunda-feira");
684
685     F_linha_1 = F_linha_1 +2
686
687
688     do {
689
690             F_terca_valor = F.getRange(F_linha_2,
                F_coluna_fixa).getValue()
691
692
693     F_linha_2++

```

```

694
695
696         } while (F_terca_valor != "Terca-feira");
697
698         F_linha_2--
699
700
701         /* Passagem dos dados */
702
703         F_hora_linha = F_linha_1
704         F_linha_1 = F_linha_1 + 2
705         F_coluna_variavel = 1
706
707
708         P_linha_3 = P_linha_1
709         P_linha_1 = P_linha_1 + 2
710         P_hora_linha = P_linha_1 - 2
711         P_coluna_variavel = 1
712
713         F_ultima_coluna = F_ultima_coluna / 3
714         F_ultima_coluna = F_ultima_coluna*2
715
716         a=0
717
718
719         do {
720
721             if (F.getRange(F_linha_2-1,F_coluna_variavel).getValue() ==
722                 true){
723
724                 do {
725
726
727                     Nome = F.getRange(F_linha_1, F_coluna_variavel).getValue
728                         ()
729                     F_hora_ajuda = F.getRange(F_hora_linha ,F_coluna_variavel

```

```

        ).getValue()
729     if ((F_hora_ajuda.length < 11) || (typeof F_hora_ajuda.
        length === 'undefined')) {F_hora = ""}
730     else {F_hora = ""
731           F_hora = F_hora_ajuda.substring(0,5)}
732     tipo_aula = F.getRange(F_hora_linha-2 ,F_coluna_variavel).
        getValue()
733     id = F.getRange(F_hora_linha-2 ,F_coluna_variavel+1).
        getValue()
734
735
736     if (S.getRange(P_hora_linha, P_coluna_variavel) != F.
        getRange(F_hora_linha,F_coluna_variavel).getValue()) {
737
738     cell_atual = S.getRange(P_hora_linha, P_coluna_variavel).
        activate()
739     cell_atual = S.getRange(P_hora_linha, P_coluna_variavel).
        setValue(F_hora)}
740
741     if (S.getRange(P_hora_linha-1, P_coluna_variavel) != F.
        getRange(F_hora_linha-2,F_coluna_variavel).getValue())
        {
742
743     cell_atual = S.getRange(P_hora_linha-1, P_coluna_variavel
        ).activate()
744
745     cell_atual.setValue(tipo_aula)
746     cell_atual = cell_atual.offset(0,1)
747     cell_atual = cell_atual.setValue(id)
748
749     }
750
751
752     cell_atual = S.getRange(P_linha_1, P_coluna_variavel).
        activate()
753     cell_atual = cell_atual.setValue(Nome)
754

```

```

755         F_linha_1++
756         P_linha_1++
757
758         } while (F_linha_1 != F_linha_2 - 1);
759
760 P_coluna_variavel = P_coluna_variavel + 3
761
762
763         a=0
764     }
765
766     if (F.getRange(F_linha_2-1,F_coluna_variavel).getValue() ==
767         false){
768
769
770         a++
771     }
772
773     F_linha_1 = F_hora_linha + 2
774     P_linha_1 = P_linha_3 + 2
775
776
777     F_coluna_variavel = F_coluna_variavel +2
778
779 } while (a<10);
780
781
782 /* Criacao de uma table para base de dados */
783
784 /* Na base dados presencas */
785
786     bd_ultima_linha = P.getLastRow()
787
788     bd_ultima_coluna = P.getLastColumn();
789
790     P.getRange(1,1,bd_ultima_linha,bd_ultima_coluna).

```

```
        createFilter();
791
792
793     /* Na base dados descricao */
794
795         bd2_ultima_linha = bd2.getLastRow()
796
797         bd2_ultima_coluna = bd2.getLastColumn();
798
799         bd2.getRange(1,1,bd2_ultima_linha,bd2_ultima_coluna).
            createFilter();
800
801     /* Na base dados Professores */
802
803         Prof_ultima_linha = Prof.getLastRow()
804
805         Prof_ultima_coluna = Prof.getLastColumn();
806
807         Prof.getRange(1,1,Prof_ultima_linha,Prof_ultima_coluna).
            createFilter();
808
809 }
```

Q "Normal game" macro code

```
1
2 function jogo_po_inicio() {
3
4     var app = SpreadsheetApp;
5     var S = app.getActiveSpreadsheet().getSheetByName("bd_pontos");
6     var P = app.getActiveSpreadsheet().getSheetByName("Avaliacao");
7
8
9     /* Pintar a celula para avisar que o jogo comecou a ser avaliado */
10
11     P.getRange(20,3).setBackground("#e06666")
12
13
14     var today = new Date();
15
16
17     /* Encontrar a ultima linha da base de dados */
18
19     ultima = S.getLastRow()
20
21
22     linha = ultima
23
24     do {
25         linha--
26
27
28     }while(S.getRange(linha,10).getValue() == "")
29
30     linha++
31
32
33
34
35     if(S.getRange(linha-1, 15).getValue() == 1){a=1} else {a=0}
```

```

36
37
38
39
40 /* Definicao do id do jogo */
41
42 if(S.getRange(linha-1,10).getValue() == "ID"){
43     id = 1
44     }else if (isNaN(S.getRange(linha-1,10).getValue()) == false) { id
45         = S.getRange(linha-1,10).getValue()+1}
46
47 if(a==0 && S.getRange(linha-1,10).getValue() != "ID"){id= S.getRange(
48     linha-1,10).getValue()}
49
50 P.getRange(21,5).setValue(id)
51
52
53
54
55
56 /* Defenir os jogadores */
57
58
59 jogador1 = P.getRange(10,2).getValue()
60 jogador2 = P.getRange(5,2).getValue()
61 jogador3 = P.getRange(5,7).getValue()
62 jogador4 = P.getRange(10,7).getValue()
63
64 tipo = P.getRange(19,3).getValue()
65
66
67
68
69
70 /* Comecar o jogo */

```

