A Process to Identify Players' Motivational Profiles for Designing a Gamification Project

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Abstract. This article presents an innovative process for identifying the motivational profiles of a specific target audience using three distinct strategies: assessment by judges, application of game dynamics, and the Intrinsic Motivation Inventory (IMI) questionnaire. Each strategy aims to align with the Octalysis framework, emphasizing the importance of personalization and adaptability in gamification. The process is tested on a gamification project within a Brazilian government portal for scientific dissemination, focusing on engaging Brazilian students in science. The analysis reveals differences in strategy outcomes, highlighting the requirement of a multifaceted approach to accurately capture the target audience's motivational profiles and improve gamification effectiveness.

Keywords: Gamification · Motivational Profile · Design Project · Octalysis

1 Introduction

Gamification, defined as the application of game design elements in non-game contexts, has emerged as an innovative approach at the intersections of technology, human behavior, and engineering. This concept, extensively explored by Deterding et al. [1], aims to engage individuals and motivate them to achieve specific goals, enhancing interactivity across a variety of activities. Its implementation has been notable in sectors such as education and corporate, as highlighted by Hamari et al. [2] and Robson et al. [3]. Gamification has improved motivation and learning in complex areas like computer science and engineering, as well as played a vital role in enhancing productivity and fostering collaboration in the corporate environment [4].

Research shows that gamification in educational and corporate environments enhances engagement and learning outcomes. Luarn et al. [5] analyzed the influence of gamification in educational contexts, emphasizing its impact on student engagement

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and learning effectiveness. In the corporate realm, the studies by Fábregas Grau et al. [6] discussed the role of gamification in corporate communication, suggesting its potential to improve employee training and internal communication strategies. This research collectively illustrates the versatile benefits of gamification across different sectors.

The relevance and growth of gamification are further emphasized by the study of Schöbel et al. [7], which explores the need for adaptive and personalized gamification designs. This work emphasizes the need to account for users' diverse motivations and needs for the success of gamification, drawing support from Ryan and Deci's Self-Determination Theory [8]. They discuss the future of gamification and the need for adaptive and personalized strategies to improve the relevance outcomes of gamification.

The aim of this paper is to present an innovative process for identifying the motivational profile of a specific target audience, using three distinct strategies: assessment by judges familiar with the target audience's profile, application of dynamics, and use of the Intrinsic Motivation Inventory (IMI) questionnaire. Each strategy is designed to identify a motivational profile aligned with the Octalysis framework [9], in line with the trend of personalization and adaptability in gamification highlighted by Schöbel et al. [7]. The identified profiles are then harmonized into a single detailed Octalysis motivational profile, providing specific insights into suitable gaming techniques.

In this study, we emphasize the importance of personalization and adaptability in gamification, an aspect still underexplored in previous research. While studies such as those by Deterding et al. [1] and Hamari et al. [2] have laid the foundations of gamification, our research advances by developing an innovative process for the identification of motivational profiles. This process not only aligns with the growing trend of personalization, as highlighted by Schöbel et al. [7], but also fills an important gap: the practical application of adaptive gamification strategies based on an in-depth understanding of the target audience's needs and motivations. Thus, our work significantly contributes to the field of gamification, offering a practical and theoretically grounded model for the implementation of personalized and effective solutions in various contexts.

This paper is structured to provide a comprehensive overview of the proposed process. Section 2 reviews the related literature in gamification, contextualizing the study within the existing field and expanding the discussion based on the findings of Schöbel et al. [7]. Section 3 details the three strategies used for the identification of motivational profiles. Section 4 illustrates the practical application of the process and its validation. Section 5 discusses the obtained results, and Sect. 6 concludes the article, summarizing the main findings and proposing directions for future research in the area.

2 Literature Review

In this review, we explore the evolution of gamification, underscoring its growing relevance across various sectors, including education and corporate environments. We begin with an overview of gamification applications, highlighting their impact on learning, student engagement, and corporate communication. The analysis focuses on gamification's influence on motivation and educational effectiveness, as well as its role in the workplace, particularly under the conditions of increased remote work prompted by the pandemic.

The study by Luarn et al. [5] is relevant to this discussion. This research investigates the influence of specific gamification elements in the educational environment and their

impact on students' intrinsic motivation to learn. The authors consider factors such as perceived collaboration, perceived competition, positive feedback, self-expression, and sense of control, analyzing how each contributes to intrinsic learning motivation. The study adopts a quantitative approach, employing a survey with a 26-item questionnaire measuring seven constructs related to gamification and intrinsic motivation.

The findings from this study aid in understanding how to structure gamification in educational contexts [10]. They suggest that certain gamification elements, like collaboration and positive feedback, are particularly effective at enhancing students' intrinsic motivation. These insights offer valuable guidance on how educators can incorporate gamification elements into their teaching practices to improve knowledge retention and student motivation. This study's contribution provides a foundation for future research and educational practices aiming to integrate gamification effectively.

Luarn et al. [5] research, by highlighting the efficacy of specific gamification elements in education, draws a parallel to the proposition of this article. Our work focuses on expanding this understanding, proposing a process that not only incorporates key gamification elements but also personalizes them according to users' motivational profiles. This focus on customization is inspired by evidence that certain aspects of gamification, such as collaboration and positive feedback, can significantly increase motivation and engagement. Thus, our study aims to develop a method for identifying and harmonizing these motivational profiles within the context of gamification, aiming to maximize its effectiveness in various settings, including education. By aligning the customization of gamification elements with the individual needs and preferences of users, we seek to provide a more effective and adaptable gamification model, applicable in teaching and other areas, such as corporate training.

