Gamification for Project Management Quality

Lucía I. Thea,[1] Luciana G. Valiente[1], Magali Bogado[1], Sofía Dodera[1], Patricia R. Cristaldo[1], Daniela López De Luise[1,2]

(1) GIBD - Universidad Tecnológica Nacional, Facultad Regional Concepción del Uruguay
(2) *Computational Intelligence & Information Systems Lab, Buenos Aires*

Abstract

One of the most challenging tasks in project management is plan tracking. It allows the leaders of a project team to adjust deviations and keep the budget under control. Additional topics contribute to the problem, like team productivity, and project management model. This paper aims to introduce a model for gamification of project management resources, in order to evaluate specific metrics that allow for a comparison of project management quality. As part of the scope, some of the current state of the art and a prototype implementing the model are described.

Keywords. Gamification, Project Management, Unreal Engine, Godot Engine, Quality Metrics.

1. Introduction

Software project management involves science and management convergence to combine technical and executive skills. Therefore, several features are covered like leadership, planning, activity tracking and control, project requirements administration, and enterprise concerns management. As a consequence, project direction must handle both management activities and technological duties. In this context, there are many suitable technologies and guides available in the community that provide help in this field. Among others, there is PMBOK [1], PRINCE2 [2][3], APM [4], ISO 21500 [5], SCRUM [6] [7], KANBAN [8], CRISP-DM [9] [10]. The main goal of proper project management is to reach a successful product within the planned time and costs [11]. According to the CHAOS report in 2018, just 29% of projects succeeded in deadlines, budget, and required features and functionalities. About 37% do not fit in at least one of these key dimensions. The document explains that almost 52% of the total projects have delays, budget overruns, or implementation of fewer requirements [12]. These statistics are 10% over the ones reported in 2010. Also, 19% of the projects ended without any product. Software projects require a precise handling of both technical issues and management in order to succeed. Despite there are several methodologies available, there is still a difficult road to an effective project running under time and costs regarding the established goals and user expectations. Among the reasons are inadequate planning [13] [14] [15], poor requirement definition [16] [17] [18], lack of skills, problems with management discipline, and deficient leadership [19]. Gamification constitutes one of the most recent proposals to overcome lack of formality, and commitment. There has been much research in these years on the so-called serious games, applying video games to education [20] [21], health [22], marketing [23] [24], and social behavior [25]. Despite the recent evolution in the field, there remains an adequate introduction of gamification as an option, since it involves much more than a technical process of applying game elements and tools for fun and enjoyment [26] [27]. There must be specific game dynamics with a determined rewards system, competing, selflessness, and self-expression; encompassing individual psychological needs like autonomy, relationship, and antagonism [28] [29]. Game articulation by means of specific rewards, skills, and culture among other tips, provides motivation and engagement during the experience [30] [31]. This paper presents a prototype for collecting information required for a project management model recommendation model introduced in previous publications. The aim of the implementation is to provide a gamified perspective to overcome boring sessions with project leaders or enterprise staff. This way it is possible to gather more information and to improve its quality.

The rest of this paper is organized as follows: Section 2 introduces the global project and its main features, sections 3 and 4 are two alternate gamification proposed, and section 5 are conclusions and future work.

2. Proposal

The gamification of an enterprise's documentation process is not new [32] This proposal aims to contribute to software projects by implementing achievements and progress aligned with the fundamental cores of the

Octalysis Framework. The system of levels, experience, and rewards directly addresses the need for personal development and professional achievement. The ability for personalization and feedback provides tangible empowerment and encourages active participation. In addition, aspects such as healthy peer competition, the appearance of unexpected rewards, and the creation of a sense of urgency help to strengthen social influence, fuel curiosity, and generate an aversion to loss. These strategies have the potential to enhance motivation and engagement in project management, addressing the psychological and emotional needs of those involved in the process in a particularly effective way [33].

3. Gamification with Godot Engine

Godot Engine is a free, all-in-one, cross-platform game engine that makes it easy for you to create 2D and 3D games [34]. The gamification collects information based on the adventures of a capybara called Cimarrón.

