

# Using Gamification for Improving Time Tracking

Rogério Cabaço, IST; Miguel Mira da Silva, INOV/IST; Daniel Gonçalves, INOV/IST;

**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, questionnaires 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.

## I. INTRODUCTION

Time tracking is the 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.

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.

## II. RESEARCH METHODOLOGY

We propose Design Science Research Methodology (DSRM) to guide evaluation and iteration processes of our work[1]. This methodology focuses on the development of successful artifacts based on principles, practices, and procedures that guarantee an improvement in artifact performance and an understood

This paragraph of the first footnote will contain the date on which you submitted your paper for review. It will also contain support information, including sponsor and financial support acknowledgment. For example, "This work was supported in part by the U.S. Department of Commerce under Grant BS123456."

The next few paragraphs should contain the authors' current affiliations, including current address and e-mail. For example, F. A. Author is with the

National Institute of Standards and Technology, Boulder, CO 80305 USA (e-mail: author@boulder.nist.gov).

S. B. Author, Jr., was with Rice University, Houston, TX 77005 USA. He is now with the Department of Physics, Colorado State University, Fort Collins, CO 80523 USA (e-mail: author@lamar.colostate.edu).

T. C. Author is with the Electrical Engineering Department, University of Colorado, Boulder, CO 80309 USA, on leave from the National Research Institute for Metals, Tsukuba, Japan (e-mail: author@nrim.go.jp).

research problem. Artifacts are defined by constructs, models, methods and instantiations.

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.

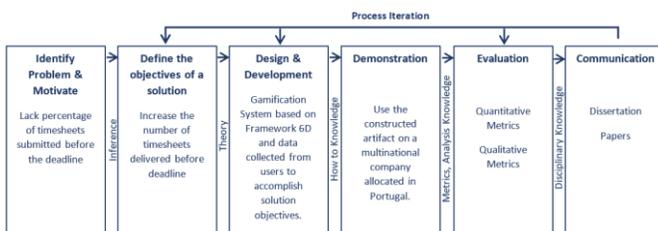


Figure 1 - DSRM Process Model (adapted from [18])

### III. RESEARCH PROBLEM

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

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.

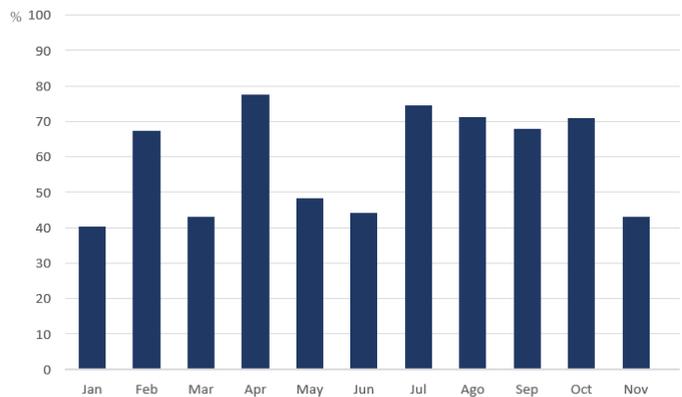


Figure 2 - Percentage of timesheets submitted before the deadline collected from company A in 2018.

### IV. RELATED WORK

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.

#### A. 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]

#### B. 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 organization'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.

#### C. 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.

## V. RESEARCH PROPOSAL

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.

### A. 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.

### B. 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.

### C. 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 subsection 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.

### D. 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.

### E. 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 colleagues are laughing 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

### F. 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.
- 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.

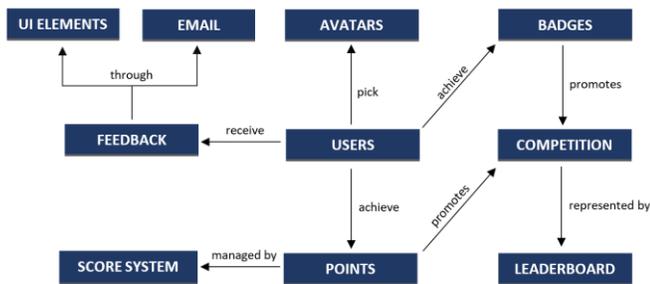


Figure 10 – Game Mechanics and Elements interactions.