In this context, Yu-kai Chou's Octalysis framework [9] emerges as a tool, deepening our understanding of gamification's practical application. This framework is distinguished by its holistic and multidimensional approach, examining human motivations and the behavioral drivers underlying gamification's effectiveness. Structured around eight core drives, Octalysis provides valuable insights for creating more engaging and gamification experiences. The core drives of Octalysis include: Epic Meaning & Calling (CD1); Inspiring users to be part of something greater; Development & Accomplishment (CD2): Focusing on progress and achievement; Empowerment of Creativity & Feedback (CD3): Allowing for experimentation and continuous interaction; Ownership & Possession (CD4): Strengthening users' sense of ownership; Social Influence & Relatedness (CD5): Exploring aspects such as mentorship and camaraderie; Scarcity & Impatience (CD6): Creating a desire for items or experiences not immediately accessible; Unpredictability & Curiosity (CD7): Keeping users engaged with the unknown; and Loss & Avoidance (CD8): Motivating users to avoid negative consequences.

Octalysis framework enables the possibility of creating personalized and adapted approaches to users' motivations, a central aspect in our study. For example, consider a motivational profile based on the Octalysis framework, which might identify an individual primarily motivated by CD2 and CD3. Such a profile suggests that this user is highly driven by personal growth, achievement, and the ability to experiment and receive feedback on their actions.

The study conducted by Fábregas Grau et al. [6], focused on the application of gamification in remote job contexts during the pandemic, reveals critical aspects of business communication in small and medium enterprises. The research investigates how remote job, intensified using digital technologies, impacts interpersonal relationships and the understanding of strategic goals and values of the company. The study points to the potential of gamification as a tool to improve internal communication but also highlights a lack of effective implementation and knowledge about gamification in the studied companies. The qualitative methodology, based on semi-structured interviews with managers, provides insights into perceptions and attitudes towards gamification, suggesting a need for greater practical exploration of this tool.

In the context of the findings by Fábregas Grau et al., the process of identifying target audience motivational profiles proposed in our study gains relevance. By understanding the motivations, preferences, and needs of employees in a remote job environment, gamification can be more personalized and adapted.

Implementing a gamification approach based on detailed motivational profiles can address various challenges identified in the study by Fábregas Grau et al. In a remote job scenario, where face-to-face interaction is limited, personalized gamification can offer a means to keep employees engaged, motivated, and aligned with corporate objectives [11, 12]. Furthermore, gamification adapted to the individual characteristics of employees can facilitate the understanding of the company's values and strategic goals, improving internal communication and strengthening organizational culture. Therefore, our study proposes a model that not only fills a gap in gamification research but also offers a practical solution to emerging challenges in the modern workplace.

In the study by Tatarinova et al. [13], the application of gamification technologies in employee training in Russian and international companies is examined. The central goal is to assess the efficacy of gamification in the educational context and its capacity to address practical challenges in various public life sectors. The research tests the influence of gamification on training efficiency and the learning process.

The relevance of this study is anchored in the digital transformation impacting businesses and societies, especially in corporations as reported by Assis and Freitas [4]. The work of Tatarinova et al. was conducted with a specific focus on enhancing educational systems in Russia through the integration of new technologies and educational methodologies. The adopted methodology includes a meta-analysis of international scientific literature and practical cases, complemented using neuroimaging techniques to analyze participants' brain activity during gamification activities.

The results indicate that gamification contributes to improved productivity and attention, although its effect on player engagement is more limited, a result reinforced by Ishaq et al. [14]. The authors conclude that gamification offers significant benefits for training but also caution against the need for careful design to avoid potential distractions or divisions among participants.

Integrating these findings into our work, we propose a gamification model that personalizes the training experience based on detailed motivational profiles of players. This model aims to align gamification with organizational strategic objectives, maximizing its impact on learning and employee engagement. This approach responds to the needs

identified in the study by Tatarinova et al., offering a practical strategy to overcome the challenges of implementing and evaluating gamification.

Aligned with the scenario outlined by Schöbel et al. [7], this article proposes a new process for customization in gamification. This process is divided into three distinct strategies, each aiming to identify and harmonize users' motivational profiles in gamification contexts.

The first strategy involves assessment by judges who have in-depth knowledge about the target audience's profile [12, 15]. In the second strategy, interactive dynamics are applied to elicit behavioral responses and preferences from users in a controlled environment. The third and final strategy of the process uses the IMI questionnaire [8]. This instrument is employed to capture quantitative data on users' motivations and preferences, offering a detailed view of their motivational profiles. Combining these three strategies allows for the creation of an Octalysis motivational profile [9], reflecting a personalized and adaptive approach in gamification.

This proposed process not only aligns with the trend of personalization and adaptability in gamification, as highlighted by Schöbel et al. [7], but also fills a significant gap in the field. We offer a practical and theoretically grounded model for the implementation of personalized and effective gamification solutions, suitable for various contexts and user needs.

Our work also establishes a connection between the gamification customization process we propose and some psychological theories. By highlighting the importance of meeting the diverse motivations and needs of users to make gamification experiences effective, we rely on Ryan and Deci's Self-Determination Theory [8].