3.i. Platform

Godot is a multi-platform, free, and open-source 2D and 3D videogame engine, under the MIT License and developed by the Godot community [34]. It has been an outspring of an Argentinean company OKAM Studios since around 2001. Godot allows exporting video games created for PC (Windows, OS X, and Linux), mobile with Android/ iOS, and HTML5.

-Game proposal: This implementation uses Godot to gamify the data collection.

-Name: The name of the prototype for collecting information is Capybara Spaceship, in reference to the mainstream of the story.

-Type of game: The prototype is to contemplate the initial stage of project management through a conversational adventure in which each member of the team can advance in their individual game, generating contributions to the project being worked on at the time.

-Visual and artistic appearance of a game: Table I is the summary of the pieces of music used in the gamified experience.

Table I. Music for the Godot version

Author and song's name	Usage
Sergio "Nardo" González - Sendero del Capibara	Main menu, Credits, End.
Sergio "Nardo" González - Hermano Capibara	During game

-Lighting, Colors, User Interface, and Animations: Textures, colors, lights, and details are those related to nature and Argentinean customs. Regarding the animation and the user interface, a 2D interface. Sprites and assets are made with tools such as pixel art and with layouts that are intuitive to use and visually friendly, i.e. that have aspects that are not tiring to the eye given the context and use.

-Characters: The main character is the capybara's rebellion leader who is called "Cimarrón". His name represents a wild animal and a bitter mate in relation to Argentinean traditions. In order to collaborate with Cimarrón's adventure, there is a group of capybaras that represent the user of the game. That group will be named "Malón". Its name refers to the group of individuals in an Indian attack usually on a village with the goal of stealing, burning, and taking captives in relation to Argentinean traditions.

-Story: In exasperation due to global warming and the invasion of their natural habitat, the capybaras of Nordelta study human behavior. They intend to evolve and manage to forge their way off the planet to a place where they can develop their species and improve their quality of life.

3.ii. Context

In 2014 becomes public a dramatic situation in Nordelta, an exclusive village in the north of Buenos Aires, Argentina (see Table II). Voices of neighbors began to worry about the presence of certain animals called capybaras [32] [35] [36] [37] [39]. By 2020, the population of those animals increased to 400 capybaras, and experts calculated an increase of 17% between 2020 and 2021. This could lead to an uncontrolled reproduction, probably reaching a total of approximately 3,000 specimens by 2022, which would result in a very complex situation. The claim of the local population arose from the fact that the animals were invading their territory and testimonies of attacks by capybaras on neighbors' pets. But were the capybaras the real invaders?

According to the experts, the problem arose because the installation of the neighborhood was developed without a previous environmental impact study, imposing itself on nature and subjugating a place that was prepared for another ecosystem, which consequently made these rodents, jaguars, ocelots, and canids disappear. The problem was discussed in meetings with the flora and fauna department, the environmental management team of the municipality of Tigre, biologists from the CONICET (National Committee for Science and Technology), and representatives of the AVN (a local association of neighbors). They looked to find a solution, to establish a plan to achieve peaceful coexistence with the fauna. This involves the creation of specific sites to house capybaras in sufficient vegetation to protect and feed them. There were neighbors who were not in total agreement with this and attacked some capybaras with bats, compressed air, and rifles.

Faced with these unfavorable conditions Cimarrón, the leading capybara, decided that coexistence in this space was no longer the best way for them. They had to find a new habitat where they could avoid traumatic situations for both humans and their species. How to achieve this was the next question Cimarrón asked himself. Then he decided to command a troop to investigate people's behavior in order to find out how to find a new home.

3.iii. Game mechanics

There are three levels that will be discussed here.

Level 1 - Accessing the house: The capybaras (played by users) in this level aim to access a technological device, which they observed is used by humans. To achieve the goal it is necessary to build a log bridge to access the house that has the most accessible technology, according to their own research. As long as the business requirements relevant to the project under development are entered, logs are acquired and added to the stock of the user. Once 10 logs are accumulated, a log bridge leading to the house is formed.

Table II. Images with real capibaras at Delta

Level 2 - In search of technology: The capybaras in this level aim to get a computer from which they can obtain recommendations of destinations and objects required for their expedition. To achieve the goal of this level it is necessary for Cimarrón to enter the dwelling, take the computer and the garment to look for the information. Cimarrón gets access to the dwelling when the users give him the plans. In order to give the plan, they must enter the functional requirements relevant to the project.