```

71
72 if(linha<ultima){
73
74
75
76 b=0
77
78 do{
79
80     var now = new Date();
81
82         if (now.getTime() - today.getTime() >
83             255000) { P.getRange(20,3).
84                 setBackground("white");return}
85
86
87
88     S.getRange(linha,1).getValue() != "") {
89
90
91
92     S.getRange(linha,10).setValue(id)
93
94     numeroJ = S.getRange(linha,2).getValue()
95
96
97
98     if (S.getRange(linha,2).getValue() == 1) {S.getRange(linha,2).
99         setValue(jogador1)}
100    if (S.getRange(linha,2).getValue() == 2) {S.getRange(linha,2).
        setValue(jogador2)}
101    if (S.getRange(linha,2).getValue() == 3) {S.getRange(linha,2).
        setValue(jogador3)}
102    if (S.getRange(linha,2).getValue() == 4) {S.getRange(linha,2).
        setValue(jogador4)}
103
104
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```

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101
102     if((S.getRange(linha-1,14).getValue() == "Resultado Set") || (a==1)
103         ) {S.getRange(linha,14).setValue("0 - 0")}
104     else {
105         S.getRange(linha,14).setValue(S.getRange(linha-1,14).getValue())}
106
107
108
109
110
111
112
113     acao = S.getRange(linha,3).getValue()
114
115
116     /* Caso a acao seja um erro */
117
118     if (acao == "Erro nao forçado" || acao == "Erro forçado") {
119
120         if(numeroJ <= 2 ) {
121             if((isNaN( S.getRange(linha-1,12).getValue()) == true) || (S.
122                 getRange(linha-1,12).getValue() == "") || (a==1) ) {
123                 if ( (isNaN(S.getRange(linha-1,11).getValue()) == true) || (
124                     S.getRange(linha-1,11).getValue() == "") || (a==1)) {S.
125                     getRange(linha,11).setValue(0)} else {S.getRange(linha,11)
126                     .setValue(S.getRange(linha-1,11).getValue())}
127
128                     S.getRange(linha,12).setValue(15)
129                 }
130                 else if(S.getRange(linha-1,12).getValue() == 15) {
131     if ( isNaN(S.getRange(linha-1,11).getValue()) == true) {S.getRange(
132         linha,11).setValue(0)} else {S.getRange(linha,11).setValue(S.
133         getRange(linha-1,11).getValue())}
134
135         S.getRange(linha,12).setValue(30)
136     }

```

```

131     else if(S.getRange(linha-1,12).getValue() == 30) {
132 if ( isNaN(S.getRange(linha-1,11).getValue()) == true) {S.getRange(
    linha,11).setValue(0)} else {S.getRange(linha,11).setValue(S.
    getRange(linha-1,11).getValue())}
133
134     S.getRange(linha,12).setValue(40)}
135     else if(S.getRange(linha-1,12).getValue() == 40) {
136
137     /* Caso tie-break */
138
139     result = S.getRange(linha,13).getValue()
140     res = ""
141     res = result.substring(0,1)
142     outr = result.substring(4,5)
143
144     outr = Number(outr) + 1
145
146     soma = outr - Number(res)
147
148     if(outr >= 6  && soma >= 2) {
149
150         setes = S.getRange(linha,14).getValue()
151         set_res = setes.substring(0,1)
152         set_outr = setes.substring(4,5)
153
154         set_outr = Number(set_outr) + 1
155
156         S.getRange(linha,14).setValue(""+set_res+" - "+set_outr+"")
157
158
159     }
160
161
162
163
164
165     S.getRange(linha,13).setValue(""+res+" - "+outr+"")

```

```

166
167     S.getRange(linha,11).setValue("")
168     S.getRange(linha,12).setValue("")
169
170 }
171
172     S.getRange(linha,16).setFormula("=if(A"+linha+"<>\"\",if(G"+
        linha+"=\"Bolha a malha\",G"+linha+",if(G"+linha+"=\"
        Bandeja\",G"+linha+",if(G"+linha+"=\"Smash\",G"+linha+",
        IF(F"+linha+"<>\"\",IF(F"+linha+"=\"Lob\",CONCATENATE(G"+
        linha+",\" Lob\" ,\" Esquerda\"),CONCATENATE(G"+linha+",\"
        Esquerda\")),if(E"+linha+"<>\"\",if(E"+linha+"=\"Lob\",
        CONCATENATE(G"+linha+",\" Lob\", \" Direita\"),
        CONCATENATE(G"+linha+",\" Direita\")),G"+linha+"))))))
        ,\"\")")
173     S.getRange(linha,17).setValue(tipo)
174     S.getRange(linha,18).setValue(1)
175
176
177 }
178
179
180
181
182
183
184
185     if(numeroJ >= 3 ) {
186         if((isNaN( S.getRange(linha-1,11).getValue()) == true) || (S.
            getRange(linha-1,11).getValue() == "") || (a==1)) {
187             if ( (isNaN(S.getRange(linha-1,12).getValue()) == true) || (S
                .getRange(linha-1,12).getValue() == "") || (a==1) ) {S.
                getRange(linha,12).setValue(0)} else {S.getRange(linha,12)
                .setValue(S.getRange(linha-1,12).getValue())}
188
189             S.getRange(linha,11).setValue(15)}
190         else if(S.getRange(linha-1,11).getValue() == 15) {

```

