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Using Gamification for Time Tracking

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To each and every one of you – Thank you.

Abstract

Time tracking has been gradually a real problem that companies fight every month. They see their Finance Department, not able to pay employees because most of them didn't fill their timesheet before the deadline announced by the company which blocks the billing process by Finance Department, who not knowing how to solve this problem, alerts and reminders aren't enough to make people fill their timesheets.

We propose gamification as a solution for improving Time Tracking, motivating employees to fill their timesheets and finally start to break their barriers with the timesheet submission process.

To conduct our work, we follow the Design Science Research Methodology and involved those employees in the solution design process with a wide range of methods, including interviews, surveys and prototypes which allow us to define and redefine our work.

Our solution design process will follow the Framework 6D which allows us to define a solution according to company business objectives and define the behaviors which users must adopted to achieve those objectives, to choose the right activity loops with the appropriate gamification elements & mechanics to keep users engaged and motivated.

We evaluate our solution with metrics described on the proposal, questionnaires about the impact of process change, interviews and users feedback which will able us to refine our solution for solving the research problem.

Keywords

Time Tracking; Timesheet; Gamification; Motivation.

Resumo

O registo de tempos tem sido gradualmente um problema real que as empresas lutam todos os meses. Elas vêm o seu departamento financeiro impossibilitado de pagar aos funcionários porque estes não registam a sua folha de horas antes da data final anunciada pela apresenta, o que impede o processo de pagamento por parte do departamento financeiro que não sabe como resolver este problema onde alertas e lembretes já não são suficientes.

A nossa proposta para solução deste problema é a aplicação de Gamificação no processo, motivando os funcionários a preencher a sua folha horas e finalmente começar a quebrar as suas barreiras com este processo.

Para conduzir o nosso trabalho, ao nível da estrutura, iremos seguir o Design Science Research Methodology e envolver os funcionários na definição da solução com diversos métodos como entrevistas, questionários e protótipos que nos irão definir e redifinir a melhor solução para eles.

O nosso processo de design da solução irá seguir a Framework 6D que nos permite definir uma solução orientada aos objetivos do negócio da empresa e os comportamentos que os funcionários devem adotar para atingir esses objetivos, irá também escolher os ciclos de atividade da gamificação juntamente com as mecânicas e elementos apropriados de modo a manter os utilizadores envolvidos e motivados com a solução.

A avaliação da solução será baseada nas métricas descritas na proposta, questionários sobre o impacto da mudança do processo, entrevistas e feedback dos utilizadores irão permitir-nos definir a melhor solução para resolver o problema anunciado nesta tese.

Palavras Chave

Registo de tempo; Folha de horas; Gamificação; Motivação;

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Acronyms

DSRM	Design Science Research Methodology
UI	User Interface
XP	Experience Points
IT	Information Technology

1

Introduction

Contents

Time tracking is a report process of time spent on assigned tasks. The common use is to automate payroll or client invoicing, providing insights on operations, such as: which tasks are taking a lot of staff's time and costing the most money; allowing business to plan project budgets; helping the student to plan their study hours in the different disciplines.

A timesheet is a method for recording the amount of a worker's time spent on their work/tasks and allows the time tracking process flow. Timesheet has different formats that can be presented, one of them is the standard sheet of paper with the data arranged in tabular format, and the common format is the digital document where the sharing, shelving and accessing timesheet processes are more secure, fast and allow the automation of data analysis process.

The low percentage of timesheet submissions before the deadline is the research problem associated to this project. Many companies delineate a deadline to receive the timesheets from their employees. Every month the Finance Department must resolve the billing process for every employee and without having those timesheets becomes impossible to do it because there is no time tracking about employees work time and the company don't know on what and where their employees spent their work time.

Gamification brings the idea of applying game thinking, design and mechanics to engage and motivated users with a system. We propose a gamification solution to increase the low percentage of timesheet submissions using competition and feedback as game mechanics to engage and motivate users with the time tracking process, notify them about their performance and also alerts for those who are not following the game rules. Users have leaderboard to track their competition performance, with a classification based on experience points and badges that reflects directly those who are following the game rules and consequently working for solving the research problem. Our proposal has a game design process based on Framework 6D to guarantee that our solution stills aligned with the business objectives identified, that our users are adopting the target behaviors and that those behaviors are aligned with the user types and desires as we describe in more detail in chapter 6.

Demonstration activities were performed on a multinational company referenced as company A along this document, where we implemented our solution on their time tracking application. We had 75 users randomly picked to use our gamified system and another 75 which used the time tracking application without gamification, to evaluate the impact of gamification as a solution of our research problem. Our solution was tested by those users from July to September. According to the gamified system results, we registered over 90% timesheets submissions before deadline on each month. Looking for the users who submitted their timesheets on the system without gamification we had about 70% timesheets submissions before deadline on each month, which we describe in more detail in chapter 7.

1.1 Organization of the Document

To conduct our research, we adopted Design Science Research which reflects this document's structure. Following this methodology, we start this document by describing this methodology in section 2 which allow us to identify the iteration process so that we can define and refine our solution. Next step is to identify the research problem of this project which we announced before and we detail in chapter 3. The next two chapters are focused on what has been done in science about this thesis theme, chapter 4 describe the main gamification concepts to give a better understanding and knowledge and chapter 5 shows how gamification has been applied on science, which solutions had been developed to help users/employees on finding effectiveness and efficiently on their activities/work and also improve their experience.

Chapter 6 presents our research proposal where we applied all the knowledge from the different gamification applications results to propose a solution for the research problem. The next two chapters (7,8) demonstrate and evaluate our gamified solution application with all the results along the three months of solution testing. We also analyze and compare those results according with the metrics defined to guide our evaluation and conclude our solution contribute to solve the research problem.

Last but not least, chapter 10 gives the conclusions about all the work performed, explain what we learned from this research, our limitations and future work.

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Research Methodology

Contents

We propose Design Science Research Methodology (DSRM) to guide evaluation and iteration processes of our work[1]. This methodology focus on the development of successful artifacts based on principles, practices, and procedures that guarantee an improvement in artifact performance and an understood research problem. Artifacts are defined by constructs, models, methods and instantiations.

2.1 DSRM process model

The DSRM process model provides a process iteration with a flux of 6 activities[18] including definition, development and testing phases to create, and future instantiation, the artifact model. These activities are:

- **Problem identification and motivation**: Define the specific research problem and justify the value of a solution. Since the problem definition will be used to develop an effective artifactual solution, it may be useful to atomize the problem conceptually so that the solution can capture the problem's complexity. Resources required for this activity include knowledge of the state of the problem and the importance of its solution.

- **Define the objectives for a solution**: Infer the objectives of a solution from the problem definition. The objectives should be inferred rationally from the problem specification/analysis. Resources required for this include knowledge of the state of problems and current solutions and their efficacy if any.

- **Design and development**: Create the artifactual solution. This activity includes determining the artifact's desired functionality and its architecture and then creating the actual artifact. Resources required moving from objectives to design, and development includes knowledge of theory that can be brought to bear as a solution.

- **Demonstration**: Demonstrate the efficacy of the artifact to solve the problem. This could involve its use in experimentation, simulation, a case study or other appropriate activity. Resources required for the demonstration include practical knowledge of how to use the artifact to solve the problem.

- **Evaluation**: Observe and measure how well the artifact supports a solution to the problem. This activity involves comparing the objectives of a solution to actual observed results from use of the artifact in the demonstration. It requires knowledge of relevant metrics and analysis techniques.

- **Communication**: Communicating the artifact, its utility and novelty, its effectiveness to researchers and such as practicing professionals, when appropriate.

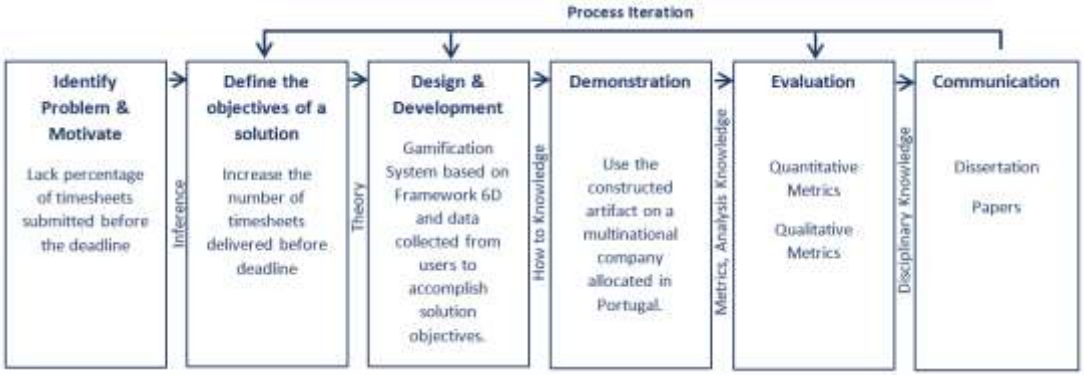

Figure 1 - DSRM Process Model (adapted from [18])

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Research Problem

This section corresponds to the first activity of the DSRM process model, here we detail the research problem identified.

Time tracking is the measurement and documenting of hours worked by an employee, which allows business department on tracking additional data such as efficiency and employee productivity, improve project schedules, track the global state of a job anytime you want, and identify areas for improvement. Software, spreadsheets and papers are some ways to track time, but one of the most significant problems of time tracking is the timesheets submission. This process consists of employees filling timesheets which allow the company to time tracking. However, company employees always forget to fill timesheets on time, when the deadline is nearing, someone or something alert employees about that, and that's only when they finally fill timesheets.

To consolidate the research problem, we decided to analyze, as Figure 2 shows, data collected from company A timesheets software database which represents timesheets submissions per month by company employees in 2018. Data were analyzed from 11 months, where we obtained a media of 59% timesheets submitted before the deadline per month with a standard deviation of 14,89.
We notice that January was the worst month with about 40% of company employees that submitted their timesheets before the deadline, and the period from July to October, where the company invested in employees motivation to submitted their timesheets but company didn't reach 80% of company employees that submitted their timesheets before the deadline in any month. However, the increase of those percentages according to other months suggests that employee's motivation can contribute to one possible solution to the research problem.