Applying the Self-Determination Theory in our process involves analyzing users' basic psychological needs - autonomy, competence, and relatedness. In the motivational profile evaluation phase, the goal is to identify and integrate users' intrinsic motivations. The goal is to design gamification experiences that resonate with these fundamental needs, thereby increasing user motivation and engagement.

Upon concluding the literature review on gamification, we identified specific gaps in current research, especially regarding personalization and adaptability. These gaps indicate promising areas for future research, where deeper exploration could bring significant benefits to both the theoretical development and practice of gamification.

1. **Personalization in Gamification**: A critical gap in gamification is the lack of personalized experiences. Despite trends toward greater customization, substantial research is needed to integrate users' unique preferences into gamification frameworks effectively. Future studies should aim to develop and implement methods for efficiently and ethically gathering and analyzing user data to enhance engagement and tailor experiences.
2. **Adaptability of Gamification Systems**: Another significant gap is the adaptability of gamification systems. Future research should explore how these systems can dynamically respond to user behavior changes. This involves studying algorithms and AI strategies for ongoing adaptation of gamification elements to maintain relevance and motivation over time.
3. **Long-Term Impact of Personalized Gamification**: There is a need for research on the long-term impact of personalized gamification. Important questions include how

personalized gamification experiences affect user engagement over time and whether these experiences can lead to lasting changes in behavior or learning.

Furthermore, our process proposes an adaptive approach, where gamification can be adjusted based on user responses. Through the application of the IMI questionnaire [8] and the Octalysis framework [9], we aim to create a gamification system that responds and adapts to changes in user behavior and preferences over time. This addresses the gap related to the adaptability of gamification systems.

By examining the long-term impact of personalized gamification through this process, our study also aims to investigate how personalized gamification experiences influence user engagement and behavior over time. This contributes to understanding the lasting impact of personalized gamification, an area that requires further investigation.

Finally, by integrating fundamental psychological theories such as Self-Determination Theory into the design of our gamification process, we seek to create experiences that not only motivate but also respect users' autonomy and well-being.

3 The Process

To gain a deeper understanding of players' motivational profiles using the Octalysis framework, a process incorporating three strategies from various perspectives was developed and implemented. These strategies are used in a complementary manner. Figure 1 illustrates the main process through which these strategies are applied.

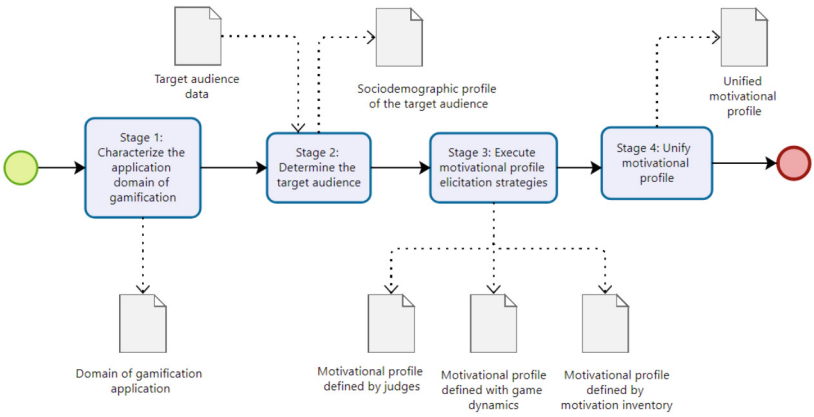


Fig. 1. Process to Identify Players' Motivational Profiles in Gamification Design.

The importance of employing these three strategies is rooted in the fundamental need to address the complexity and multifaceted nature of human motivation. Each strategy offers a unique and complementary perspective, enabling a more holistic and comprehensive analysis. The first strategy (S1), which utilizes judges specialized in the domain of gamification application, leverages the knowledge of these professionals on the specific behaviors of the target audience, ensuring a grounded and contextualized

evaluation. The second strategy (S2), based on game dynamics, provides a practical and interactive understanding of motivations, revealing preferences and tendencies in a realistic and engaging context. Finally, the third strategy (S3), employing a motivation inventory, offers a more quantitative and structured approach, allowing for the collection of direct data from the target audience.

The combination of these three methodologies results in a robust and detailed motivational profile, essential for the development of effective gamification solutions that are aligned with the specific needs and preferences of the audience.

The process begins with "*Stage 1: Characterize the Application Domain of Gamification*" whose goal is a detailed analysis of the context in which gamification will be applied. This includes understanding the specific characteristics of the context and identifying key elements that can be enhanced through gamification techniques.

The next step is "*Stage 2: Determine the Target Audience*", which focuses on identifying and understanding the group of individuals who will interact with the gamified system. Aspects such as age, preferences, needs, challenges, and objectives of the target audience are analyzed to ensure that the gamification approach is relevant and effective.

Based on the identified target audience and application domain, a survey of the target audience's motivational profile is conducted with "*Stage 3: Execute Motivational Profile Elicitation Strategies*". This stage encompasses three distinct sub-processes, each corresponding to a specific strategy used to achieve this goal.

After applying the three strategies for eliciting the motivational profile, the final stage "*Stage 4: Unify Motivational Profile*" is executed involving the compilation and analysis of the motivational profiles obtained from each strategy to form a unified motivational profile. It is expected that this profile will be comprehensive enough for the development of a gamification approach that ensures the use of techniques aligned with the motivations and preferences of the target audience.