```

191 if ( isNaN(S.getRange(linha-1,12).getValue()) == true) {S.getRange(
    linha,12).setValue(0)} else {S.getRange(linha,12).setValue(S.
    getRange(linha-1,12).getValue())}
192
193     S.getRange(linha,11).setValue(30)}
194 else if(S.getRange(linha-1,11).getValue() == 30) {
195     if ( isNaN(S.getRange(linha-1,12).getValue()) == true) {S.
        getRange(linha,12).setValue(0)} else {S.getRange(linha,12)
        .setValue(S.getRange(linha-1,12).getValue())}
196
197     S.getRange(linha,11).setValue(40)}
198 else if(S.getRange(linha-1,11).getValue() == 40) {
199
200     /* Caso tie-break */
201
202     result = S.getRange(linha,13).getValue()
203     res = ""
204     res = result.substring(0,1)
205     outr = result.substring(4,5)
206
207     res = Number(res) + 1
208
209     soma = res - Number(outr)
210
211     if(res >= 6  && soma >= 2) {
212
213         setes = S.getRange(linha,14).getValue()
214         set_res = setes.substring(0,1)
215         set_outr = setes.substring(4,5)
216
217         set_res = Number(set_res) + 1
218
219         S.getRange(linha,13).setValue(""+set_res+" - "+set_outr+"")
220
221     }
222
223     S.getRange(linha,13).setValue(""+res+" - "+outr+"")

```

```

224
225     S.getRange(linha,11).setValue("")
226     S.getRange(linha,12).setValue("")
227
228
229 }
230
231 S.getRange(linha,16).setFormula(
232     "=if(A"+linha+"<>\"\",if(G"+linha+
233     ="Bolha a malha\",G"+linha+",if(G"+linha+"=\"Bandeja\",G"+linha+
234     ",if(G"+linha+"=\"Smash\",G"+linha+", IF(F"+linha+"<>\"\",IF(F"+
235     linha+"=\"Lob\",CONCATENATE(G"+linha+",\" Lob\" ,\" Esquerda\"),
236     CONCATENATE(G"+linha+",\" Esquerda\")),if(E"+linha+"<>\"\",if(E"+
237     linha+"=\"Lob\", CONCATENATE(G"+linha+",\" Lob\", \" Direita\"),
238     CONCATENATE(G"+linha+",\" Direita\")),G"+linha+"))))\"")
239     S.getRange(linha,17).setValue(tipo)
240     S.getRange(linha,18).setValue(2)
241
242 }
243
244 }
245
246 /* Caso a acao seja um Winner */
247 if (acao == "Winner" ) {
248
249     if(numeroJ <= 2 ) {
250         if((isNaN( S.getRange(linha-1,11).getValue()) == true) || (S.
251             getRange(linha-1,11).getValue() == "" ) || (a==1)) {
252             if ( ( isNaN(S.getRange(linha-1,12).getValue()) == true) || (S
253                 .getRange(linha-1,12).getValue() == "" ) || (a==1)) {S.
254                 getRange(linha,12).setValue(0)} else {S.getRange(linha,12)
255                 .setValue(S.getRange(linha-1,12).getValue())}
256
257         S.getRange(linha,11).setValue(15)}
258     else if(S.getRange(linha-1,11).getValue() == 15) {

```

```

251     if ( isNaN(S.getRange(linha-1,12).getValue()) == true) {S.
        getRange(linha,12).setValue(0)} else {S.getRange(linha,12)
        .setValue(S.getRange(linha-1,12).getValue())}
252
253     S.getRange(linha,11).setValue(30)}
254 else if(S.getRange(linha-1,11).getValue() == 30) {
255     if ( isNaN(S.getRange(linha-1,12).getValue()) == true) {S.
        getRange(linha,12).setValue(0)} else {S.getRange(linha,12)
        .setValue(S.getRange(linha-1,12).getValue())}
256
257     S.getRange(linha,11).setValue(40)}
258 else if(S.getRange(linha-1,11).getValue() == 40) {
259
260 /* Caso tie-break */
261
262
263     result = S.getRange(linha,13).getValue()
264     res = ""
265     res = result.substring(0,1)
266     outr = result.substring(4,5)
267
268     res = Number(res) + 1
269
270     soma = res - Number(outr)
271
272
273
274
275     if(res >= 6  && soma >= 2) {
276
277         setes = S.getRange(linha,14).getValue()
278         set_res = setes.substring(0,1)
279         set_outr = setes.substring(4,5)
280
281         set_res = Number(set_res) + 1
282
283         S.getRange(linha,14).setValue(""+set_res+" - "+set_outr+"")

```

```

284
285
286
287     }
288
289     S.getRange(linha,13).setValue(""+res+" - "+outr+"")
290
291     S.getRange(linha,11).setValue("")
292     S.getRange(linha,12).setValue("")
293
294
295 }
296
297     S.getRange(linha,16).setFormula("=if(A"+linha+"<>\"\",if(G"
+linha+"=\"Bolha a malha\",G"+linha+",if(G"+linha+"=\"
Bandeja\",G"+linha+",if(G"+linha+"=\"Smash\",G"+linha+",
IF(F"+linha+"<>\"\",IF(F"+linha+"=\"Lob\",CONCATENATE(G
"+linha+",\" Lob\" ,\" Esquerda\"),CONCATENATE(G"+linha+
",\" Esquerda\")),if(E"+linha+"<>\"\",if(E"+linha+"=\"
Lob\", CONCATENATE(G"+linha+",\" Lob\", \" Direita\"),
CONCATENATE(G"+linha+",\" Direita\")),G"+linha+")))))
,\"\"")
298     S.getRange(linha,17).setValue(tipo)
299     S.getRange(linha,18).setValue(1)
300
301
302
303 }
304
305
306 if(numeroJ >= 3 ) {
307     if((isNaN( S.getRange(linha-1,12).getValue()) == true) || (S.
getRange(linha-1,12).getValue() == "") || (a==1)) {
308         if ( ( isNaN(S.getRange(linha-1,11).getValue()) == true) ||
(S.getRange(linha-1,11).getValue() == "") || (a==1)) {S
.getRange(linha,11).setValue(0)} else {S.getRange(linha
,11).setValue(S.getRange(linha-1,11).getValue())}

```