Concluding and having the **deadline date** of timesheets monthly submission process as each **day 25**, the problem we are addressing here is **the low percentage of timesheets submissions before deadline**, which overlaps Financial Department on the next days to analyze timesheets and invoice everything.

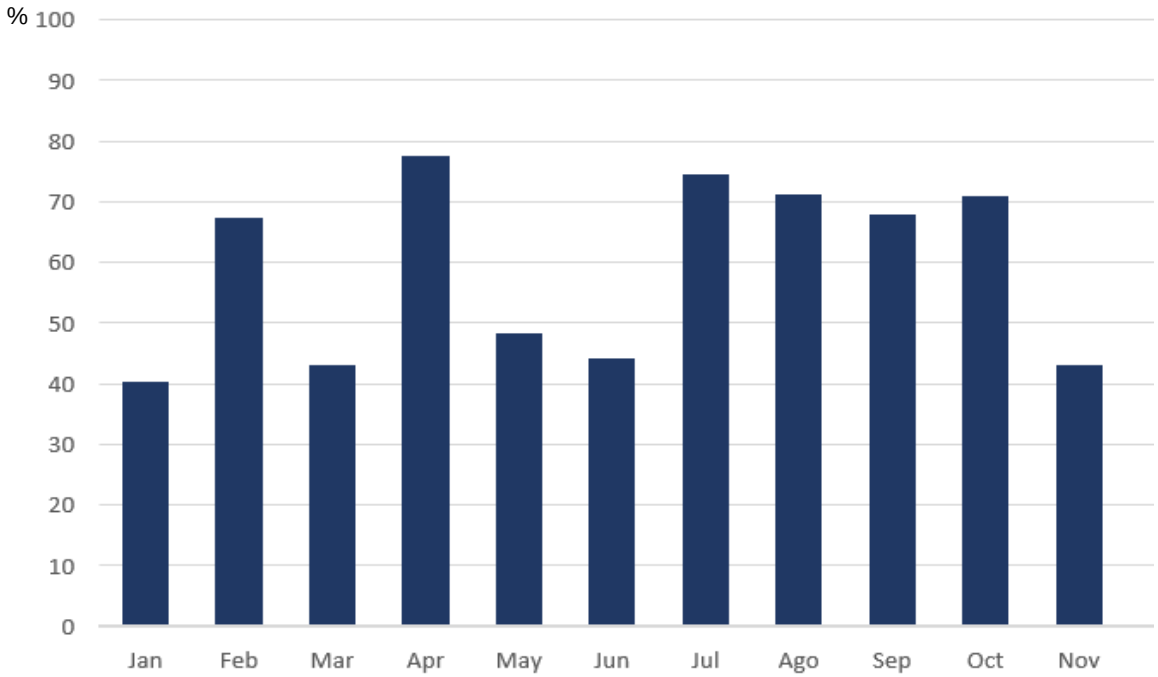

Figure 2 - Percentage of timesheets submitted before the deadline collected from company A in 2018.

4

Theoretical Background

Contents

4.1 Gamification

"Gamification brings together all the diverse threads that have been advanced in games for non-gaming contexts"[5]. That's, in my opinion, one of the best definitions of this concept. Gamification brings the idea of apply game thinking, design and mechanisms to engage system users and consequently to solve problems[19].

4.1.1 Non-game contexts

The idea of using game design elements in non-game contexts to motivate and increase user activity and retention has rapidly gained traction in interaction design and digital marketing [16].
Recently there has been a growing interest in using elements of video games in non-game applications as a means to enhance the engagement with products [20]. Coined as gamification, this trend potentially opens up ways to create more engaging user experiences with a wide range of applications.

The main non-game contexts can be categorized, according to [19], as:

- **Internal**: Improve productivity with the organization to foster innovation, enhance within the organization to foster innovation and any derive positive business results through their employees.
- **External**: Increase the relationships between businesses and customers, producing increased engagement, stronger loyalty and higher revenues.
- **Behavior-change**: Form beneficial new habits among a population like encouraging people to make better health choices or building systems that help people save more money for retirement.

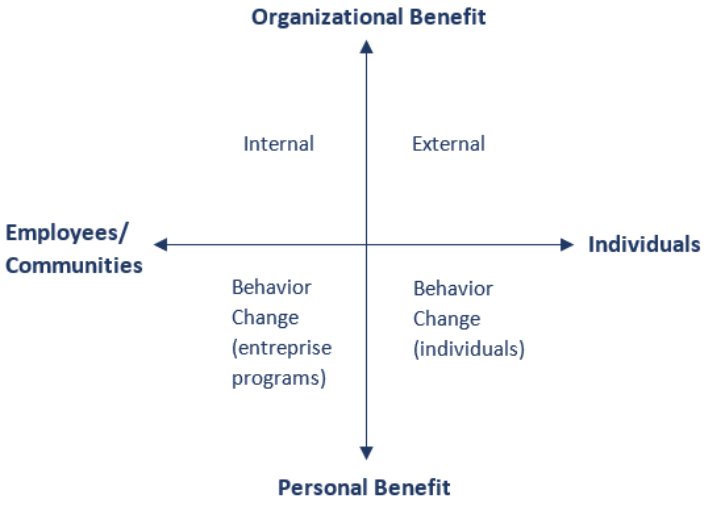

Figure 3 - Relationship between different gamification types (copied from [19])

4.1.2 Motivation

People are motivated to pursue some activities that have few rewards because they gain satisfaction from doing them [4]. Other motivations are developing personal skills, building friendship or companionship, and engaging in competition.
Let's think about games, why people play games? There is anyone or anything forcing them to do it? The answer is no, games always have the fun component, inherent to them, and that's one of the most crucial game's characteristics that makes people play, that's why games are so influential in getting people's attention and interest.

There is a big difference between the two types of motivation, intrinsic and extrinsic, according to [19], which help us to understand how to motivate people:

- **Intrinsic motivation**: Any activity that people do because they want to do, no matter what, the activity motivates users by itself. People hobbies is a perfect example, like playing football or video-games.
- **Extrinsic motivation**: Activities that 'mean' nothing to people, where you need to present good reasons to people do it. Such as doing a certification to be able to work on projects with higher payments.

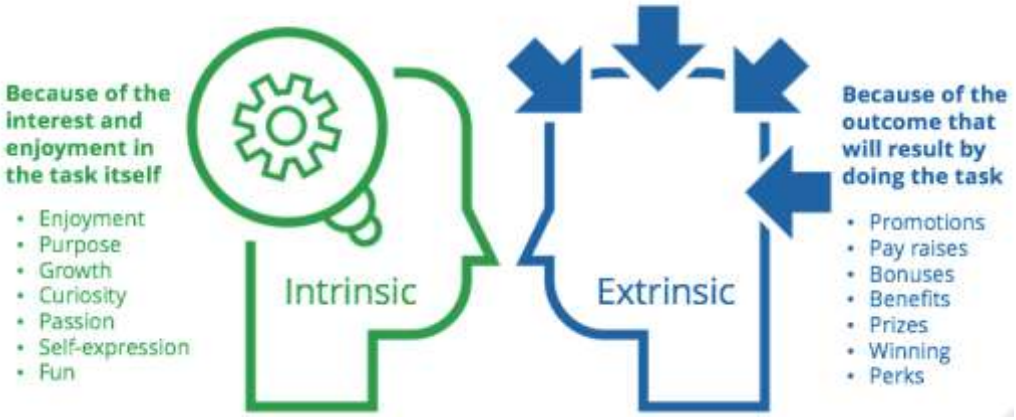

Figure 4 - Intrinsic vs Extrinsic Motivation (adapted from 2)

Motivation has been studied for a long time. Behaviorism was the dominant theory at twentieth century which defends that extrinsic motivation is when motivation comes from something or someone else (external source) [13]. B. F. Skinner created boxes which gave food or electric shocks to animals with the goal of teaching them 'how to play/react' to these activities.

There are, also, many theories which result in approaches of behaviorism, as "cognitivist" which focus on what happens on people's heads [13]. One of them is Self-Determination Theory, which defends intrinsic motivation [13], where human has a strong internal desire for growth and are inherently proactive, however, the external environment must support this because people only respond to external reinforcements. The elements of this theory are:

- **Autonomy**: is the innate need to feel in command of one's life and to be doing that which is meaningful and harmony with one's values.
- **Competence**: means being effective in dealing with the external environment. For example, pulling off a difficult deal.
- **Relatedness**: involve social connection and the universal desire to interact with and be involved with family, friends, and other ones.

4.1.3 User Types

Motivation can be related to gamification in terms of how human personalities can define user types on a future gamified solution.
There are models to create that relationship, and the Hexad gamification is one of them, based on human motivation research, user types, and years of practical design experiences [11]. This model presents the first typology to classify users of gamified systems, enabling clustering them based on intrinsic and extrinsic motivational factors.
Further, the HEXAD model builds on already existing player type models, specifically on Bartle's Player Types [2] and the BrainHex model [9]'[11] that can be categorized, according to [11], as:

- **Socializer**: The socializers are motivated by relatedness and are looking to create social connections and a sense of being part of a group within the system.

- **Free Spirit**: The free spirits are motivated by autonomy, agency, and self-expression. This group likes to explore, dislikes restrictions, embarks on their journey, or likes to create.

- **Achiever**: The achievers are motivated by the ultimate goal of mastery, of overcoming challenging obstacles, of completing every possible task, learning new skills, of reaching 100\%.

- **Philanthropist**: The philanthropists are motivated by a sense of a purpose, meaning and altruism.

- **Player**: The players are motivated by extrinsic rewards, which they gain through a variety of strategies. This group does not need additional motivation besides extrinsic rewards.

- **Disruptor**: The disruptors feel a need to disrupt the gamified system in some way, by acting directly on the system or by influencing other users. This may be to the benefit of the system and other users, or just for their enjoyment.