When unifying the different motivational profiles generated by the sub-processes of Stage 3, some guidelines should be considered:

- Identify the core drives that most significantly affect the target audience's motivation, focusing on those with the highest scores – (D1).
- For the initial planning of gamification, strategies S2 (game dynamics) and S3 (motivation inventory) are highly recommended due to their direct contact with the target audience in the data collection phase, as S1 provides a superficial view of the motivational profile since it does not involve the direct engagement of the target audience – (D2).
- The strategy S3, which involves the use of a motivation inventory, is particularly suitable for planning improvements in an existing gamification, offering detailed insights into underlying motivations – (D3).
- For evaluating an ongoing gamification, strategies S3 and S2 are the most indicated, providing an in-depth analysis of user engagement – (D4).
- The strategy S2 stands out in the precise identification of the real motivational profile of users, being a valuable tool both in the planning phase and in the evaluation of gamifications – (D5).

- In selecting game techniques, prioritize those that received the highest scores from judges on each core drive. Given the judges' expertise in the gamification application domain and knowledge of core drives, their evaluations are fundamental for identifying the most effective techniques in motivating the target audience – (D6).

The subprocess "Execution of Motivational Profile Elicitation Strategies" encompasses three distinct sub-processes, each corresponding to a specific strategy used to achieve this goal. The detailed description of these sub-processes is presented in the subsequent sections.

3.1 Subprocess: Eliciting Motivational Profile Through Judges (S1)

This strategy is based on the selection and use of judges' opinions (Fig. 2). Judges are professionals with expertise in the specific area where the gamification will be implemented. Its execution begins with the activity "*Leveling judges' knowledge in gamification*" which is focused on training the judges in essential gamification concepts, with an emphasis on the Octalysis framework [9]. The goal is to equip the judges with a comprehensive understanding of motivational strategies. The subsequent activity, "*Elicit the target audience's motivational profile*" involves the judges filling out a form in which they evaluate various gamification techniques across each core drive of the Octalysis framework, assigning scores that reflect the suitability and effectiveness of these techniques for the target audience. The final activity, "*Determine the Target Audience's Motivational Profile*" consists of analyzing the average scores assigned to the techniques in each core drive, thus establishing the target audience's profile.

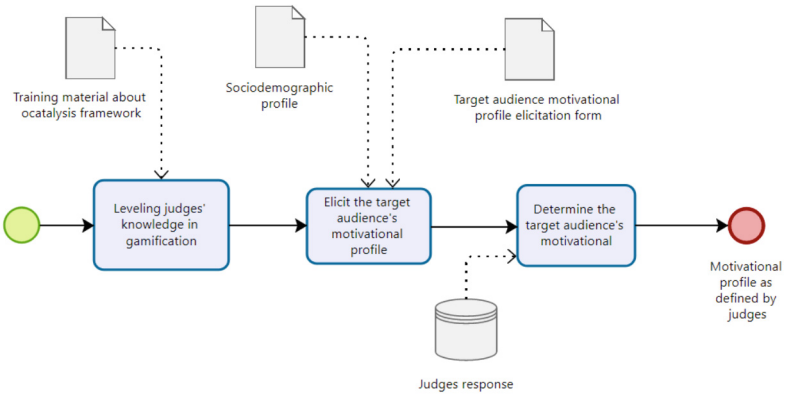


Fig. 2. Subprocess: Eliciting Motivational Profile through Judges (strategy 1).

3.2 Subprocess: Eliciting Motivational Profile with Game Dynamics (S2)

This strategy identifies motivational profiles through the implementation of game dynamics (Fig. 3), directly involving the target audience. In this subprocess, the initial activity,

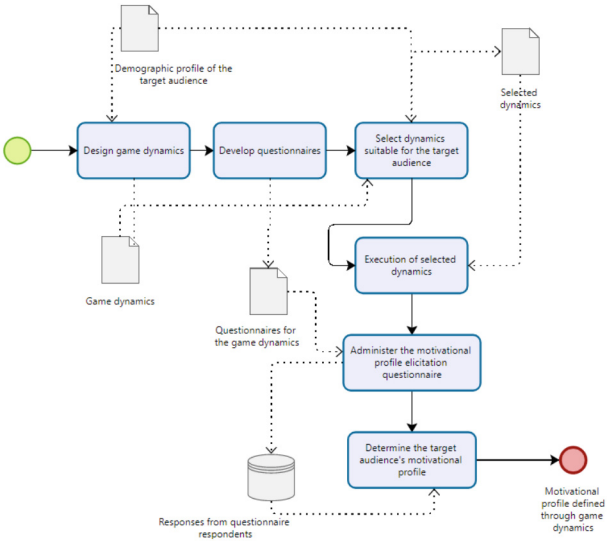


Fig. 3. Subprocess: Eliciting Motivational Profile with Game Dynamics (strategy 2).

"*Design game dynamics*", focuses on developing dynamics that highlight the core drives of the Octalysis framework.

Validating these dynamics with experts is advisable to ensure their effectiveness. Then, "*Develop questionnaires*" involves creating questionnaires to collect data on the target audience's motivational profile, using questions based on the Octalysis core drives, which are answered on a 5-point Likert scale.