```

309
310     S.getRange(linha,12).setValue(15)}
311 else if(S.getRange(linha-1,12).getValue() == 15) {
312     if ( isNaN(S.getRange(linha-1,11).getValue()) == true) {S.
        getRange(linha,11).setValue(0)} else {S.getRange(linha
        ,11).setValue(S.getRange(linha-1,11).getValue())}
313
314     S.getRange(linha,12).setValue(30)}
315 else if(S.getRange(linha-1,12).getValue() == 30) {
316     if ( isNaN(S.getRange(linha-1,11).getValue()) == true) {S.
        getRange(linha,11).setValue(0)} else {S.getRange(linha
        ,11).setValue(S.getRange(linha-1,11).getValue())}
317
318     S.getRange(linha,12).setValue(40)}
319 else if(S.getRange(linha-1,12).getValue() == 40) {
320
321     /* Caso tie-break */
322
323     result = S.getRange(linha,13).getValue()
324     res = ""
325     res = result.substring(0,1)
326     outr = result.substring(4,5)
327
328     outr = Number(outr) + 1
329
330     soma = outr - Number(res)
331
332
333
334     if(outr >= 6  && soma >= 2) {
335
336         setes = S.getRange(linha,14).getValue()
337         set_res = setes.substring(0,1)
338         set_outr = setes.substring(4,5)
339
340         set_outr = Number(set_outr) + 1
341

```

```

342     S.getRange(linha,14).setValue(""+set_res+" - "+set_outr+"")
343
344 }
345
346     S.getRange(linha,13).setValue(""+res+" - "+outr+"")
347
348     S.getRange(linha,11).setValue("")
349     S.getRange(linha,12).setValue("")
350
351
352
353 }
354     S.getRange(linha,16).setFormula("=if(A"+linha+"<>\"\",if(G"
        +linha+"=\"Bolha a malha\",G"+linha+",if(G"+linha+"=\"
        Bandeja\",G"+linha+",if(G"+linha+"=\"Smash\",G"+linha+",
        IF(F"+linha+"<>\"\",IF(F"+linha+"=\"Lob\",CONCATENATE(G
        "+linha+",\" Lob\" ,\" Esquerda\"),CONCATENATE(G"+linha+
        ",\" Esquerda\")),if(E"+linha+"<>\"\",if(E"+linha+"=\"
        Lob\", CONCATENATE(G"+linha+",\" Lob\", \" Direita\"),
        CONCATENATE(G"+linha+",\" Direita\")),G"+linha+")))))
        ,\"\"")
355     S.getRange(linha,17).setValue(tipo)
356     S.getRange(linha,18).setValue(2)
357
358
359 }
360
361 }
362
363 /* Chama o código do tie-break */
364
365     result = S.getRange(linha,13).getValue()
366     res = result.substring(0,1)
367     outr = result.substring(4,5)
368
369     if(res == 6 && outr == 6){
370

```