4.1.4 Game Design

For hundreds of years, the field of game design has drifted along under the radar of culture, producing timeless masterpieces and masterful time-wasters without drawing much attention to itself.[15]
Gamification usually coincide with gameful design as defined above: The most likely strategy of designing for gameful experiences is to use game design elements, and the most likely goal of using game design elements are gameful experiences [16].

The aspects of games that make them fun, addicting, challenging, and emotionally resonant can't be reduced to a list of components or step-by-step instructions. Game Design is a bit of science, a bit of art, and a lot of hard-won experience as strategic leadership, managing a team or creating a killer marketing campaign. [19]

Game design elements can be defined by different levels of abstraction, according to [16], ordered from concrete to abstract, five levels can be distinguished : Interface design patterns; game design patterns or game mechanics; design principles, heuristics or ‘lenses'; conceptual models of game design units; game design methods and design processes.
Framework 6D is a conceptual framework composed of the following 6 steps, according to 6D[19], which model an efficient, structured and user-centered game design process:

- **Define Business Objectives**: The first step is to define business objectives, these goals must be clear, objectives and quantifiable. We started by listing all potential business objectives according to our problem, after that we reduced the list to the final objectives, which has something to achieve.

- **Delineate target behavior**: The next step is to delineate target behavior, here we must describe which behaviors we expect from players. To do it, we should specify all the tasks clearly, with the corresponding success metrics and win states, and define how win states will be measured.

- **Describe your players**: The third step is to describe our players. First of all, we must know our players, some demographic characteristics as age, common behaviors, relationships with the game World.

- **Devise activity loops** - We must identify and evaluate carefully the repetitive and recursive structures that we will provide to our users, specifically our analysis must focus on two different loops:

    - **Engagement loops**: Based on the motivational design rules, we should identify the task, motivate them to do it, and give feedback to users learn it.

    - **Progressive loops**: Loops where we provide small challenges to the user to arrive at a final goal. A good design must provide engagement and progressive loops as the natural way to help the user to learn and to become a master of the product.

- **Don't forget the fun**: Fun is one of the most important intrinsic motivation. With all those processes it's common that you lose focus, but it's important to keep in mind that Fun must be everything on our solution.

- **Deploy appropriate tools:** For the end, we should apply the right dynamics, mechanics, and components based on the previous steps, which our tool will be aligned with our kind players, how we provide challenges and game progression to our users, how we provide FUN to them, and obviously to align their behavior with the business objectives.

4.1.5 Game Thinking

Game thinking means using all the resources you can muster to create an engaging experience that motivates desired behaviors, sustains interest from breaking down significant challenges into manageable steps, promotes teamwork, rewarding out-of-the-box thinking, giving players a sense of control and personalizing their experiences and reduces the fear of failure which inhibits innovate experimentation. [19]
Using game thinking to engage people, "The Fun Theory's Piano Staircase" emerges as a gamification solution which was used at a Swedish subway station, where people can choose in using stairs or an escalator. People prefer the escalator comfort instead of stairs, so subway managers decided to turn the staircase into a large electronic piano with each step corresponding to a key that made audible sounds.

Figure 5 - Volkswagen: Fun Theory Piano Staircase

4.1.6 Game Elements

“Game elements are the specific characteristics of games which can be applied in non-game contexts” [19].

Every game seems as a different 'world' of interactions that defines your experience, player loves to feel the power of choosing is own experience, and game elements are precisely the pieces of the game, which have their values to players objectives providing them, different interactions and relationships between the game pieces (game elements) resulting in a series of interactions which allow players to create their own experience.

According to Werbach and Hunter [19], **Game elements** can be defined by three levels of categories that matters to gamification, which some of them are represented at Figure 7: **Dynamics** as the big-picture aspects of the gamified system that you have to consider and manage but which can never directly enter into the game, **Mechanics** in down level as the processes responsible for guiding the users behaviors and engagement, and **Components** at pyramid base as the more-specific forms that mechanics or dynamics can take.

Game Elements					
Dynamics		**Mechanics**		**Components**	
Constraints	Limitations or force trade-offs	**Challenges**	Tasks that require effort to solve	**Achievements**	Defined objectives
Emotions	Curiosity, competitiveness, frustation, happiness	**Competition**	One player or group wins, and the other loses	**Badges**	Visual representations of achievements
Narrative	A consistente, ongoing storyline	**Cooperation**	Players must work together to achieve a shared goal	**Leaderboards**	Visual displays of players progression and achievement
Progression	The player's growth and development	**Feedback**	Information about how the player is doing	**Team**	Defined groups of players working together for a common goal
Relationship	Social Interactions generating feelings	**Rewards**	Benefits for some action or achievement	**Levels**	Defined steps in player progression

Figure 6 - Werbach and Hunter model: Game elements (adapted from [19])

Another approach to game elements definition, MDA framework [14], brings a new category which describes the desirable emotional responses evoked in the player, when player interacts with the game system, as shown in Figure 8.

MDA framework [14], shows the designers perspective where the mechanics give rise to dynamic system behavior, which in turn leads to particular aesthetic experiences. From the players perspective, aesthetics set the tone, which is born out in observable dynamics and eventually, operable mechanics.

Aesthetics	Points of view
Sensation	Game as sense-pleasure
Fantasy	Game as make-believe
Narrative	Game as drama
Challenge	Game as obstacles course
Fellowship	Game as social framework
Discovery	Game as uncharted territory
Expression	Game as self-discovery
Submission	Game as pastime

Figure 7 – MDA framework: Game Aesthetics (adapted from [14])

5

Related Work

Contents

Gamification demonstrates that game elements are not restricted to games, a real case that retracts perfectly that difference occurred on a global consulting company, Deloitte, which came up with a feature called "WhoWhatWhere" to its internal social messaging platform. The goal was to incentive consultants on sharing details about their client meetings to prevent redundant work and information loss. There are leaderboards which track who has shared the most information, leaders gain social recognition in the company and potential new job opportunities, that motivates consultants to participate. Their conclusions registered an increasing number of data sharing, about client meetings which users recognized as helpful to save relevant information and keep teams organized.

Gartner Inc., the world's leading research and advisory company, predicted in 2011 that by 2014, 70 percent of Global 2000 organizations would have at least one gamified application [12]. Considering the rising trend in gamified applications and the stakes at hand for businesses, organizations, and government, it is crucial to research game-thinking in organizational contexts. Gamification can change stakeholder behavior because it taps into motivational drivers of human behavior in two connected ways: reinforcements and emotions. [8]
Searching in literature for work that use gamification to solve time tracking problems and combining words as "Time Tracking", "Timesheets" or "Time Reporting" we identified a lack of information to sustain our research, so we tried to look for other applications of gamification.

5.1 Gamification to Time Tracking

Time tracking is a report process of time spent on assigned tasks. The common use is to automate payroll or client invoicing, providing insights on operations, such as: which tasks are taking a lot of staff's time and costing the most money; allowing business to plan project budgets; helping the student to plan their study hours in the different disciplines. However, many company employees are facing a big problem in this area which consists on their employees don't fill timesheets on time. With that, the Finance Department can't resolve the company billing process because there is no time tracking about employees work time and the company don't know on what and where their employees spent their work time.

IST researchers have been studying gamification solutions to prevent this time tracking problem. One of them, was applied in a class of a 24-week post-graduation course in Software and Information Systems Engineering where was implemented a software tool using Google Suite technologies to make time reporting tasks more engaging for employees. The course was sponsored by a large consultant group providing audit, tax, consulting, risk, and financial advisory services.[21] Their solution had the single goal of improve the rates of time reporting. They used teams to promote competition and cooperation with the individual and collective challenge of reporting their work time within the period scheduled by the company. Leaderboard and badges where the game elements chose to track, classify and reward users performance in the gamification-based experience which will also give feedback to

users according to those performance. This solution uses five levels, where users start in level three (the middle one) and they progress through levels by completing (or not) their individual challenges. If a user fails a challenge, levels down once. If user completes it, levels up once.

Results suggest that the number of timesheets submitted slightly improved, with a statistically significant increase of 8.9% when compared against the baseline. However, players think their motivation did not change after using the app, which is too simple to be engaging in the long term. They enjoyed the teams and leaderboards but think more rewards, individual achievements, and reminders should be available.[21]

5.2 Gamification to Workplaces

At the core of gamification strategies to workplaces contexts is the assumption that if organizations make the completion of a task synonymous with the playing of a game, employees can be intrinsically motivated by the challenge to invest a sustained effort in their work, similar to as they would when playing a challenging game. [3]

Literature comes with more research to determine whether gamified work is efficient when employees escapist tendencies and self-efficacy are examined as potential moderating variables. Paper results demonstrate that gamification can accommodate different learning styles and pace, and allow individuals to achieve mastery at their own pace, but the organisation's task is to ensure the game design, elements and goals move beyond necessary information to achieve innovation, through motivating individuals to problem-solve and achieve strategic outcomes. Based on those results, the main new question/problem which Garris, Ahlers & Driskell (2002) mentioned [6] : Which characteristics of games are relevant to the workplace? The paper finishes with three game characteristics which can answer that question: namely learning, rewards, and individual and group performance. [3]

Looking for literature to identify which moments are adequate to gamify on a workplace, IBM researchers[10] propose that an essential consideration for applying gamification within the enterprise is finding such times and focusing on those that are acceptable to an organization.
The moment of play depends on the employee’s time and can potentially impact other employees who benefit from another’s gaming moment or choose to engage in the same activity. Work within the enterprise often requires team participation, such as software development and business meetings. Factors as corporate culture, the team’s social norms, and leadership style can dictate when it is appropriate for a team to participate in a gamification-based experience.[10]
The considerations for a moment of play by oneself may be different from a moment of play with a colleague or with a client – such as our own experiences with “multiplayer” versus “single-player” gamification. Finding the right moment of play may also be essential for certain learning experiences – extending the learning strategy of “enrichment”. [10]

They concluded that gaining a better understanding of moments of play in individual and community contexts is crucial to engage users with a gamification-based experience because every user has their own work schedule and plan so it's important to identify their behaviors and be the experience prepared and equally available to everyone.