Level 3 - In search of information: The capybaras in this level aim to get recommendations of destinations and objects required for their expedition. They have decided to implement an Artificial Intelligence that the two-legged neighbors talk about. To achieve the goal of this level, Cimarrón logs into the browser, looks for the AI tool, and asks questions that will be useful for his adventure. Upon entering the AI, he asks questions and gets the results that guide the next steps of his malón. From the game-level perspective, Cimarrón gets the answers when the malón enters information about the relevant project stakeholders. Among these, he must detail who the stakeholders are and what their requirements are.

Level 4 - Selection of new habitat: The capybaras in this level aim to obtain a report on the best place to migrate to the outside of Planet Earth. For the goal of this level, Cimarrón details the AI what their survival conditions are, and what their amenities would be. Therefore it should specify within the available options of the previous level what their optimal location would be. From the user experience, Cimarrón gets the report when the capybaras in the team specify the project requirements and the quality requirements of the relevant project. When entering the project requirements they write P. Similarly with C when it is a quality requirement in order to be counted favorably for acquiring the report.

Level 5 - Search for listing objects: The capybaras in this level aim to collect the objects necessary for their journey. To achieve the goal of this level Cimarrón tells them where to find each item on the survival list. The objects in the inventory are acquired one at a time by providing constraints or assumptions of the project under analysis. When entering the information regarding the enterprise's constraint the Capybara writes R. Similarly it must press S to provide an assumption. This way it enables acquiring objects.

Level 6 - Spaceship assembly: The goal of the capybaras in this level is to assemble their spaceship. Cimarrón must provide indications to his companions with the right sequence in which they should place the pieces of the spaceship. The gamification requires that by assembling the spacecraft the Malon enters the project requirements' tools and techniques.

Level 7 - Ready for take-off: The capybaras at this level aim to ensure that they carry the necessary items and enter the vessel. Cimarrón must check that everything the AI told him was indispensable is there and make sure that everyone in the malón enters the ship. At this moment in the story, the crew is ready to take off, but only if the capybara crew members cooperate with the last phase of the project's scope. In order to get on board they will have to enter the tools and techniques of the documentation of requirements.

END - CAPYBARAS ARE GOING TO SPACE!!!

Once the necessary conditions to level up are acquired, the game displays the option to continue contributing to the project, in which case the player accumulates UTN logos that show the progress budget to determine a status at the end of the game that will serve as a competitive incentive for his workmates. When there are more contributions to be made, the option to continue to the next level is presented by means of another text command.

4. Gamification with Unreal Engine

4.i Platform

Unreal Engine is a widely-used game engine under Epic Games. It can be used for creating and developing video games, virtual reality experiences, architectural visualizations, and more. UE is free to use for learning and for developing internal projects. Epic Games allows the distribution of commercial projects without paying any fees to the company. This includes any product that generates no revenue or whose revenue falls below the royalty threshold (if it is below $1 million USD). Unreal Engine is a versatile game engine that supports various platforms like Windows, iOS, Android, macOS, PlayStation, Xbox, and numerous others [38].

-Game proposal: This section describes the game prototype, its name, aesthetic, central mission and mechanics, and the approach to gamify the data collection making use of Unreal Engine's numerous features.

-Name: The game is Antonio Holmes and the Royal Enigma. The inclusion of the surname “Holmes” brings instant familiarity by giving a nod to a legendary character in literature, and with this nod pretends to show the user that this is a puzzle video game. The second segment of the name refers to the story location and the heart of the game’s narrative.

-Music: This section entails the description of the game’s style, music, and design choices. Table III is a summary of the music pieces used in the gamified experience.

Table III. Music for the Unreal version

Song	Source	Usage
Flujo de Tiempo Loop 1	Fiftysounds	Main menu
Noche de Lounge	Fiftysounds	Level option 1
Secuencias Aleatorias Loop 1	Fiftysounds	Level option 2

-Background, sprites, and user interface: All resources used for the development of the game are 2D. Most of the assets are pixel art, with castle and dungeon settings.