## VI. DEMONSTRATION

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.

### A. 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.

### B. 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 this 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 a 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.

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 A 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.

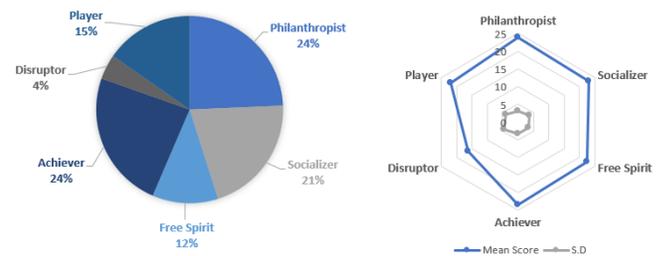


Figure 11 – User types results according to Hexad user types model.

### C. 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.

#### D. 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.

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 workdays 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 this process and help them on possible errors which they can face.

New Slot								8 hours	4 hours	0 hours
Monday	Thursday	Wednesday	Tuesday	Friday	Saturday	Sunday	Hours/Week			
1	2	3	4	5	6	7	40			
8	9	10	11	12	13	14	32			
15	16	17	18	19	20	21	40			
22	23	24	25	26	27	28	32			
29	30	31					24			

Figure 12 – Low Fidelity 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.

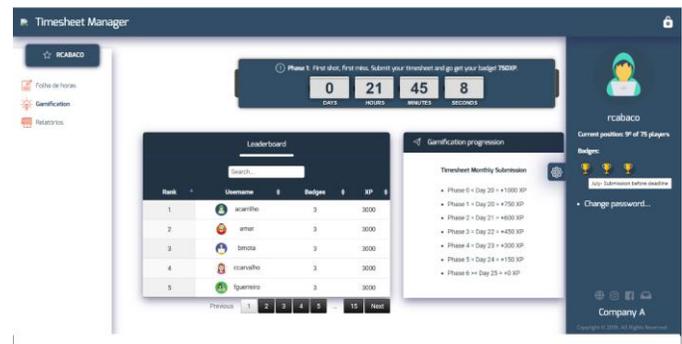


Figure 14 – Final Prototype – User profile (Avatar, Badges, Competition) and Gamification page (Leaderboard, Score System, Countdown).

## VII. EVALUATION

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.

### A. 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.

### B. Metric I – Timesheet monthly submissions before deadline

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.

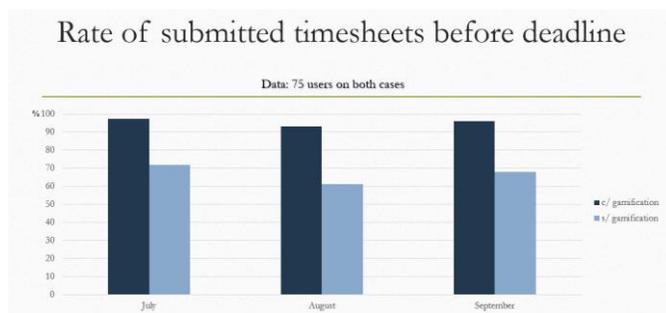


Figure 15 – Timesheet monthly submission results on both systems (gamified one and the software without gamification).

### C. Metric II – Timesheet monthly submissions before deadline 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 decrease 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 increase on the number of timesheet submissions, but in the last 3 days occurred an increase 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.

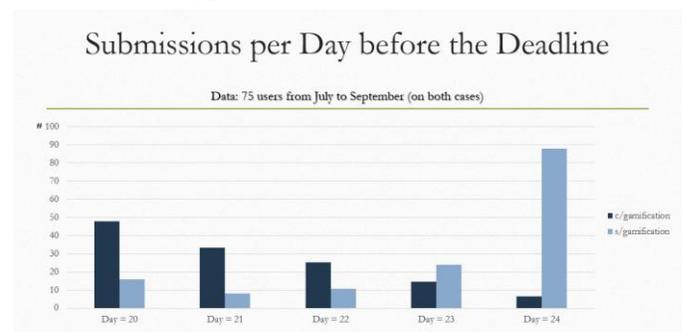


Figure 16 – Timesheet monthly submissions per day, on the last five

## VIII. 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.

## APPENDIX

### A. Survey sentences relationship with the Hexad – gamification user types model

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 <a href="#">for me</a> 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 provoke.
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.