Next, "*Select dynamics suitable for the target audience*" involves choosing dynamics that optimize the Octalysis core drives, considering the sociodemographic profile of the target audience. "*Execution of selected dynamics*" occurs with the active participation of the target audience, aiming to foster immersion and interactivity in a playful context. "*Administer the motivational profile elicitation questionnaire*" involves the target audience members responding to the questionnaires. Finally, "*Determine the target audience's motivational profile*" consists of analyzing the collected data, and assessing which Octalysis core drives are most impactful for the target audience.

3.3 Subprocess: Eliciting Motivational Profile Through a Motivation Inventory (S3)

This strategy (Fig. 4) focuses on directly collecting data from the target audience using immersive questionnaires, which are developed based on the analysis of correlations between the IMI [8] and the Octalysis framework [9]. The first activity, "*Map octalysis with IMI*" involved a comparative analysis between the Octalysis framework [9], outlining eight Core Drives, and the Intrinsic Motivation Inventory (IMI) [8], presenting seven distinct scales. This step aimed to identify correlations and emerging patterns between these theoretical structures. Initially, a matching analysis between the Core Drives and the IMI scales was conducted. Subsequently, the analysis was broken down into three

sub-activities: (1) targeted comparison of IMI against Octalysis, aiming to identify similarities and differences between the motivations proposed by both theories; (2) reciprocal comparison of Octalysis against IMI, to see if and how Octalysis Core Drives could be interpreted or represented by IMI sub-scales; and (3) synthesis of the results obtained in both comparisons (Table 1), concluding with a consolidation of findings and providing possibilities for future research.

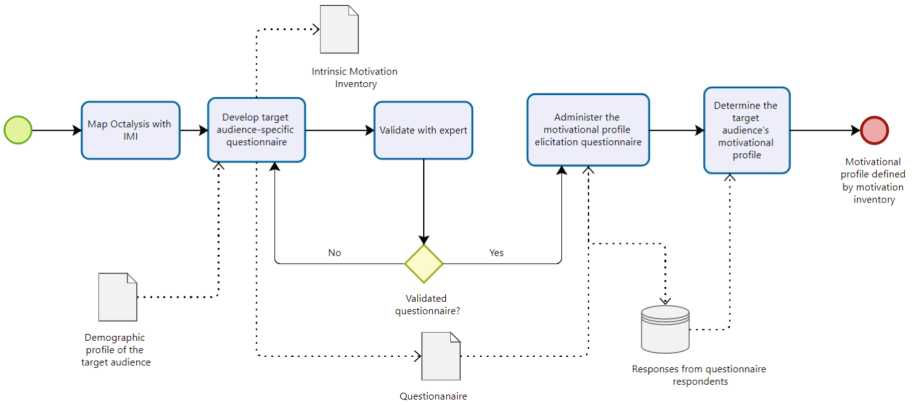


Fig. 4. Subprocess: Eliciting Motivational Profile through a Motivation Inventory (strategy 3).

The "Interest/Enjoyment" subscale (I) measures the pleasure and interest in an activity. It mainly relates to the core drives "Empowerment of Creativity & Feedback" (CD3) and "Unpredictability & Curiosity" (CD7). This emphasizes the link between pleasure, creativity, and the excitement of discovery. The "Perceived Competence" subscale (P), focusing on the sense of skill and mastery, aligns with "Development & Accomplishment" (CD2) and "Ownership & Possession" (CD4), reflecting the significance of personal growth and customization.

Table 1. Mapping of IMI Subscales with the Octalysis Framework Core Drives**.**

IMI Subscale	I	P	E	T	C	V	R
Octalysis Core	CD 3	CD 2	CD 2	CD 6	CD 2	CD 1	CD3
Drives	CD 7	CD 4	CD 8	CD 8	CD 4	CD 7	CD 5

The "Effort/Importance" subscale (E), assessing the effort and importance assigned to an activity, is related to CD2 and CD8. It highlights the importance of effort in personal growth and minimizing negative outcomes. "Pressure/Tension" (T), measuring internal anxiety or pressure, aligns with CD6 and CD8, indicating the influence of urgency and loss aversion. "Perceived Choice" (C), related to autonomy and choice, finds parallels in CD2 and CD4, showcasing control and customization as motivational factors. "Value/Usefulness" (V), evaluating perceived value and usefulness, is mirrored

in CD1 and CD7, underlining the importance of meaningful contributions and exploration. Lastly, "Relatedness" (R), focusing on social connection and belonging, correlates with CD5 and CD3, highlighting the significance of feedback and social interactions in relationship building and the creative process.

The second activity is "*Develop target audience-specific questionnaires*" where questionnaires are tailored from the IMI [8], considering the socio-economic criteria of the audience. This is followed by "*Validate with Expert*" involving the review and evaluation of the questionnaires by professionals experienced in using the IMI and the Octalysis framework. This aims to ensure the accuracy, relevance, and quality of the questions and the suitability of the instrument for the target audience. Then, in the activity "*Administer the motivational profile elicitation questionnaire*" the questionnaires are filled out by the target audience members, for directly gathering information on the participants' motivations. Finally, "*Determine the target audience's motivational profile*" involves analyzing the collected data to identify the motivational profile of the target audience as outlined by the Octalysis framework, offering relevant insights for customizing the gamification experience.