```

371     tie_break()
372 }
373
374 }
375
376     /*Caso o set tenha acabado */
377
378     result = S.getRange(linha,13).getValue()
379     res = ""
380     res = result.substring(0,1)
381     outr = result.substring(4,5)
382
383
384     soma = Number(outr) - Number(res)
385
386     soma1 = Number(res) - Number(outr)
387
388     if((outr >= 6 && soma >= 2) || (res >= 6 && soma1 >= 2) ||
389         (result=="7 - 6") || (result=="6 - 7")){b=1}else{b=0}
390
391     a=0
392
393     linha++
394 }while (linha < ultima+1)
395 }
396
397     /* Pintar a celula para avisar que o jogo acabou de ser avaliado */
398     P.getRange(20,3).setBackground("white")
399
400
401
402
403 }

```

R Google Form to cluster evaluation

Avaliação atleta

*Required

1. Jogador *

Mark only one oval.

1

2

3

4

2. Tipo *

Mark only one oval.

Winner

Erro forçado

Erro não forçado

3. Posição no campo *

Mark only one oval.

Ataque

Meio

Defesa

4. Tipo de pancada

Mark only one oval per row.

	Baixo	Lob
Direita	<input type="radio"/>	<input type="radio"/>
Esquerda	<input type="radio"/>	<input type="radio"/>

5. Pancada *

Mark only one oval.

- Direto
- Vidro
- Volei
- Bandeja
- Smash
- Saida de Parede
- Amortie
- Half-volei
- Bola à malha

6. Direção

Mark only one oval.

- Paralelo
- Meio
- Cruzado

7. Comentário

S Example of game evaluated by the system

Timestamp	Jogador	Tipo	Posição no can	Direita	Esquerda	Pancada	Direção	Comentário	ID	Dupla	Dupla	Resultado Jo	Resultado	Final do Jo	Pancada	Tipo de Jogo	Dupl
11/04/2021 1	Marco-Carvalho	Winner	Ataque			Smash	Paralelo	Mau balão p	10	1	0				Smash	Super tie-break	1
11/04/2021 1	Manuel-Leitão	Erro não forçad	Ataque			Bandeja	Paralelo		10	1	1				Bandeja	Super tie-break	1
11/04/2021 1	Marco-Carvalho	Erro não forçad	Defesa	Baixo		Saída de Pare	Paralelo		10	1	2				Saída de Pared	Super tie-break	1
11/04/2021 1	Diego-Magalhães	Erro não forçad	Ataque			Smash		a cair para tr	10	2	2				Smash	Super tie-break	2
11/04/2021 1	Marco-Carvalho	Erro forçado	Defesa	Baixo		Vidro			10	2	3				Vidro Esquerda	Super tie-break	1
11/04/2021 1	Marco-Carvalho	Winner	Ataque			Bandeja	Cruzado		10	3	3				Bandeja	Super tie-break	1
11/04/2021 1	Marco-Carvalho	Erro forçado	Meio		Baixo	Volei			10	3	4				Volei Esquerda	Super tie-break	1
11/04/2021 1	Marco-Carvalho	Erro não forçad	Defesa	Baixo		Saída de Parede		apanhou mu	10	3	5				Saída de Pared	Super tie-break	1
11/04/2021 1	Pedro-Alves	Erro forçado	Meio	Baixo		Half-volei		levou com bo	10	4	5				Half-volei Direit	Super tie-break	2
11/04/2021 1	Manuel-Leitão	Winner	Defesa	Baixo		Saída de Pare	Paralelo		10	5	5				Saída de Pared	Super tie-break	1
11/04/2021 1	Pedro-Alves	Winner	Defesa	Baixo		Saída de Parede			10	5	6				Saída de Pared	Super tie-break	2
11/04/2021 1	Pedro-Alves	Erro não forçad	Defesa	Baixo		Saída de Pare	Paralelo		10	6	6				Saída de Pared	Super tie-break	2
11/04/2021 1	Marco-Carvalho	Winner	Ataque			Smash	Meio	mau balão p	10	7	6				Smash	Super tie-break	1
11/04/2021 1	Manuel-Leitão	Erro não forçad	Ataque			Bandeja	Cruzado		10	7	7				Bandeja	Super tie-break	1
11/04/2021 1	Diego-Magalhães	Erro não forçad	Defesa	Baixo		Direto		Resposta fall	10	8	7				Direto Direita	Super tie-break	2
11/04/2021 1	Manuel-Leitão	Erro não forçad	Defesa	Baixo		Saída de Pare	Cruzado		10	8	8				Saída de Pared	Super tie-break	1
11/04/2021 1	Diego-Magalhães	Winner	Ataque			Smash		mau balão n	10	8	9				Smash	Super tie-break	2
11/04/2021 1	Diego-Magalhães	Erro não forçad	Ataque			Smash	Paralelo	a cair para tr	10	9	9				Smash	Super tie-break	2
11/04/2021 1	Pedro-Alves	Erro não forçad	Defesa	Baixo		Direto	Paralelo		10	10	9				Direto Direita	Super tie-break	2
11/04/2021 1	Marco-Carvalho	Erro não forçad	Defesa	Baixo		Direto			10	10	10				Direto Direita	Super tie-break	1
11/04/2021 1	Diego-Magalhães	Erro não forçad	Ataque		Baixo	Volei	Paralelo	Volei alto	10	11	10				Volei Esquerda	Super tie-break	2
11/04/2021 1	Pedro-Alves	Erro não forçad	Defesa	Baixo		Saída de Parede			10	12	10			1 Saída de Pared	Super tie-break	2	

T "Word cloud" macro code

```
1 Sub Word_Cloud()  
2  
3 Dim Pivot_tables As Worksheet  
4 Dim Dashboard_sheet As Worksheet  
5 Dim inicio As Integer  
6 Dim comprimento As Integer  
7 Dim minimo As Long  
8 Dim maximo As Long  
9 Dim Minimo_letra As Integer  
10 Dim Maxima_letra As Integer  
11 Dim limitacao_palavras As Integer  
12 Dim mycell As Range  
13 Dim myrange As Range  
14  
15 Application.DisplayAlerts = False  
16  
17  
18 Set Pivot_tables = ThisWorkbook.Sheets("Pivot_tables1")  
19 Set Dashboard_sheet = ThisWorkbook.Sheets("Dashboard")  
20  
21  
22 Minimo_letra = 10  
23 Maxima_letra = 25  
24 minimo = Application.WorksheetFunction.Min(Pivot_tables.Range("N7:S15")  
    )  
25 maximo = Application.WorksheetFunction.Max(Pivot_tables.Range("N7:S15")  
    )  
26  
27  
28  
29  
30  
31 Dashboard_sheet.Range("C17:F27").Select  
32  
33 If ActiveCell.MergeArea.Rows.Count > 3 Then
```

```

34
35     With Selection
36         .HorizontalAlignment = xlGeneral
37         .VerticalAlignment = xlBottom
38         .WrapText = True
39         .Orientation = 0
40         .AddIndent = False
41         .IndentLevel = 0
42         .ShrinkToFit = False
43         .ReadingOrder = xlContext
44         .MergeCells = False
45     End With
46     Selection.UnMerge
47     Selection.ClearContents
48
49     End If
50
51
52     Dashboard_sheet.Range("C17").Locked = False
53
54
55     Set myrange = Pivot_tables.Range("N7:S15")
56
57
58     For Each rng In myrange
59         If Not IsEmpty(rng.Value) Then
60             Total = Total + 1
61         End If
62     Next
63
64
65     limitacao_palavras = 1
66
67     If IsEmpty(Total) = True Then limitacao_palavras = 3
68
69
70

```