5.3 Gamification to Human Resource Management

There are numerous ways in which game concepts can be used in Human Resource Management as attract, induct, train (learn) and develop, engage and retain employees [17]. As well as, human resource professionals understanding gamification to actively create gamification strategies themselves, to enable them on recognizing the impact of gamification experiences because, as in any strategic investment, keeping the focus on the managerial goals and strategic objectives is what really matters.
Karen and Kietzmann[8] have been working to advance the understanding of gamification concepts, applications, and impacts applied to Human Resource Management. Their work was sustained by: gamification principles to design highly engaging processes in a range of service industries; MDE framework to show how gamification mechanics, dynamics and emotions are used to create gamified experiences which will continuously need to be monitored, both internally (Does it still make sense?) and externally (Are players, observers, and spectators still excited and engaged?). [8] Mechanics should be adjusted accordingly so that individuals can continue playing and not moving on to something else more exciting (in terms of emotions) or more engaging (regarding the overall experience), losing the focus on target behaviors. [8]

From this research, they conclude that gamification can really improve Human Resource Management processes in terms of efficacy and quickness. The key to do that is to teach and show to Human Resource professionals how to identify different gamification measures and targets, and understand how the intended mechanics, dynamics, and emotions would drive and moderate these measures, according to their business goals.

6

Research Proposal

Contents

Our research proposal uses Framework 6D as a design method, where we describe our step-by-step the processes which must be followed to guide our work for solving the research problem.

6.1 Define Business Objectives

The main business objective identified by the company involved on this study was to **increase the number of timesheets submitted before deadline**. The monthly deadline defined by the company was at 25th day.

According to them, the submissions success rates last year covers an average of 59% of their employees, which company traduced on a number too low to a mandatory employee process and consequently delays the their billing process which occurs between the deadline and the last working day of the month.

6.2 Delineate target behaviors

To achieve the business objective, we defined behaviors which users must practice and metrics to evaluate those behaviors. As the target behavior, we defined '**timesheets monthly submission before the deadline'**, with a quantitative metric, **the number of timesheets monthly submissions before the deadline** to quantify it.

Besides this metric, we also defined '**the number of timesheets submission on each day'** as the second metric to evaluate our target behavior where we chose **the last five days before deadline** to understand if our solution besides increasing the number of timesheets submissions before the deadline, also reduces the number of submissions in last five days before the deadline, which traduced our score system on six phases as Figure 9 shows.

6.3 Describe your players

To describe our players, we should involve them on the process. Questionnaires and interviews are good ways to that and the hexad user type model is a good tool to traduce these metrics.

We produced a survey (represented in Appendix A) to identify our user types and a conversion table to traduce the results, which we describe in more detail at subsubsection 7.2 . This user research teaches us about users understanding and thinking way, what they like and which tools must be developed to guarantee that we have our users motivated and engaged with our solution.

6.4 Devise activity loops

Activity loops were defined to improve the user engagement of our gamified solution. According to subsection 4.1.4, two different activity loops types are engagement and progression loops.

Our solution adopted one engagement loop where users should monthly submit their timesheets before the deadline, get rewarded (with the monthly badge) for that and check their progression on our score system according to their submission day, which we describe at subsection 6.6 .

6.5 Don’t forget the fun

In this step, we will describe which fun elements will be used on the solution to engage, our play tries to encourage our players. From our user research, described in subsection 7.2 , we conclude that most users have strong social characteristics and their desire on having an intuitive, responsive and user-friendly solution.

So, our solution will have a minimalist design with appropriate colors and icons. Users can see their profile, with the avatar picked, the current position on our leaderboard as well as their collected badges.

To add some fun on our feedback system, we decided to implement one comic phrase associated to our score systems phases. So, on each phase defined by the user timesheet submission day as one comic phrase each time they get feedback from the system, as Figure 8 shows.

Submission Day	Phrase
Day 20	First shot, first miss. Submit your timesheet and go get your badge!
Day 21	Your collegues are laughting of your leaderboard’s position. Get some XP!
Day 22	Three days to deadline and you keep losing XP. Wake up!
Day 23	Really that you wanna be the loser? Come on, the company counts on you!
Day 24	Only one day left! We don’t believe you will lose your badge.
Day 25	Deadline is today. Do you wanna get paid or not?

Figure 8: Comic phrases

6.6 Deploy appropriate tools

In this section, we will present the game elements/tools used to guarantee that our solution engages our users.

As game mechanics of our proposal, our choice fell on competition and feedback, which will be achieved by using Game Components as: badges, points, leaderboards and avatars. Figure 10 shows, in a global view, all the connections and interactions between the game elements chose to our solution. Our monthly badge can be achieved by users who submit their timesheet before the deadline, to identify the success cases which contribute to achieve the business objective.

Our score system is represented at Figure 9, which has experience points (XP) as unit of measure that depends on timesheet submission day to achieve those points.

Phase	Submission Day	Gamification Bonus
Phase 0	< Day 20	1000XP
Phase 1	Day 20	750XP
Phase 2	Day 21	600XP
Phase 3	Day 22	450XP
Phase 4	Day 23	300XP
Phase 5	Day 24	150XP
Phase 6	>= Deadline	0XP

Figure 9 – Score system.

The leaderboard is the visual representation of users competition, and uses the number of badges achieved as the first unit of ranking because reflects directly to users who are playing according to achieve the business objective, and experience points (XP) as the second unit of ranking which identify users that didn't let their submission to the last days before the deadline.

Our feedback mechanism was applied in two different ways:

- The first one uses UI elements of our app such as pop-ups and countdowns to teach users about our gamification system rules and notify their gamification results according to their actions and performance.\newline
- The second one was used on the last 5 days before the deadline, by e-mail functionality to alert users who haven't submit their timesheet already about our score system rules and bonus and promote their submissions before deadline.

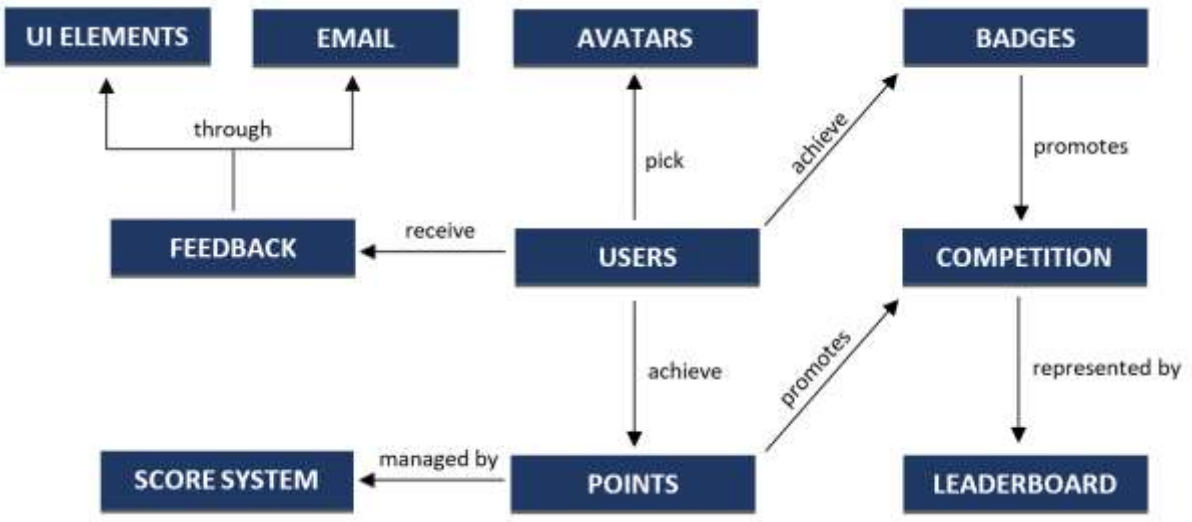

Figure 10 – Game Mechanics and Elements interactions.

7

Demonstration

Contents

In this section, we demonstrate how our proposed solution was implemented, describing the demonstration activities, analyzing the user research results and conclusions, and showing the different prototypes developed according to users requirements.

7.1 Description

Demonstration activities are being performed in company A, an IT Consultant with 700 employees. Company A works in Portugal, providing software products and services in three different business types: OutSourcing, Nearshore and Turnkey projects. They have clients located in Portugal, however some of them are from other countries. Their main business areas are banks and insurers.

We randomly selected 75 users to use our software with gamification and another 75 users to use the software without gamification, so we can compare both systems and conclude our solution contribution to solve the research problem.

7.2 User Research

To improve our research, we performed a survey on company A. Overall, 142 employees answered with a total response ratio of 0.20.

Survey results were analyzed with quantitative and qualitative metrics as averages, standard deviation and the Hexad Model which identified the user types in terms of motivation, demographic user characteristics and their knowledge about gamification as well as their interactions with timesheet submission process.

Respondents ages are between 26 and 30 years and we identified that most of them have a Computer Science and Engineering background as well as a Bachelor's Degree.

Looking for the timesheet submission process, we identified 52% users which have done it for at least 2 academic or professional contexts. They identified the "Possibility to report hours every day", "Having a simple and user-friendly time tracking tool" and "Reminders for submitting timesheets" as important activities to successfully complete this process. And as the big reasons to fail these process, their answers were "Forgetfulness", "Difficulty in remembering hours of past days" and "Lack of motivation".

Gaming characteristics were identified on users. Survey shows that 81% of them agrees with the phrase "Do you like to play games?", 59% of users prefer to play multiplayer games which 51% prefer to play online with people who know.

Besides the gaming questions and to a better understanding about how users are available to lead with gamification we made an single choice question: "A gamification solution applied in the workplace can be a distraction from my work's main focus.", where the results shows that 76% of them didn't agreed with the phrase.

Appendix A shows the full survey which results are being presented here. At the motivation section of the survey we create a multiple choice grid with sentences relatable to the different user types from The Hexad User Type Model where users must rate the phrases according to their agreement with the phrase, from 1 (Strongly Disagree) to 7 (Strongly Agree). Those sentences were grouped according to the different user types as Appendix B shows, and having each user type score we could identified our user types from our user research where Philanthropist, Socializer and Achiever were the main user types identified. Figure 11 represents the results from this analysis.