-Characters: During the game, the user meets two different characters. The first is King Leandro, who will give Antonio Holmes the mission to discover the contents of the centuries-long mystery of the treasure test in his castle; and Antonio Holmes, who the user will be able to play with.

-Story: The main mission of this game follows Antonio Holmes, the great-great-great-grandson of Sherlock Holmes, to find the hidden clues to open all the treasure chests in King Leandro III's castle, which have been there for centuries and no one has been able to open them. The king promised Holmes that he could keep a fraction of each chest he managed to open, in gratitude for his service to the Crown.

4. viii Game mechanics

This section details the way the user is able to play the game and the achievements and incentives given.

A) Instructions

-Game Introduction: Before starting the game, data about the user and the organization should be entered.

-Unraveling clues: The player will enter the requirements. The user will find clues around the map, which contain questions that are called “clues” that the user will answer by typing it with a keyboard. By the end of the Chapter, there will be a .txt file available with the inputs.

-The end: In the end, the user will have a good collection of requirements.

B) Levels and mechanics

The game is divided into levels, which by now will be referred to as chapters. The chapters are: Business Requirements, Functional Requirements, Non-Functional Requirements, Stakeholder Requirements, Project Requirements, Quality Requirements, Constraints, Assumptions, and Tools.

Table IV. Questions in the game

Chapter	Questions
Business requirements	
Business requirements	Which is the main goal of the business project?
	What are the specific challenges to solve?
	What are the market opportunities to take advantage of?
	What are the success metrics?
	What are the key features and functionalities?
	How affects the project to the organization?
Functional requirements	
	What are the specific activities for the System/Software/product?
	What manual tasks/processes will be automated/affected?
	What type of users will interact with the system?
	What data must be collected, stored, and shown?
	Which workflows/processes must be modeled?
	Which external systems/services are connected? how?
Not functional requirements	
Performance	What is the maximum number of concurrent users?
	What is the longest latency for responses to users?

Availability	What is the longest idle time per month/year?
	How is the recovery procedure? Maximum availability?
Security	What are the user authentication/authorization requirements?
Scalability	How does the system scale with user/data?
Usability	Are specific accessing/usability standards for every user type?
Technology	What software/hardware are compatible?
Regarding regulations and by laws	What regulations/bylaws must be endorsed?
	What are the legal fulfillment warranties for data privacy?
Stakeholder requirements	
Final clients/users:	What are the client's needs/expectations?
	What are the relevant functionalities according to them?
Staff team	What are their requirements in order to accomplish their duties?
Management Staff	What are the strategic/financial goals?
	What are the reports/metrics for proper tracking?
Stakeholders	What information is needed to evaluate financial/profit performance?
Vendors and partners	How is the critical information shared with them?
Community	How does the project affect the community/specific interest groups?
Potential customers	What features/functionalities could bring new clients?
Project requirements	
Project scope	Are there clear boundaries for functions/deliveries?
Schedule/deadlines	Are there critical milestones/deadlines?
Budget/resources	What is the available budget?
Project team	How organizes/communicates the team during the project?
Communication	What communication channels will use team/stakeholders?
	How will keep updated stakeholders about project evolution?
Risk management	What risks could affect the project's success?
	How are risks being identified/evaluated/managed during the project?

Quality and tests	What quality standards must be accomplished in deliverables?
	How are tests planned/run for quality assurance?
Documents and deliverables	What technical documentation/manuals/others are delivered?
Approvals and validations	Who performs approvals?
Implementation/ deployment	How is the implementation/deployment of the product?
Capacitation/support	What capacitation needs users/team?
Monitor/Evaluation	How to assess the project's success after deployment?
Quality requirements	
Functionality	What are the key features of the product/service according to goals?
Reliability	What availability/inactivity times are tolerated?
Usability	What usability/accessibility is required?
	How is ensured the user interface is clear/simple?
Security	What security is implemented for data and privacy?
Maintainability	Which coding/documenting/best practices are applied?
Scalability	What scalability strategies are implemented?
Restrictions	
Time	Are specific deadlines or relevant steps?
	What is the time frame for development/implementation?
Budget	What is the budget for project components?
Human resources	Is there a limitation in the team's availability?
	How many collaborations will be working/which seniority?
Technology	Are certain technologies/platforms required?
Capacity	Are processing/storage/bandwidth limits?
Regulations and bylaws	What regulations/bylaws must be imposed? How will it affect the project?
Physical space	What physical restrictions are for hardware or pieces of equipment?
Compatibility	Are compatibility restrictions with other systems/technologies?
Organization changes	Are there restrictions to changes in organization structure/roles?