```

71
72 Do Until limitacao_palavras >= 3
73 For Each mycell In myrange
74
75
76
77 If Total > 10 Then
78 If limitacao_palavras <= 6 Then
79 If (IsEmpty(mycell.Value) = False) And (IsNumeric(mycell.Value) = True)
      Then
80 If (mycell.Value = Application.WorksheetFunction.Large(myrange, 1)) Or
      (mycell.Value = Application.WorksheetFunction.Large(myrange, 2)) Or
      (mycell.Value = Application.WorksheetFunction.Large(myrange, 3)) Or
      (mycell.Value = Application.WorksheetFunction.Large(myrange, 4)) Or
      (mycell.Value = Application.WorksheetFunction.Large(myrange, 5)) Or
      (mycell.Value = Application.WorksheetFunction.Large(myrange, 6))
      Then
81 linha = mycell.Row
82
83 If mycell.Column < 16 Then
84
85     If limitacao_palavras = 1 Then
86         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("N" &
            linha).Value
87     Else
88         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
            ").Value & "," & Pivot_tables.Range("N" & linha).Value
89     End If
90
91 End If
92 If mycell.Column > 16 Then
93
94     If limitacao_palavras = 1 Then
95         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("R" &
            linha).Value
96     Else
97         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17

```

```

        ").Value & "," & Pivot_tables.Range("R" & linha).Value
98     End If
99 End If
100
101 limitacao_palavras = limitacao_palavras + 1
102 End If
103 End If
104 End If
105 End If
106
107
108 If Total = 10 Then
109 If limitacao_palavras <= 5 Then
110 If (IsEmpty(mycell.Value) = False) And (IsNumeric(mycell.Value) = True)
        Then
111 If (mycell.Value = Application.WorksheetFunction.Large(myrange, 1)) Or
        (mycell.Value = Application.WorksheetFunction.Large(myrange, 2)) Or
        (mycell.Value = Application.WorksheetFunction.Large(myrange, 3)) Or
        (mycell.Value = Application.WorksheetFunction.Large(myrange, 4)) Or
        (mycell.Value = Application.WorksheetFunction.Large(myrange, 5))
        Then
112 linha = mycell.Row
113
114 If mycell.Column < 16 Then
115
116     If limitacao_palavras = 1 Then
117         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("N" &
                linha).Value
118     Else
119         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
                ").Value & "," & Pivot_tables.Range("N" & linha).Value
120     End If
121
122 End If
123 If mycell.Column > 16 Then
124
125     If limitacao_palavras = 1 Then

```

```

126     Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("R" &
        linha).Value
127 Else
128     Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
        ").Value & "," & Pivot_tables.Range("R" & linha).Value
129 End If
130 End If
131
132 limitacao_palavras = limitacao_palavras + 1
133 End If
134 End If
135 End If
136 End If
137
138 If Total = 8 Then
139 If limitacao_palavras <= 5 Then
140 If (IsEmpty(mycell.Value) = False) And (IsNumeric(mycell.Value) = True)
        Then
141 If (mycell.Value = Application.WorksheetFunction.Large(myrange, 1)) Or
        (mycell.Value = Application.WorksheetFunction.Large(myrange, 2)) Or
        (mycell.Value = Application.WorksheetFunction.Large(myrange, 3)) Or
        (mycell.Value = Application.WorksheetFunction.Large(myrange, 4))
        Then
142 linha = mycell.Row
143
144 If mycell.Column < 16 Then
145
146     If limitacao_palavras = 1 Then
147         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("N" &
            linha).Value
148     Else
149         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
            ").Value & "," & Pivot_tables.Range("N" & linha).Value
150     End If
151
152 End If
153 If mycell.Column > 16 Then

```

```

154
155     If limitacao_palavras = 1 Then
156         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("R" &
            linha).Value
157     Else
158         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
            ").Value & "," & Pivot_tables.Range("R" & linha).Value
159     End If
160 End If
161
162 limitacao_palavras = limitacao_palavras + 1
163 End If
164 End If
165 End If
166 End If
167
168
169 If Total = 6 Then
170 If limitacao_palavras <= 5 Then
171 If (IsEmpty(mycell.Value) = False) And (IsNumeric(mycell.Value) = True)
            Then
172 If (mycell.Value = Application.WorksheetFunction.Large(myrange, 1)) Or
            (mycell.Value = Application.WorksheetFunction.Large(myrange, 2)) Or
            (mycell.Value = Application.WorksheetFunction.Large(myrange, 3))
            Then
173 linha = mycell.Row
174
175 If mycell.Column < 16 Then
176
177     If limitacao_palavras = 1 Then
178         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("N" &
            linha).Value
179     Else
180         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
            ").Value & "," & Pivot_tables.Range("N" & linha).Value
181     End If
182

```

```

183 End If
184 If mycell.Column > 16 Then
185
186     If limitacao_palavras = 1 Then
187         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("R" &
                linha).Value
188     Else
189         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
                ").Value & "," & Pivot_tables.Range("R" & linha).Value
190     End If
191 End If
192
193 limitacao_palavras = limitacao_palavras + 1
194 End If
195 End If
196 End If
197 End If
198
199
200 If Total = 4 Then
201 If limitacao_palavras <= 2 Then
202 If (IsEmpty(mycell.Value) = False) And (IsNumeric(mycell.Value) = True)
        Then
203 If (mycell.Value = Application.WorksheetFunction.Large(myrange, 1)) Or
        (mycell.Value = Application.WorksheetFunction.Large(myrange, 2))
        Then
204 linha = mycell.Row
205
206 If mycell.Column < 16 Then
207
208     If limitacao_palavras = 1 Then
209         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("N" &
                linha).Value
210     Else
211         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
                ").Value & "," & Pivot_tables.Range("N" & linha).Value
212     End If

```