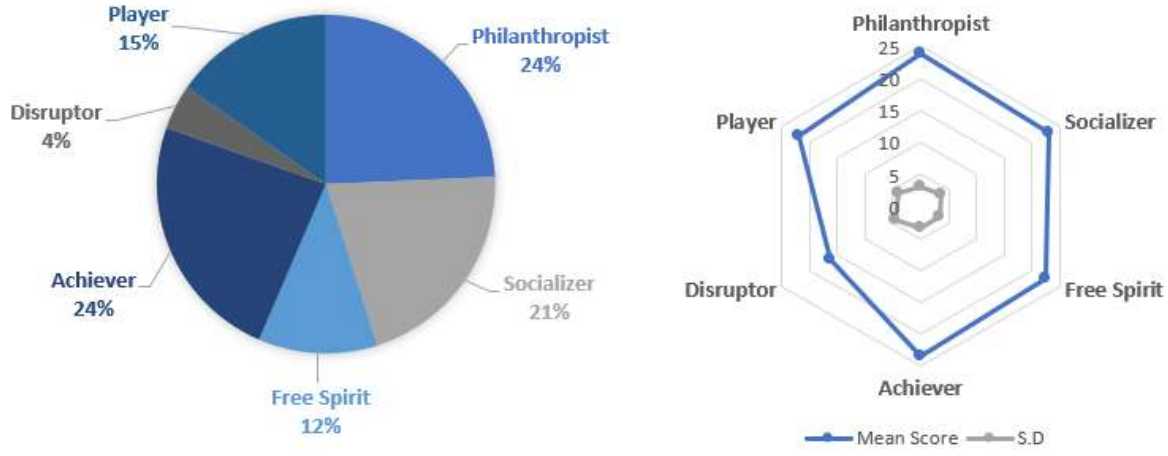

Figure 11 – User types results according to Hexad user types model.

7.3 Iteration Process

To consolidate our research and prove our solution impact in terms of solving the research problem we performed one iteration process, of 3 months (July, August, September). At the end of the iteration, we analyzed the evaluation results from the software database to understand what our solution contribution on solving the research problem.

7.4 Prototypes

In this subsection we show the final prototype used on our solution according to gamification elements, and also the software interface elements which are intuitive and user-friendly as users requested with the appropriate colors and icons associated.

7.4.1 First Prototype

The first prototype developed to demonstrate and future evaluation. Our solution is being developed and to define the design process we choose the Low Fidelity Prototype, which is one of many prototype types, to perform it.

The prototype provides a timesheet submission process with a design that brings a new approach where users have to fill their timesheets by clicking actions instead of writing ones. Users choose a slot color which as the number of hours worked and they must 'paint' timesheet work days where they worked those hours. Slots can be personalized, users can create slots with custom hours and colors to get more attach and comfortable with their timesheets.

Prototype provides feedback system, where users get information about their timesheet submission process performance if they fill their timesheets without errors and providing a tutorial system with a step-by-step guide for teaching users to succeed on these process and help them on possible errors which they can face.

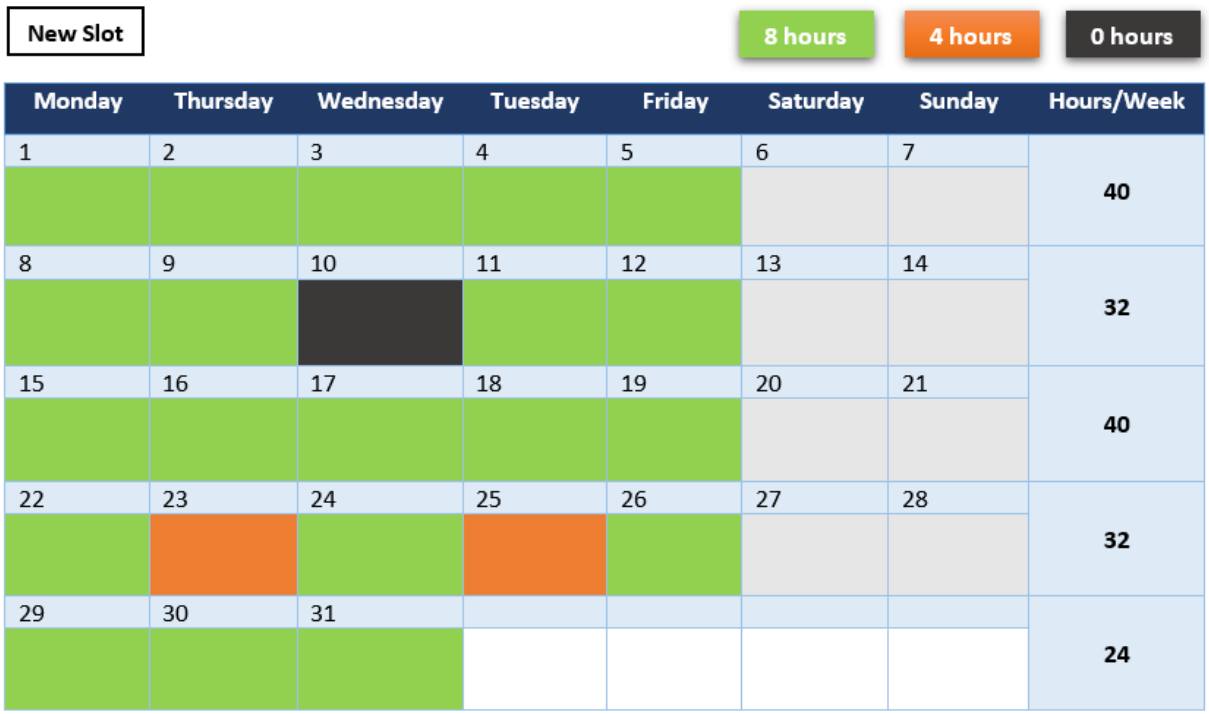

Figure 12 – Low Fidelity Prototype

7.4.2 Final Prototype

To submit a timesheet, first of all our users must choose the month and year on a modal which will appears after they click on 'New Timesheet' button. After that, will render a new page where with an upgrade and more intuitive First Prototype version, represented in figure 13.

This version able users to have a list with all the activities which they made spent their work time on the company. They must pick those they wanna register with the respective amount of hours and click on the day where activities were performed. By doing that users added an item on calendar which will be represented by a bullet with the activity color. Doing hover on a day with activities registered, will render a popover with the list of activities and the respective hours registered on that day.

Users can also add projects at the same page if they have to register activities on more than 1 project in the month and year selected, the page will render another calendar with the respective 'My Activities' card.

They also have two 'quick buttons' on calendar to clear all the items or fill all working days of the activity selected to make a more intuitive and faster process, as Figure 13 shows. By clicking on ‘Submit Timesheet’ button, users will submit their timesheet and win the respective experience points (XP) and monthly badge if they do it on a date before the deadline.

Figure 13 – Final Prototype – Timesheet submission page

As we announce, our solution has Leaderboard, Badges, Points and Avatars as game elements, as Figures 14 shows.

Users must check gamification page where they find the leaderboard with the competition results based on badges and the score system. They also have a card with the score system phases according to the submission day and a countdown which details the current phase and how much time left for the next phase. Beyond that, users have their profile available on every page to check the current position on leaderboard, their badges as well as user's avatar.

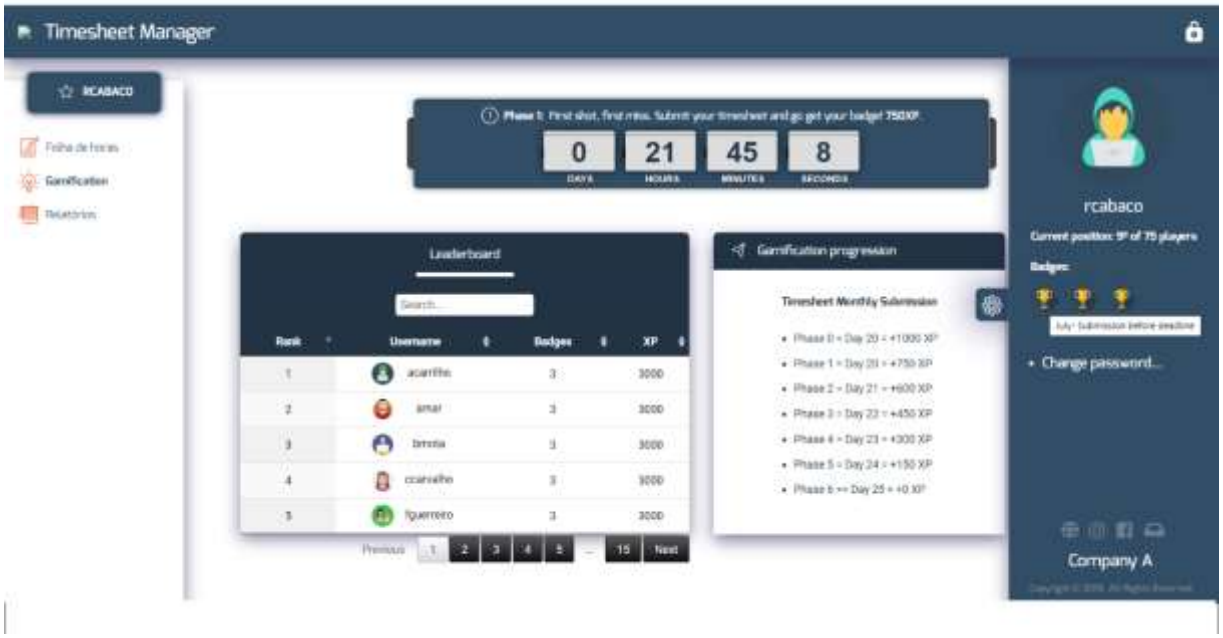

Figure 14 – Final Prototype – User profile (Avatar, Badges, Competition) and Gamification page (Leaderboard, Score System, Countdown).

8

Evaluation

Contents

At this section, we're showing our proposed solution evaluation to conclude how solution performed, which solution parts need to be refined and identify which tools that must do it, concerning solving the research problem referenced in section 3.
Setting evaluation methods, we decided to use quantitative evaluation to analyze the monthly timesheets submissions and the day that those submissions occurred. This Evaluation refers to the first iteration process which occurs between July and September of the current year.