Internal policies	Are there restrictions due to internal policies?
External influences	Are there external influences that could affect the project?
Assumptions	
Data requirements	Are there assumptions on data availability, precision, or quality?
Technology and platforms	What are the premises on technologies/platforms to be used?
Resources availability	Are there premises regarding the availability of required resources?
Schedule	Is it supposed that milestones will be accomplished in a timeframe?
User behavior	Are hypotheses on how users will interact with the product/service?
Security and privacy	Are there premises on threats/risks?
Organization changes	Existing premises on personnel changes acceptance/adoption?
Regulations and bylaws	Are there premises on regulation/bylaws fulfillment problems?
Risk mitigation	Are there premises on risk probability/impact?

At the beginning of the chapter there are trigger questions related to clues to be searched for within the room. The player has to find which of them contains a trigger question. The game ends when all chests in all chapters have been opened. The user then receives bonus points, and may have completed an achievement or received a special badge. After finishing all the chapters, the user receives experience scoring "units" for the personal profile. Another incentive for the user is the profile. The profile shows badges, level progress, and virtual prizes like redeeming "gold" from chests for virtual prizes (cheaper) or real prizes (more expensive) for the organization or company. In this version, the user is able to reach 15 levels. The experience bar starts with 50 experience units needed to level up. Each level requires 0.20 more experience than the previous one. Finally, the user's profile could also show the badges earned, and how far are from reaching the next badges (e.g., Achievement of 100 accumulated contributed requirements, completion of which will give you a gold detective badge).

5. Conclusions and future work

There are several problems with project success due to management deficiencies. The state of the art indicates that is related to formality and team administration.This paper introduces a gamified data collection of the current project status. Documentation, planning, and technical tracking are demanding and hard. To overcome those inconveniences a model with metrics is derived from documentation. Among other pending, there remains to statistically evaluate the logs of the gamified data collection and the analysis of those statistics from the perspective of previously published findings.

Referencias

[1] Pmbok Guide (2021) A Guide to the Project Management Body of Knowledge. 7 Ed. Project Management Institute. ISBN: 978-1628256796.

[2] Office of Government Commerce (2009) An introduction to PRINCE2: managing and directing successful projects. Stationery Office, 123 p. ISBN-10: 0113311885.

[3] A. Böhm (2009) Application of PRINCE2 and the Impact on Project Management. ISBN 978-3-640-42634-8.

[4] J. Highsmith (2010) Agile project management: creating innovative products. 2 Ed. Boston, MA: Addison-Wesley. 432 p.

[5] ISO (2012) ISO 21500:2012 Guidance on Project Management, Geneva: ISO.

[6] J. Sutherland (2014) Scrum: The art of doing twice the work in half the time. New York: Crown Business. 256 p. ISBN-10: 038534645X, ISBN-13: 978-0385346450.

[7] R. Van Solingen, R. Van Lanen (2014) Scrum voor Managers. Den Haag: Academic Service. EAN: 9789012585903.

[8] H. Lei, F. Ganjeizadeh, P. Jayachandran, P. Ozcan (2015) Statistical analysis of the effects of Scrum and Kanban on software projects. Mz. onRobotics & Computer-Integrated Manufacturing.

[9] C. Shearer (2000) The CRISP-DM model: The new blueprint for data mining. Journal of Data Warehousing, no. 4, pp. 13-22.

[10] U. Shafique., H. Qaiser (2014) A Comparative Study of Process Models Data Mining).International Journal of Innovation and Scientific Research, pp.217-22.

[11] J. Varajão, C. Dominguez, P. Ribeiro, A. Paiva (2014) Critical success aspects in Project management. Tech. Gazette 21 (3) 583–589.

[12] TSG (2018) The CHAOS Report. The Standish Group, 2018. Disponible en https://secure.standishgroup.com/reports/flyers/CM2018 - TOC.pdf.