```

213
214 End If
215 If mycell.Column > 16 Then
216
217     If limitacao_palavras = 1 Then
218         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("R" &
                linha).Value
219     Else
220         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
                ").Value & "," & Pivot_tables.Range("R" & linha).Value
221     End If
222 End If
223
224 limitacao_palavras = limitacao_palavras + 1
225 End If
226 End If
227 End If
228 End If
229
230 If Total = 2 Then
231 If limitacao_palavras <= 2 Then
232 If (IsEmpty(mycell.Value) = False) And (IsNumeric(mycell.Value) = True)
        Then
233 If Pivot_tables.Cells(mycell.Row, mycell.Column - 1).Value <> "" Then
234 If mycell.Value = Application.WorksheetFunction.Large(myrange, 1) Then
235 linha = mycell.Row
236
237 If mycell.Column < 16 Then
238
239     If limitacao_palavras = 1 Then
240         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("N" &
                linha).Value
241     Else
242         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
                ").Value & "," & Pivot_tables.Range("N" & linha).Value
243     End If
244

```

```

245 End If
246 If mycell.Column > 16 Then
247
248     If limitacao_palavras = 1 Then
249         Dashboard_sheet.Range("C17").Value = Pivot_tables.Range("R" &
                linha).Value
250     Else
251         Dashboard_sheet.Range("C17").Value = Dashboard_sheet.Range("C17
                ").Value & "," & Pivot_tables.Range("R" & linha).Value
252     End If
253 End If
254
255 limitacao_palavras = limitacao_palavras + 1
256 End If
257 Else: limitacao_palavras = limitacao_palavras + 1
258 End If
259 End If
260 End If
261 End If
262
263
264 Next mycell
265
266 Loop
267
268
269 With Dashboard_sheet.Range("C17")
270     .WrapText = True
271     .HorizontalAlignment = xlCenter
272 End With
273
274 Dashboard_sheet.Range("C17:F27").Select
275     With Selection
276         .HorizontalAlignment = xlCenter
277         .VerticalAlignment = xlBottom
278         .WrapText = True
279         .Orientation = 0

```

```

280     .AddIndent = False
281     .IndentLevel = 0
282     .ShrinkToFit = False
283     .ReadingOrder = xlContext
284     .MergeCells = False
285 End With
286 Selection.Merge
287
288
289 For Each mycell In myrange
290
291
292     comprimento = Len(mycell.Value)
293     valor = mycell.Value
294     If IsEmpty(valor) = False Then
295
296     If mycell.Column < 16 Then
297
298     If InStr(1, Dashboard_sheet.Range("C17"), valor, 0) <> 0 Then
299
300
301     inicio = Application.WorksheetFunction.Search(mycell.Value,
302         Dashboard_sheet.Range("C17").Value)
303
304     With Dashboard_sheet.Range("C17").Characters(inicio, comprimento).Font
305
306         .ColorIndex = Application.WorksheetFunction.RandBetween(3, 56)
307
308         .Bold = True
309
310         .Size = Minimo_letra + Pivot_tables.Range("0" & mycell.Row).
311             Value * ((Maxima_letra - Minimo_letra) / maximo)
312
313     End With
314 End If

```