8.1 Quantitative Evaluation

This evaluation type will use every metric defined at subsection 6.2 to be compared between the software with gamification and the other case where users only have the software functionalities to submit their timesheet.

8.1.1 Metric 1- Number of timesheets monthly submissions

This metric evaluates the number of timesheet monthly submissions before deadline which represents directly our solution success or unsuccess according to our research problem.

According to the software with gamification, the first month results reflected a good engage from the users with our solution. 73 users (97.3%) submitted their timesheet before the deadline and only 2 users (2.7%) didn't. At the others two months, success rates were a little bit low because of most users went on vacations and when it happens users didn't check their emails because the company knows about their vacations and has a benevolent behavior with their timesheet submission process. So, at the second month we got 70 submissions before the deadline and 5 submissions after the deadline. At the third and last month of the iteration process we had 72 submissions before the deadline and 3 submissions after the deadline.
Overall we got a media of 71,67 (95,5%) timesheets submissions before the deadline per month with a standard deviation of 1.53.

Looking for the software without gamification where the other 75 users submitted their timesheets, values are also represented in Figure 16, we got a media of 50.3 (67.1%) timesheets submission before the deadline with a standard deviation of 4.04.
Figure 15 shows this metric evaluation representing the submissions by percentages and along months which covers the iteration process.

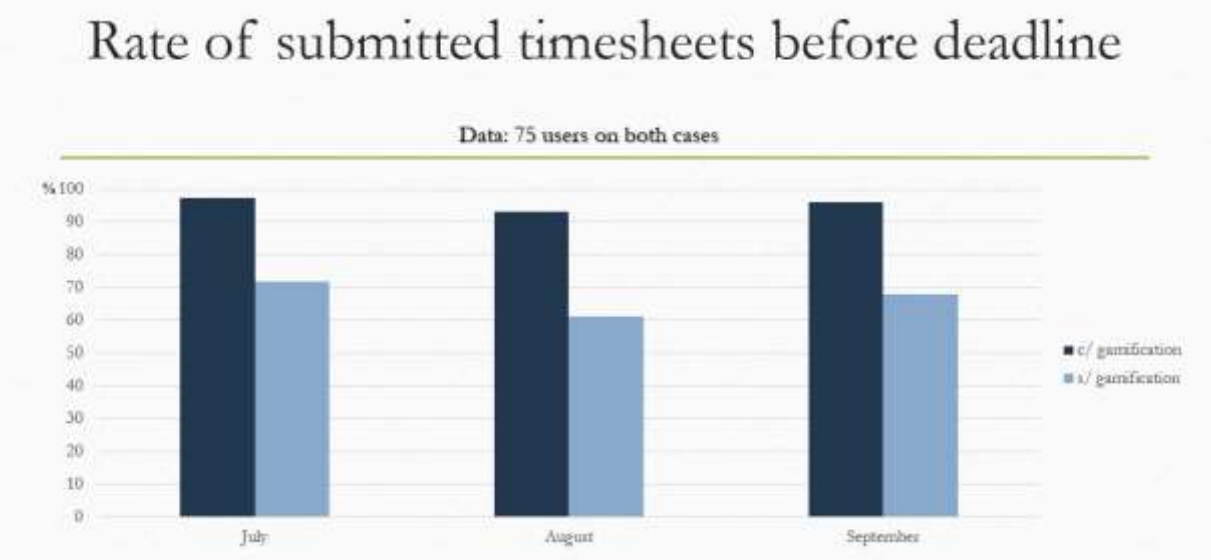

Figure 15 – Timesheet monthly submission results on both systems (gamified one and the software without gamification).

8.1.2 Metric 2 - Timesheets monthly submissions per day

This metric evaluates the timesheets submission days before the deadline. As we announce at subsection 6.6, we chose the last 5 days before the deadline to define our score system and encourage the users to not leave their submission until the last day. Figure 16 shows this metric evaluation representing the number of timesheets submissions per day from July to September.

As we can see, the software with gamification shows a decreasement of timesheets daily submissions from almost 50 submissions on day 20 to less than 7 submissions at day 24 along the last five days before the deadline. Overall we got a media of 48 submissions in day 20, 33 submissions in day 21, 25 submissions in day 22, 14 submissions in day 23 and 6 submissions in day 24, per month.
These results able us to conclude that our feedback system via email which starts on Day 20 and goes along the next days until the deadline associated to our score system bonification and reflected on our competition, are having a good impact on users who now didn't leave their timesheet submission to the last day before the deadline.

Looking for the software without gamification where the other 75 users which used submitted their timesheets, values are also represented in Figure 16, in the first two days, we can see that the typical alerts and reminders produced an increasement on the number of timesheet submissions, but in the last 3 days occurred an increasement of that number mainly on the last day before the deadline which values were almost around 90 submissions on this day.

Overall we got a media of 16 submissions in day 20, 8 submissions in day 21, 10 submissions in day 22, 23 submissions in day 23 and 87 submissions in day 24, per month.
These results show us that without gamification users still leave their submissions to the last days which can overlap the software and can be a problem to Finance Department who have to start the billing process on day 25.

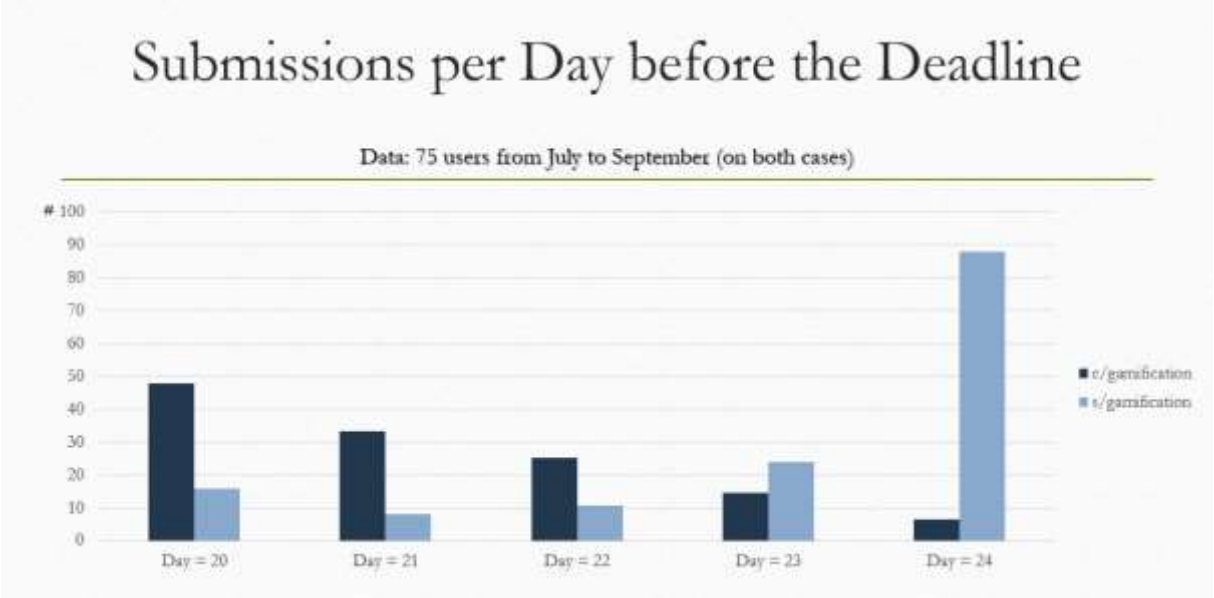

Figure 16 – Timesheet monthly submissions per day, on the last five days, before deadline.

9

Conclusion

The low percentage of timesheets submitted before the deadline was demonstrated in this document as the research problem, where gamification is proposed as a possible solution.
The DSRM provides the research method used for the research process model, which gave us the iteration processes and generation/testing cycles to have a continuous evaluation which will able us to refine our solution according to its performance.

At the beginning, we searched in literature for Time Tracking combining words as "time tracking", "timesheets" or "time reporting" we identified a lack of information to sustain our research, so we decided to look for other types of gamification applications to understand how and where gamification can be applied to solve real problems. We concluded that gamification solve real problems in organizational contexts where users have are not motivated to perform assigned tasks because they considered those tasks boring and don't see or have a direct benefit for themselves besides their salary, so it's important to adjust those traditional tasks to engage it with users in a way that they really feel comfortable, interested and involved on something where everyone gets benefits for their work, sometimes company just need to show the real value of their work.

Our gamified solution used Framework 6D to guide our design process, we included users on this process and defined the business objectives in order to produce the right tools, promote our target behaviors to have users contribute on solving the research problem.
Demonstration activities traduced the solution first iteration process results in a 28,4% improvement of timesheets monthly submission before the deadline comparing with the software without gamification results. We had more than 90% submissions before the deadline on each month within the iteration process period. Another good conclusion came from the second metric defined where we evaluate the submissions day which shows that users are now concerned to not let their submissions to the last day before the deadline because they want to reach the highest positions on leaderboard and to do that they must follow our score system which gives less experience points to those who let their submissions to the last days. These results suggest that users are now engaged with our solution and consequently motivated to fulfill the time tracking process.

As lessons learned we concluded that competition and feedback are two valuables mechanics to engage users with any standard or boring process because they feel involved with the process and find own benefits as social and/or company recognition, but we also realized that our solution needs to be improved to maintain their engagement. Users feedback showed the desire on having physical rewards to their activities because they like competition but also want to achieve something outside from the system to make them feel that their activities are valuable for the company and for themselves.

For further iterations process we want to had complexity to the competition with the definition of more activities loops and also reward users with simply stuff like merchandising which has low value for the company but can mean a lot to them when aggregated to a gamified solution.