## REFERENCES

- [1] Jinsoo Park Sudha Ram Alan R. Hevner, Salvatore T. March.“ Design Science in Information Systems Research”. MIS Quarterly, 2004.
- [2] Clubs Diamonds Spades Bartle, R. Hearts.“Players Who Suit Muds”.Mud, 1999.
- [3] Brenda Scott-Ladd Catherine Leighton Chris Perryer, Nicole Amanda Ce-lestine.“Research Trends in Media Informatics”. The International Journalof Management Education, 2016.
- [4] Mihaly Csikszentmihalyi.“Beyond Boredom and Anxiety: ExperiencingFlow in Work and Play”. Jossey-Bass, 2000.
- [5] Christopher Cunningham Gabe Zichermann.“Gamification by Design”.O’Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA95472, 2011.24
- [6] Ahlers Robert Driskell James E. Garris, Rosemary.“Games, Motivation,and Learning”. Journal: Simulation Gaming, 2002.
- [7] Michelle L. Evans James C. Kaufman and John Baer.“The AmericanIdol effect: Are students good judges of their creativity across domain?”.Empirical studies of the arts, Vol. 28, 2010.
- [8] Jan H. Kietzmann Ian McCarthy Karen Robson, Kirk Plangger and Ley-land Pitt.“Is it all a game? Understanding the principles of gamification”. Business Horizons, 2015.
- [9] Chris Bateman, Lennart Nacke and Regan L.

Mandryk. "BrainHex: A neurobiological gamer typology survey." Entertainment Computing, 2014.

[10] Sadat Shami Steven Rohall Casey Dugan Andrew Sempere Michael Muller Werner Geyer Li-Te Cheng, John Patterson and Joan DiMicco. "Finding Moments of Play at Work". CHI 2011, Vancouver, BC, Canada, 2011.

[11] Andrzej Marczewski Lennart E. Nacke Manfred Tscheligi Lisa Diamond, Gustavo F. Tondello. "The HEXAD Gamification User Types Questionnaire: Background and Development Process". Conference: Workshop on Personalization in Serious and Persuasive Games and Gamified Interactions, At London, UK, 2015.

[12] Richard N. Landers Michael B. Armstrong and Andrew B. Collmus. "Gamifying Recruitment, Selection, Training, and Performance Management: Game Thinking in Human Resource Management". IGI Global, 2016.

[13] C. Scott Rigby Richard M. Ryan and Andrew Przybylski. "The Motivational Pull of Video Games: A Self-Determination Theory Approach". Springer Science + Business Media, 2006.

[14] Marc LeBlanc Robin Hunicke and Robert Zubek. "MDA: A Formal Approach to Game Design and Game Research". Work. Challenges Game AI, 2004.

[15] Katie Salen and Eric Zimmerman. "Rules of play: Game Design Fundamentals". The MIT Press, 2004.

[16] Rilla Khaleed Sebastian Deterding, Dan Dixon and Lennart Nacke. "From Game Design Elements to Gamefulness: Defining 'Gamification' ". 15th International Academic Mind Trek Conference on Envisioning Future Media Environments, 2011.

[17] Penny Simpson and Pete Jenkins. "Gamification and Human Resources: an overview". iwantaspeaker, 2015.

[18] K. Peffers, T. Tuunanen, M.a. Rothenberger and S. Chatterjee. "A Design Science Research Methodology for Information Systems Research." J.Manag. Inf. Syst., vol. 24, no. 3, pp. 45–77, 2008.25

[19] Kevin Werbach and Dan Hunter. "For The Win: How Game Thinking Can Revolutionize Your Business". Wharton Digital Press, 2012.

[20] Dian Tjondronegoro Zachary, Fitz-Walter and Peta Wyeth. "Orientation Passport: Using gamification to engage university students". 23rd Australian Computer-Human Interaction Conference, 2011.

[21] Miguel Mira da Silva, Rita Marques and Daniel Gonçalves. "Game O'Clock: A Gamification Solution to Improve Time Reporting.". 28th International Conference on Information Systems Development (ISD2019 Toulon, France), 2019.