```

315 End If
316
317 If mycell.Column > 16 Then
318
319 If InStr(1, Dashboard_sheet.Range("C17"), valor, 0) <> 0 Then
320
321
322 inicio = Application.WorksheetFunction.Search(mycell.Value,
323         Dashboard_sheet.Range("C17").Value)
324 With Dashboard_sheet.Range("C17").Characters(inicio, comprimento).Font
325
326         .ColorIndex = Application.WorksheetFunction.RandBetween(3, 56)
327
328         .Bold = True
329
330         .Size = Minimo_letra + Pivot_tables.Range("S" & mycell.Row).
331             Value * ((Maxima_letra - Minimo_letra) / maximo)
332
333     End With
334
335 End If
336 End If
337
338
339
340 End If
341
342
343 Next mycell
344
345
346
347 End Sub

```

U Clusters means by attacking and defensive strokes

Cluster	Attack errors	Defensive errors	Attack winners	Defensive winners
1	0.250	0.364	0.180	0.133
2	0.218	0.395	0.176	0.111
3	0.253	0.530	0.242	0.619
4	0.173	0.265	0.121	0.142
5	0.142	0.169	0.268	0.291

V Google Form to cluster evaluation

Analise dos grupos

Este questionário foi desenvolvido no âmbito da tese de mestrado do treinador Bernardo Moreira em colaboração com a Quinta de Monserrate.

Este questionário dirige-se aos professores do PTC e visa recolher opinião sobre os grupos de treino formados a partir do sistema de avaliação.

Este inquérito é anónimo. O registo das respostas ao inquérito não contém qualquer informação sobre a sua identidade.

A informação recolhida é de extrema importância, de forma que se solicita a maior sinceridade nas respostas.

Avaliação ao grupo 1

Grupo 1



1. Qual é grau de homogeneidade neste grupo? (1 são muito diferentes, 5 são muito parecidos)

Mark only one oval.

	1	2	3	4	5	
Heterogêneo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Homogêneo

2. Desta lista, qual é o mais recorrente neste grupo?

Mark only one oval.

- Erro forçado
- Erro não forçado
- Winner
- Other: _____

3. Em qual deste tipo de pancadas, este grupo comete mais ERROS?

Mark only one oval.

- Ataque
- Defesa

4. Em qual deste tipo de pancadas, este grupo comete mais WINNERS?

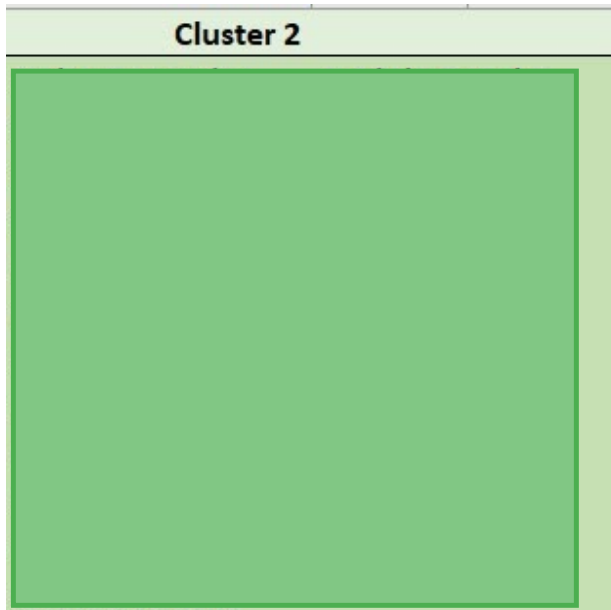
Mark only one oval.

- Ataque
- Defesa

Skip to question 5

Avaliação ao grupo 2

Grupo 2



5. Qual é grau de homogeneidade neste grupo? (1 são muito diferentes, 5 são muito parecidos)

Mark only one oval.

	1	2	3	4	5	
Heterogêneo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Homogêneo

6. Desta lista, qual é o mais recorrente neste grupo?

Mark only one oval.

- Erro forçado
- Erro não forçado
- Winner
- Other: _____

7. Em qual deste tipo de pancadas, este grupo comete mais ERROS?

Mark only one oval.

Ataque

Defesa

8. Em qual deste tipo de pancadas, este grupo comete mais WINNERS?

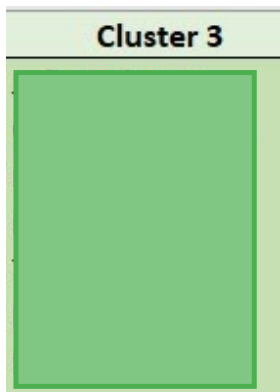
Mark only one oval.

Ataque

Defesa

Avaliação ao grupo 3

Grupo 3



9. Qual é grau de homogeneidade neste grupo? (1 são muito diferentes, 5 são muito parecidos)

Mark only one oval.

1 2 3 4 5

Heterogêneo Homogêneo

10. Desta lista, qual é o mais recorrente neste grupo?

Mark only one oval.

- Erro forçado
- Erro não forçado
- Winner
- Other: _____

11. Em qual deste tipo de pancadas, este grupo comete mais ERROS?

Mark only one oval.

- Ataque
- Defesa

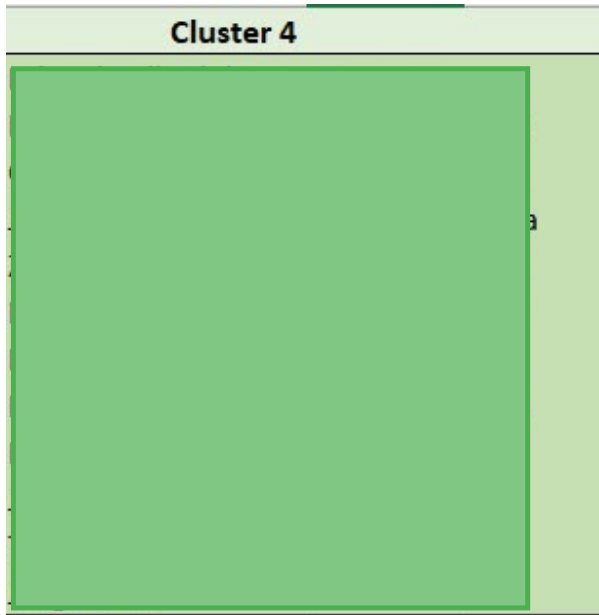
12. Em qual deste tipo de pancadas, este grupo comete mais WINNERS?

Mark only one oval.

- Ataque
- Defesa

Avaliação ao grupo 4

Grupo 4



13. Qual é grau de homogeneidade neste grupo? (1 são muito diferentes, 5 são muito parecidos)

Mark only one oval.

	1	2	3	4	5	
Heterogêneo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Homogêneo

14. Desta lista, qual é o mais recorrente neste grupo?

Mark only one oval.

- Erro forçado
- Erro não forçado
- Winner
- Other: _____

15. Em qual deste tipo de pancadas, este grupo comete mais ERROS?

Mark only one oval.

Ataque

Defesa

16. Em qual deste tipo de pancadas, este grupo comete mais WINNERS?

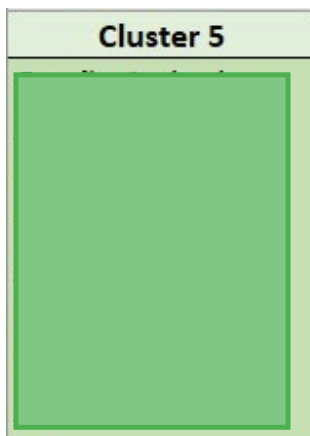
Mark only one oval.

Ataque

Defesa

Avaliação ao grupo 5

Grupo 5



17. Qual é grau de homogeneidade neste grupo? (1 são muito diferentes, 5 são muito parecidos)

Mark only one oval.

	1	2	3	4	5	
Heterogêneo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Homogêneo

18. Desta lista, qual é o mais recorrente neste grupo?

Mark only one oval.

- Erro forçado
- Erro não forçado
- Winner
- Other: _____

19. Em qual deste tipo de pancadas, este grupo comete mais ERROS?

Mark only one oval.

- Ataque
- Defesa

20. Em qual deste tipo de pancadas, este grupo comete mais WINNERS?

Mark only one oval.

- Ataque
- Defesa