4 Testing the Process in a Complex Domain

This section outlines the execution of the four stages of the process used to identify the target audience's motivational profile in a gamification project within a Brazilian government portal dedicated to scientific dissemination. The phases of this process are presented in the subsections below:

4.1 Stage 1: Characterize the Application Domain of Gamification

The process is applied to the gamification of the Canal Ciência (CC) by Brazilian Institute of Information in Science and Technology (IBICT - https://canalciencia.ibict.br/). CC is a Brazilian government initiative aimed at scientific dissemination, and IBICT is an institution linked to the Ministry of Science, Technology, and Innovation (MCTI). Its mission is to promote competence, resource development, and information infrastructure in science and technology for the production, socialization, and integration of scientific and technological knowledge. CC aims to organize and disseminate scientific information. It contributes to advancing scientific literacy in Brazil, fostering a more informed and engaged population on scientific and technological issues. The purpose of gamifying CC is to increase user motivation and engagement, aiming to boost interest in using the Portal.

4.2 Stage 2: Define the Target Audience

The primary target audience selected for this study is represented by Brazilian students, mainly from elementary to high school, interested in science. This group includes young people seeking knowledge and understanding in these areas, whether through school projects, personal curiosity, or extracurricular activities focused on science. Additionally, it's vital to consider Brazil's cultural and socioeconomic diversity, integrating students from various regions and backgrounds to ensure the gamification of the portal is accessible, relevant, and engaging for a broad spectrum of young learners.

4.3 Stage 3: Execute Motivational Profile Elicitation Strategies

This stage addresses the execution of three sub-processes, each corresponding to a specific strategy. The description of each sub-process provides an understanding of its contribution to the overall process.

S1: Elicit Motivational Profile Through Judges
The study involved the participation of 16 active judges on CC, all acting as researchers or teachers in Brazilian educational institutions. Their scope of work ranges from elementary level 2 to higher education, demonstrating a broad spectrum of educational engagement and contribution to the development and maintenance of the portal. The age range of the participants varies from 27 to 64 years, with an average of about 4 years of involvement with the CC. Notably, at least two of these participants have collaborated with the Channel for over a decade, demonstrating a long-term commitment. In terms of educational experience, the average among the judges is 10 years.

Geographically, the judges represent 80% of Brazilian regions, including the Midwest, North, Northeast, South, and Southeast, reflecting a national scope in their work. The most frequent area of knowledge among them is Social Sciences. Despite their significant contribution to education, most are not linked to a specific type of educational institution and do not work directly in the educational field.

The following activities were performed in this strategy:

Leveling Judges' Knowledge in Gamification: The training of judges was centered on the basic principles of the Octalysis framework [9], with an emphasis on core drive techniques. After the initial class, the judges were organized into 4 teams with 4 participants each. Teams continued with asynchronous study.

Table 2. Average scoring of the Octalysis core drives by team.

Octalysis Core Drives	Team 1	Team 2	Team 3	Team 4	Mean
Epic Meaning & Calling (CD1)	2,63	1,63	1,13	1,75	1.79
Development & Accomplishment (CD2)	1,56	1,31	2,25	1,94	1.77
Empowerment of Creativity & Feedback (CD3)	2,00	1,45	1,36	0,73	1.39
Ownership & Possession (CD4)	1,27	0,91	1,55	2,27	1.50
Social Influence & Relatedness (CD5)	0,77	0,77	1,77	1,31	1.56
Scarcity & Impatience (CD6)	0,83	0,42	1,67	0,75	0.92
Unpredictability & Curiosity (CD7)	1,82	1,18	2,18	2,45	1.91
Loss & Avoidance (CD8)	0,30	0,20	0,50	0,70	0.43

Elicit the Target Audience's Motivational Profile: Considering the sociodemographic profile of the target audience, in this activity, teams were asked to fill out the "target audience motivational profile elicitation form" where they scored, on each core drive of

the Octalysis framework, the suitability and impact of each technique on sustaining the motivation of the target audience they were focused on.

Determine the Target Audience's Motivational Profile: The resulting Octalysis of each team was established through the average scoring of individual techniques within each core drive of the Octalysis framework (Table 2).

We observe that the core drives CD7, CD1 and CD2 have the highest scores. These results indicate a trend towards valuing elements associated with surprise, discovery, broader purpose, and personal or professional development. The high score in CD7 highlights the importance attributed to elements that generate surprise and stimulate curiosity. CD1 emphasizes the value of purpose and the pursuit of greater goals. CD2 in turn, reflects the significance of growth and achieving goals.

On the other hand, the core drives CD8 and CD6 score the lowest, suggesting that for the target audience, there is less relevance of factors related to loss, rejection, urgency, scarcity, time, and resource limitations. This indicates a lesser predominance of negative or pressure-based factors compared to those that promote discovery, purpose, and growth. To obtain the final Octalysis of the judges, the average of each core drive was calculated from the team averages.

S2: Elicit Motivational Profile with Game Dynamics

Develop Game Dynamics: The creation of game dynamics and questionnaires was guided to stimulate the most prevalent core drives in the target audience [16]. In total, five dynamics were developed, named: "My Other Half is With You" - focusing on the CD5 core drive; "Characteristics and Quirks" - also related to the CD5 core drive; "The Problem with My City/School" - centered on the CD1 core drive; "Living with Masks" - related to the CD3; and "Two for All" - emphasizing the CD6 core drive. Each dynamic was carefully planned and adapted according to the target audience.