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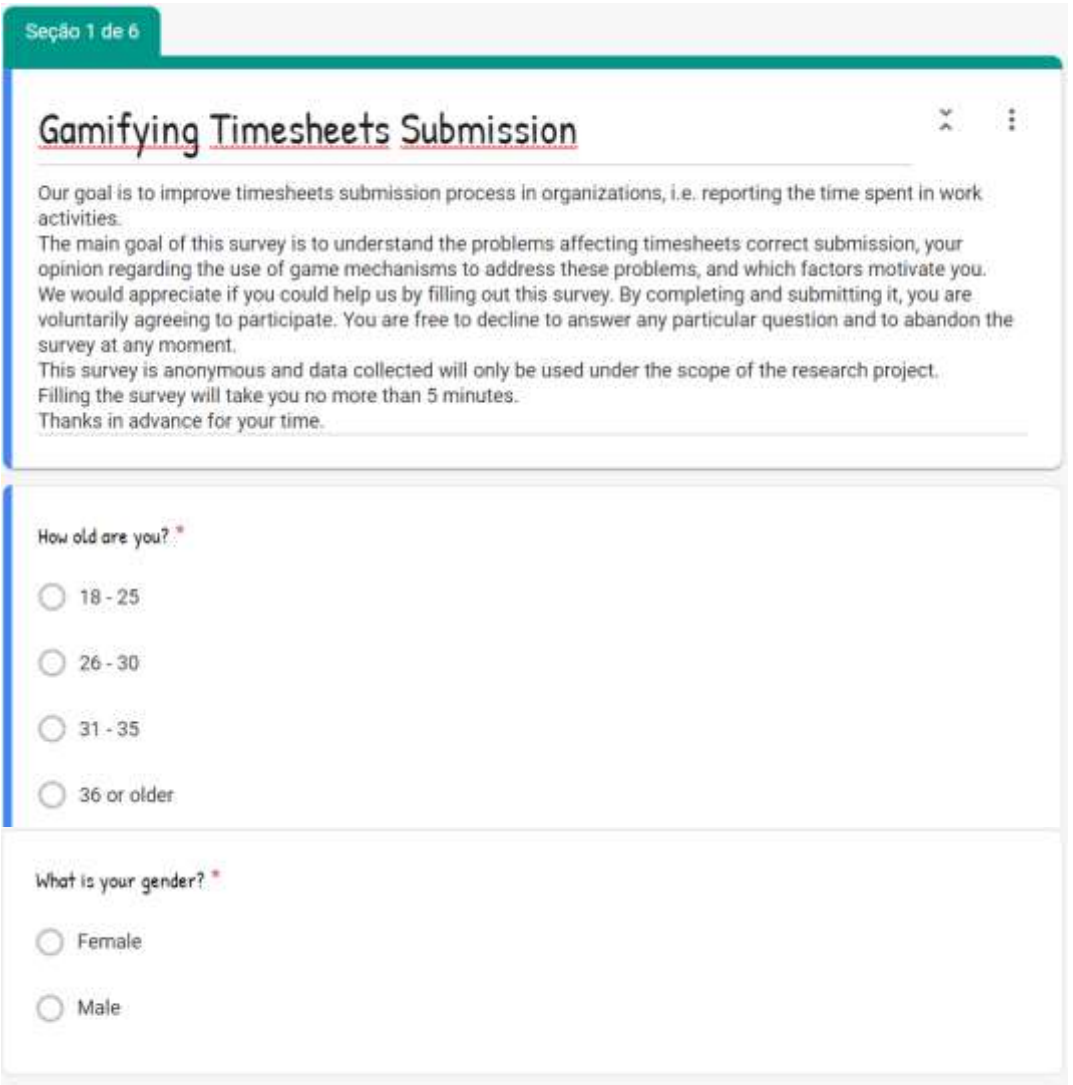
A

Survey from User Research



Seção 1 de 6

Gamifying Timesheets Submission

Our goal is to improve timesheets submission process in organizations, i.e. reporting the time spent in work activities.
The main goal of this survey is to understand the problems affecting timesheets correct submission, your opinion regarding the use of game mechanisms to address these problems, and which factors motivate you.
We would appreciate if you could help us by filling out this survey. By completing and submitting it, you are voluntarily agreeing to participate. You are free to decline to answer any particular question and to abandon the survey at any moment.
This survey is anonymous and data collected will only be used under the scope of the research project.
Filling the survey will take you no more than 5 minutes.
Thanks in advance for your time.

How old are you? *

- 18 - 25
- 26 - 30
- 31 - 35
- 36 or older

What is your gender? *

- Female
- Male

- ◯ Advanced Graduate work or Ph.D
- ◯ Outros...

What is your academic background? *

- ◯ Applied Mathematics and Computation
- ◯ Computer Science and Engineering
- ◯ Electrical and Computer Engineering
- ◯ Industrial Engineering and Management
- ◯ Telecommunications and Informatics Engineering
- ◯ Outros...

Select the option that best matches the time you have been working as a professional *

- ◯ < 1 year
- ◯ 1 - 5 years
- ◯ 6 - 10 years
- ◯ 11 - 20 years
- ◯ > 20 years

Which client are you allocated to? *

- ◯ Aubay Sede
- ◯ Outros...

Select the option that best matches your job's main function *

- ◯ Business Manager
- ◯ Recruiter
- ◯ Admnistrative

- ◯ Talent Development & Employeer Branding
- ◯ IT Consultant
- ◯ Lawyer
- ◯ Outros...

Select the option that best matches the time you have been working with Aubay *

- ◯ < 1 year
- ◯ 1 - 5 years
- ◯ 6 - 10 years
- ◯ 11 - 20 years
- ◯ > 20 years

Seção 2 de 6

Timesheets Submission

Consider timesheet submission as the reporting of time you have spent working (in general or in an activity) during a period that is closing (e.g. a week or fortnightly).

In how many academic (like courses or thesis management) and professional contexts did you have to submit timesheet reports? *

- ◯ None
- ◯ 1-2
- ◯ 3-4
- ◯ 5-6
- ◯ More than 6

Classify the following sentences according to your level of agreement. Timesheet reports

Grade de múltipla escolha

Linhas	Colunas
1. ...can benefit the organization.	Strongly Disagree
2. ...can benefit my work.	Disagree
3. ...teach me how to manage my time.	Neutral
4. ...help me improve my work practices.	Agree
5. ...allow me to monitor my productivity.	Strongly Agree
6. ...help organizations identify bottlenecks ...	Adicionar coluna
7. Adicionar linha	

Exigir uma resposta em cada linha

Classify the actual timesheets software: *

1 - "Horrible", 5 - "Perfect"

	1	2	3	4	5
Performance					
User Experience					
User Interface					

Is there any other comment you would like to provide about timesheets software?

Texto de resposta longa

Classify the following initiatives for addressing a low ratio of submitted timesheets reports according to the importance you think they have. *

	Not Important	Little Important	Neutral	Important	Very Important
Comparing rep...					
Implementing a...					
Possibility to re...					
Having a simple...					
Having an auto...					
Definition of an ...					
Reminders for s...					

Forgetfulness	○	○	○	○	○
Difficulty in rem...	○	○	○	○	○
Lack of motivat...	○	○	○	○	○
Considered a lo...	○	○	○	○	○
Time-consumin...	○	○	○	○	○
Lack of perceiv...	○	○	○	○	○

List other factors you believe that can negatively impact the timesheets submission process.

Texto de resposta longa

Rank the following initiatives on the basis of the motivation they provide you to submit your timesheet report *

1 for the least motivating, 7 for the most motivating

	1	2	3	4	5	6	7
Comparing...	○	○	○	○	○	○	○
Implementi...	○	○	○	○	○	○	○
Possibility ...	○	○	○	○	○	○	○
Having a si...	○	○	○	○	○	○	○
Having an ...	○	○	○	○	○	○	○
Definition ...	○	○	○	○	○	○	○
Reminders ...	○	○	○	○	○	○	○

List other approaches you believe that can increase your motivation in submitting timesheets.

Texto de resposta longa

Seção 3 de 6

Gamification

Note: when referring to games, we meant both digital and analogue games.

Do you like to play games? *

- ◯ Yes
- ◯ No
- ◯ Don't know/Don't want to answer

Typically, you play games... *

Select the option that best applies

- ◯ Every day
- ◯ Every week
- ◯ Occasionally
- ◯ Rarely
- ◯ Never

Would you consider yourself... *

- ◯ Harcore gamer
- ◯ Something between hardcore and casual gamer
- ◯ Casual gamer
- ◯ Don't know/ Don't want to answer

Do you prefer single or multiplayer games? *

- ◯ Single player
- ◯ Multiplayer

Regarding multiplayer games, you prefer to... *

- ○ Play online with people you know
- ○ Play online with people you don't know
- ○ Play offline with people you know

In which kind of devices do you play the most? *

Select all that applies

- ☐ Personal computer (desktops, laptops, netbooks)
- ☐ Video-game console
- ☐ Portable video-game console
- ☐ Tablet
- ☐ Smartphone
- ☐ Outros...

What are the top 3 game genres you enjoy playing the most? *

Select all that applies

- ☐ Action (Grand Theft Auto, Call of Duty)
- ☐ Adventure (The Legend of Zelda, Unlock!)
- ☐ Board/ Card/ Trivia (Trivial Pursuit, Fishing, Solitaire)
- ☐ Casual (Candy Crush, 2048)
- ☐ Construction and Management Simulation (SimCity)
- ☐ Educational (Big Brain Academy)
- ☐ Fighting (Tekken, Street Fighter)
- ☐ Life Simulation (The Sims)
- ☐ Platform (Super Mario Bros, Sonic the Hedgehog)
- ☐ Puzzle
- ☐ Racing (Gran Turismo, Need for Speed, Mario Kart)

- [ ] RPGs (Final Fantasy, World of Warcraft)
- [ ] Sandbox (Minecraft, Assasin's Creed)
- [ ] Sports (FIFA, Pro Evolution Soccer, Wii Sports)
- [ ] Strategy (Age of Empires, Catan)
- [ ] Survival Horror (The Walking Dead)

Name three games that exemplify what you enjoy about games. *

Please separate your answers by commas

Texto de resposta longa

Do you know what gamification is? *

- ○ Yes
- ○ No
- ○ Don't know/ Don't want to answer

Which of the following applications ... *

	... do you know?	... do you used ?	... do not use or know?
Foursquare	☐	☐	☐
Duolingo	☐	☐	☐
Nike+	☐	☐	☐
Chore Wars	☐	☐	☐
Fitocracy	☐	☐	☐
Super Better	☐	☐	☐
Forest	☐	☐	☐
Zombie's run	☐	☐	☐
GFoundry	☐	☐	☐

Epic Win	☐	☐	☐
Habitica	☐	☐	☐
Pokémon Go	☐	☐	☐
MBWay	☐	☐	☐

Após a seção 3 Continuar para a próxima seção

Seção 4 de 6

Gamification Solutions - Work Environment

Let us know, what solutions are you familiar with..