[13] T. Lehtinen, M. Mäntylä., J. Vanhanen, J. Itkonen, C. Lassenius (2014) Perceived causes of software project failures. Information and Software Technology, pp. 623–643.

[14] P. Ramos, C. Mota (2014) Perceptions of success and failure factors in information technology projects. Procedia - Social and Behavioral Sciences, pp. 349 – 357.

[15] S. Montequin, C. Fernandez, O. Fernandez, J. Balsera (2016) Analysis of the Success Factors and Failure Causes in Projects. Journal Information Technology Project Management, pp. 18-3.

[16] T. Chow, D. Chao (2008) A survey of critical success factors in agile software projects. Journal of systems and software, Jun. Available: Science Direct, pp.961–971.

[17] H. Elkadi (2013) Success and failure factors for e-government projects: A case from Egypt. Egyptian Informatics Journal, pp. 165–173.

[18] K. Eiemam, A. Koru (2008) A replicated survey of IT software project failures Software. IEEE Software, pp. 84–90.

[19] B. Blaskovics (2016) The impact of project manager on project success – The case of ICT sector. Assistant Professor, Strategy and Project Management Department, Corvinus University Budapest.

[20] Y. Attali, M. Arieli-Attali (2015) Gamification in assessment: Do points affect test performance? Computers & Education 83(2):57-63.

[21] J. Simões, R. Redondo, A. Vilas (2013). A social gamification framework for a K-6 learning platform. Computers in Human Behavior, 29(2), 345-353.

[22] S. McKeown, M. Stringer, E. Cairns (2015). Classroom segregation. British Ed. Research Journal, 42(1), 40–55.

[23] L. Garm Lucassen, J. Slinger (2014) Gamification in Consumer Marketing - Future or Fallacy? Procedia - Social and Behavioral Sciences 148:194–202.

[24] R. Rodríguez, J. González Rivera (2020) Propiedades psicométricas de la Escala de Pasión Laboral (EPL). Revista Caribeña de Sicología, 4(1), 26-35.

[25] D. Schoech, J. Boyas, B. Black, N. Elias-Lambert (2013) Gamification for Behavior Change. J. of Tech. in Human Services 31(3): 197-217.

[26] T. Harwood, T. Garry (2015) An investigation into gamification as a customer engagement experience environment. Journal on Services Marketing 29(6).

[27] A. Suh, C. Wagner, L. Liu (2015) The Effects of Game Dynamics on User Engagement in Gamified Systems. Proc. 48th Int. Conf. on System Sciences (HICSS), pp. 672-681.

[28] R. Mitchell, S. Asare, P. Rose (2020) Education research in sub-Saharan Africa: Quality, visibility and agendas. Comparative Education Review. 64 (3).

[29] A. Suh, C. Wagner, L. Liu (2018) Enhancing User Engagement through Gamification. Journal of Computer Information Systems, 58 (3), pp. 204-213.

[30] S. Dale (2014) Gamification: making work fun, or making fun of work? Business Information Review, 31(2), 82-90.

[31] G. Galetta (2015) The Gamification: Applications and Developments for Creativity and Education. Creative Personality. Collection of Scientific Papers; ISSN: 1407-6276.

[32] K. Muszyńska (2020) Gamification of communication and documentation processes in project teams. Procedia Computer Science. Vol. 176, Pp 3645-3653.

[33] Y. Kai Chou (2015) Actionable Gamification – Beyond PBLs. ISBN 1511744049

[34] Godot Engine Documentation (2023). https://docs.godotengine.org/en/stable/index.html

[35] G. Iglesias (2021) Una invasión de carpinchos agita la guerra de clases en Argentina. Elpais.com

[36] A. Horvat (2022) ¿Atacados? Mitos y realidad de la vida de los carpinchos en Nordelta, a un año de las denuncias de los vecinos. Clarín.com

[37] Agrofy News (2021) Qué pasó con los carpinchos de Nordelta. news.agrofy.com.ar

[38] Unreal Engine (2023) https://www.unrealengine.com/es-ES

[39] R. Chisleanchy (2021) La “revolución” de los carpinchos renueva el debate sobre la protección de los humedales en Argentina. es.mongabay.com