In tailoring the 'The Problem with My City/School' dynamic for ES students, the focus was on everyday challenges within the school environment, such as bullying, social integration, and academic pressures. For MS and HS participants, the adaptation addressed broader societal issues relevant to their urban surroundings, including environmental sustainability, community welfare, educational infrastructure, and civic engagement. These nuanced adjustments ensured that the game dynamics resonated with and were applicable to the developmental stages and thematic interests of each target demographic.

Develop Questionnaires: Regarding the questionnaires, two types were created: one for children and another for teenagers. In the children's questionnaire, a question for each core drive was formulated, and the Likert scale (with 5 points) was adapted using pictures related to each question.

Select Dynamics Suitable for Target Audience: The game dynamics were sent to teachers for them to select those deemed most suitable for their students.

Execution of Selected Dynamics: The selected dynamics were carried out in classrooms under the guidance of teachers, who also acted as judges in the study. They received adequate support materials and assistance to facilitate the implementation of these activities, ensuring an execution aligned with the study's objectives.

Administer the Motivational Profile Elicitation Questionnaire: Participants involved in the dynamics and in filling out the questionnaires are students from public schools in the Brazilian states of Rio de Janeiro and the Federal District. To ensure broad representativeness, the dynamics were conducted with students from elementary school, middle school, and high school. The total number of students who participated in the questionnaire was 593, as indicated in Table 3.

Table 3. Demographic Data of Students Participating in S2**.**

Target Audience	Group	Age Range	Number of Respondents
Children	Elementary	5–10	44
Youth	Middle school	11–16	97
Youth	High School	16–19	452

In total, 581 complete questionnaires and 12 incomplete questionnaires, where some target audience identification was missing, were received. Analyzing the students' responses provided essential quantitative data on the target audience in different contexts, enabling a careful and diverse evaluation of which game elements could be more effective in sustaining players' motivation.

Determine the Target Audience's Motivational Profile: The data analysis was conducted through the average of responses in each core drive and by assembling the Octalysis chart. Figure 5 represents the motivational profile outlined for the target audience according to the 3 categories: Elementary school (ES), Middle school (MS), and High School (HS).

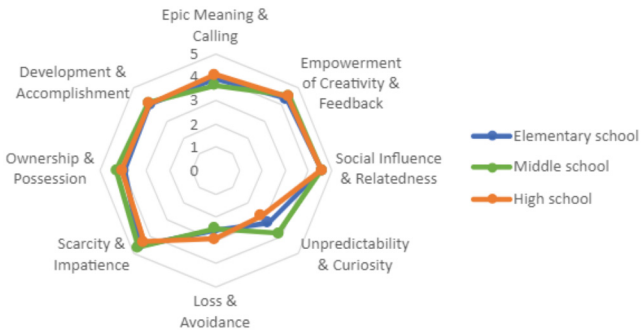


Fig. 5. Octalysis result from S2 for the 3 groups.

It's observed that there is agreement and disagreement regarding which core drives were most prevalent in each group. For all 3 groups, the top-scoring core drives were CD3, CD5 and CD6. However, the ranking of each core drive varied among the groups. For the HS and MS groups, the 1st was CD6 the 2nd was CD5 and the 3rd was CD3. For the HS group, the 1st was CD5, the 2nd was CD3 and the 3rd was CD6.

S3: Eliciting Motivational Profile Through a Motivation Inventory
The process of defining a motivational profile through the IMI followed these activities:

Map Octalysis with IMI: The resulting mapping was described in Sect. 3.

Develop Target Audience-Specific Questionnaires: The questionnaires were developed with adaptations from the IMI questions [8], considering the socio-economic criteria of the target audience. This ensured the questions were relevant and appropriate to the participants' characteristics and contexts. For this reason, two questionnaires were created: one for elementary school children with seven adapted questions, following the mapping from the previous step, and another with 14 questions for middle and high school students, also using the mapping.

Validate with Expert: This step involves the review and evaluation of the developed questionnaires by professionals experienced in using the IMI and the Octalysis framework [9]. The aim is to ensure the accuracy, relevance, and quality of the questions, ensuring the instrument is effective and suitable for the target audience. This becomes an optional but highly recommended step.

Administer the Motivational Profile Elicitation Questionnaire: The questionnaires are filled out by individuals from the target audience. This step is essential for directly collecting data on the participants' motivations, offering valuable information for subsequent analysis.

Determine the Target Audience's Motivational Profile: This activity has not yet been executed. Once it is carried out, an analysis will be conducted to identify correlations between the Octalysis framework core drives and the intrinsic motivation factors from the IMI. This procedure contributes to a deeper understanding of the underlying motivations of participants' behavior in the context of game dynamics.

4.4 Stage 4: Unify the Motivational Profile

The S1 and S2 strategies resulted in 4 Octalysis charts representing the motivational profile of the target audience for the Canal Ciência portal. These are depicted in Fig. 5, and Table 4 summarizes the scores obtained for each core drive.

A significant difference is observed in the core drive CD6 between the judges' averages (S1) and the student participants' averages (S2). This variation can be attributed to the age differences. Judges evaluate gamification strategies from a long-term strategic perspective, whereas students react based on immediate experiences. Integrating both groups' assessments could offer a fuller understanding of gamification strategies' impacts, enhancing their application and effectiveness.