Classify your level of agreement with the following sentence: A gamification solution applied in the workplace can be a distraction from my work's main focus. *

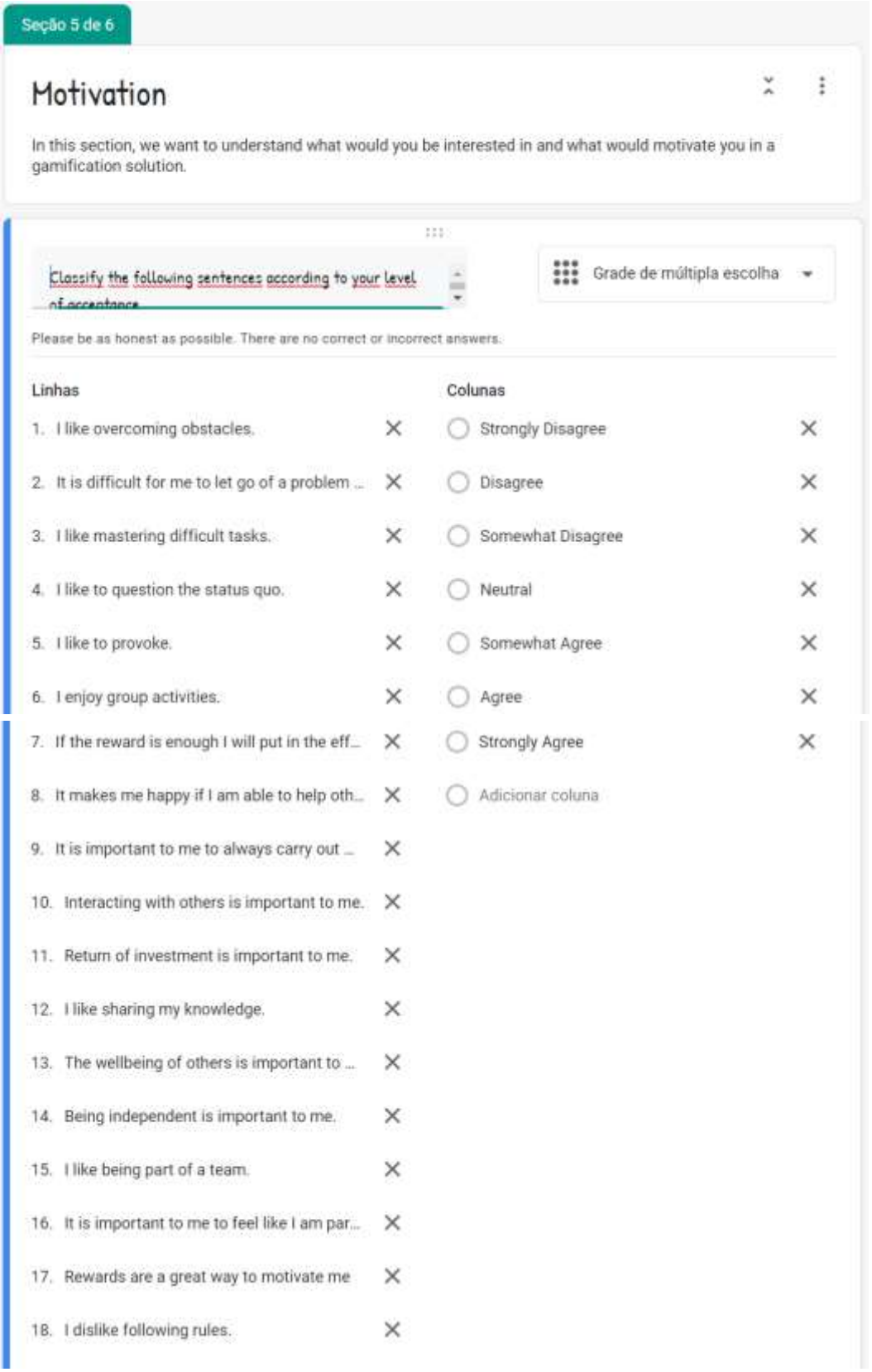
	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

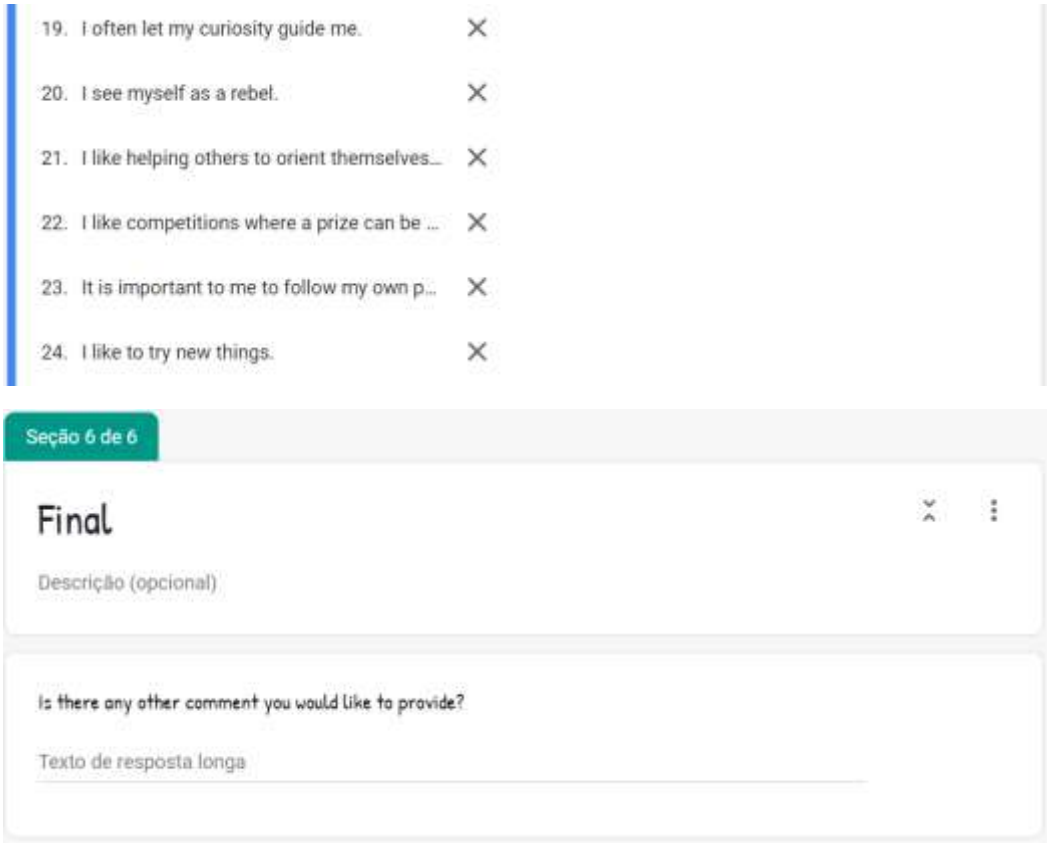
Do you have knowledge of any gamification solution applied in the workplace to engage employees in their work environment? *

- ○ Yes
- ○ No
- ○ Don't know/Don't want to answer

If you answer "Yes" to the previous question, please list the gamification solutions you know.

Texto de resposta longa


Seção 5 de 6
Motivation
In this section, we want to understand what would you be interested in and what would motivate you in a gamification solution.
Classify the following sentences according to your level of acceptance
Grade de múltipla escolha
Please be as honest as possible. There are no correct or incorrect answers.
Linhas
Colunas
1. I like overcoming obstacles.
2. It is difficult for me to let go of a problem ...
3. I like mastering difficult tasks.
4. I like to question the status quo.
5. I like to provoke.
6. I enjoy group activities.
7. If the reward is enough I will put in the eff...
8. It makes me happy if I am able to help oth...
9. It is important to me to always carry out ...
10. Interacting with others is important to me.
11. Return of investment is important to me.
12. I like sharing my knowledge.
13. The wellbeing of others is important to ...
14. Being independent is important to me.
15. I like being part of a team.
16. It is important to me to feel like I am par...
17. Rewards are a great way to motivate me
18. I dislike following rules.
Strongly Disagree
Disagree
Somewhat Disagree
Neutral
Somewhat Agree
Agree
Strongly Agree
Adicionar coluna


19. I often let my curiosity guide me.
20. I see myself as a rebel.
21. I like helping others to orient themselves...
22. I like competitions where a prize can be ...
23. It is important to me to follow my own p...
24. I like to try new things.
Seção 6 de 6
Final
Descrição (opcional)
Is there any other comment you would like to provide?
Texto de resposta longa

B

Relation between User Types & Survey questions

User Type	Survey Questions
Philanthropist	I like helping others to orient themselves in new situations.
	The well-being of others is importante to me.
	It makes me happy if I am able to help others.
	I like sharing my knowledge.
Socializer	It is important to me to feel like I am part of a community.
	I enjoy group activities.
	I like being part of a team.
	Interacting with others is important to me.
Free Spirit	I like to try new things.
	Being independent is important to me.
	It is important to me to follow my own path.
	I often let my curiosity guide me.
Achiever	I like overcoming obstacles.
	It is difficult for me to let go of a problem before I have found a solution.
	It is important to me to always carry out my tasks completely.
	I like mastering difficult tasks.
Disruptor	I like to question the status quo.
	I dislike following rules.
	I see myself as a rebel.
	I like to provoque.
Player	I like competitions where a prize can be won.
	Return of investment is important to me.
	Rewards are a great way to motivate me.
	If the reward is sufficient I will put in the effort.