Implementing the first guideline (D1), it's found that, according to the judges' evaluation (S1), the three core drives with the greatest impact on the target audience are CD7, CD1 and CD2. From the target audience's perspective, in Strategy S2, the three most valued core drives across the three groups were CD3, CD5 and CD6 only differing in their order of ranking. Based on these findings, the initial gamification planning followed the target audience's preference, as directed by guideline D2.

Table 4. Scores of the Octalysis framework core drives from strategies S1 and S2.

Octalysis Core drives	S1	S2		
		ES	MS	HS
Epic Meaning & Calling (CD1)	1,79	3,913	3,645	4,075
Development & Accomplishment (CD2)	1,77	3,982	4,082	4,020
Empowerment of Creativity & Feedback (CD3)	1,39	4,309	4,495	4,451
Ownership & Possession (CD4)	1,50	3,939	4,268	4,029
Social Influence & Relatedness (CD5)	1,56	4,597	4,608	4,606
Scarcity & Impatience (CD6)	0,92	4,620	4,713	4,385
Unpredictability & Curiosity (CD7)	1,91	3,208	3,874	2,790
Loss & Avoidance (CD8)	0,43	2,583	2,505	2,958

In selecting game techniques, as per guideline D6, those that received the highest scores from the judges (S1) in each selected core drive were prioritized. The number of techniques to be implemented in each core drive was based on the proportion of scores received.

Thus, core drives with higher scores were allocated a larger number of techniques, aiming to emphasize the elements most valued by the target audience in the gamification. The result, shown in Table 5, follows these guidelines for a balanced approach, focusing on components most effective for engaging the target audience.

Table 5. Scores of the Octalysis Core Drivers from strategies S1 and S2

Selected Core Drives	Selected Game Techniques
1st. Social Influence & Relatedness (CD5)	Mentorship; Trophy Shelves; Group Quest; Friending; Touting; Bragging
2nd. Scarcity & Impatience (CD6)	Patient Feedback; Countdown; Throttles; Torture Break
3rd. Empowerment of Creativity & Feedback (CD3)	Evergreen Mechanics; Voluntary Autonomy; Plant Picker/Meaningful Choices

For the core drive with the highest score, the four techniques with the best scores in S1 were selected. For the second core drive, three techniques were chosen, and for the third, two techniques. In situations where there was a tie in the scores of techniques for the second and third core drives, the tiebreaker will be conducted in consultation with IBICT, considering criteria such as technical feasibility, timeframe, and cost.

Game techniques such as Patient Feedback and Countdown can be implemented together to optimize user engagement, helping to keep them motivated by balancing reflection and immediate action. On the other hand, Throttles and Torture Break regulate interaction with content in a way that prevents overload and enhances anticipation. It is

expected that this combination will keep users continuously engaged and interested in the next steps.

5 Discussion

The analysis of the three motivational profile elicitation strategies reveals important differences in their outcomes. The judges' strategy (S1) provided a view based on specialized knowledge, indicating the most suitable game techniques for the target audience, yet it is at a more superficial level. In contrast, the game dynamics strategy (S2) and the motivation inventory strategy (S3) generate more practical results as they involve the target audience's participation, with S3 specifically mapping intrinsic motivation to deepen understanding of the motivational profile. The strategies are complementary, and their concurrent use results in a multifaceted motivational profile. Further studies are needed to determine how to assign appropriate weights to each strategy, according to the context in which they are applied.

Implementing strategy S2 in Canal Ciência faced challenges due to the audience's diversity, with variations in age, educational background, and socio-cultural contexts. This strategy, which includes interactive dynamics, requires adaptations to ensure its relevance and effectiveness across different groups. On the other hand, strategy S3, focused on the motivation inventory, has not yet moved to the application phase on the target audience but is anticipated to face challenges related to user diversity. Implementing S3 requires adjustments in questionnaire development to ensure comprehension and relevance for a broad spectrum of users. This heterogeneity, while enhancing data collection, introduces complexities in analysis and interpretation of the results, posing a challenge in accurately identifying motivational profiles and improving gamification.

6 Conclusion

This research delineates a novel, multifaceted process to identify motivational profiles within gamification contexts, directly aligning with goals of enhancing engagement and learning outcomes in various sectors. Through the integration of expert assessments, dynamic gaming strategies, and the application of the IMI, we have developed a comprehensive methodology that not only adheres to but also advances the personalization and adaptability aspects of gamification strategies. This approach has proven effective in capturing the nuanced motivations of diverse target audiences, thereby offering a granular insight into developing tailored gamification interventions that significantly enhance user engagement and learning outcomes.

Our findings reveal the critical importance of adopting a multifaceted lens to understand and cater to the intrinsic motivations of individuals. By leveraging the Octalysis framework, we were able to systematically dissect and reconstruct the motivational drives of our target audience, demonstrating the impact of personalized gamification on fostering meaningful engagement. Moreover, the study underscores the dynamic nature of motivation, advocating for the continuous adaptation of gamification strategies to accommodate evolving user preferences and technological advancements.

Future studies will explore the enduring impact of customized gamification across different groups and settings. Additionally, integrating cutting-edge technologies and psychological insights could sharpen gamification's effectiveness. This research significantly enriches the gamification field, offering a novel perspective for creating more captivating, efficient, and user-focused gamification strategies.

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