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# Older adults and game-based systems: Engagement model and player types of characterization based on their motivations

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ABSTRACT

Older adults are now actively participating in game-based systems. They find in these technological solutions not only a form of entertainment and socialization, but also a way to stimulate themselves physically and cognitively. Although, their participation is increasing, they face challenges such as the digital divide, since most of the games are oriented to a young audience with different tastes and motivations. Therefore, although positive results are obtained in terms of participation, there is still potential for improvement, since current game experiences are not fully adapted to the tastes and needs of older adults. Consequently, the objective of this paper is to propose a characterization of the types of players in older adults, based on the motivations previously identified. This is to better understand this population and design more appropriate game experiences. It is hoped that from the results of this research it will be possible to create attractive and fun game environments for older adults, thus improving their experience as players in these systems.

## Introduction

Game-based systems (GBS) involve a variety of approaches, such as serious games, gamified systems, simulators and digital games. These are used for a variety of purposes, such as entertainment, learning or training. Generally, these types of experiences are aimed at a younger audience, as they have historically been the main consumers. However, with the constant evolution of digital games, their reach has expanded to other populations, including adults over 60 years old, who have also found benefits and utilities in these technologies [42]. Older adults, who make up a significant part of the gaming community, are among the two most representative groups in terms of participation in games, together with those under 18 years of age [9].

Older adults represent a unique challenge in the context of digital games, because they are not digital natives. As such, they require training and learning to master technological devices before they can enjoy a game experience. In addition, many of today's game experiences are not designed considering the needs, characteristics and motivations of this population, but tend to target a younger audience. This often makes older adults reject these game experiences, as they do not feel comfortable with the available game offerings [2].

The interaction of older adults with GBS involves a series of experiences that are approached from the perspective of Human-Computer Interaction (HCI), using techniques and tools specific to this discipline. In the context of games, specific questionnaires have traditionally been used to evaluate the player's experience with game-based systems, such as the "Game Experience Questionnaire" (GEQ) [13], "Player Satisfaction Need Experience" (PENS) [29], "System Usability Scale" (SUS) [3], among others. However, due to the particularities and unique motivations of this population, some measurements have been excluded, for example questionnaires and player typology models such as the Hexad [22] or the Time Engagement Pyramid [18].

In this study, based on the motivations of older adults, we have proposed a characterization of the different types of players in this demographic group. This in order to incorporate them in the evaluation processes of the "Player eXperience" (PX) [32] of GBS designed specifically for this group of users. For this purpose, different dynamics, mechanics and game elements are recommended, and a model representing

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the engagement of the proposed typology has been designed. The objective is to provide better experiences through the design of games adapted to the different profiles of this population. The structure of the paper is as follows: Section 2 presents a contextualization of GBS, models of fun, motivation and types of players that are not oriented to the elderly population; Section 3 describes our previous work that led us to the results presented here. Section 4 describes in detail the proposed profiles of player types in the older adult population, based on their motivations, as well as the recommended dynamics, mechanics and game elements, and presents the engagement model. Finally, Section 5 presents the discussion, conclusions and future lines of work.

## Background

Young players have a variety of motivations and behaviors in games, from those who seek competition and to demonstrate their skill, to those who are just interested in enjoying themselves, socializing, or even causing chaos and frustration to other players. Although models have been developed to understand these behaviors in the young population, it is important to address this approach for older adults as well. So far, the most relevant research regarding the classification of older adults in digital games is based on the proposal by Schutter & Malliet [6]. These authors identified 5 player types in the older adult population based on their needs and satisfactions. However, the focus of the research presented here is on classification based on motivational aspects that generate enjoyment in older adults, considering both intrinsic and extrinsic human motivations. Both intrinsic and extrinsic motivations have been used by other authors for the generation of typologies of players with a general approach without distinctions in generational groups, supported in this way by different types of fun focused on the exploration of different kinds of experiences.

In addition, the proposal presented here focuses its application on GBS [32], which are understood as the use of games and the like for experience creation and problem solving. GBS can be based on or implement strategies such as gamification, serious games, simulation, playful designs and digital games [21]. Additionally, existing theories and models about fun, human motivation, existing models about types of players and their engagement in game experiences have been taken as a reference.

### *Types of fun*

Players seek fun in characteristics and particularities that are subjective but provide a basis for satisfying needs in an experience offered by a GBS. In the presented proposal, a characterization of fun is used that includes four types: "Hard fun", "Easy fun", "Serious fun" and "People fun" [17]. The "Hard fun" refers to the fun obtained by overcoming obstacles, accomplishing goals and facing challenges through strategies. "Easy fun" is the pleasure of experiencing game experiences that capture the player's attention beyond victory. "Serious fun" is the enjoyment gained through the feelings of well-being offered by participating in game experiences used as therapy. It generates emotional changes during and after the game, such as excitement, relaxation and relief, avoiding boredom and distracting the player. Finally, "People fun" is the fun obtained through social experiences. It is developed by playing with other participants, interacting with them, sharing with friends, generating rivalry, cooperation and recognition [28,40].

### *Model of intrinsic motivation (RAMP)*

The RAMP model ([20]; Office of Financial Management, State Human Resources Developed.: [24]) is a motivational approach that identifies four key drivers of intrinsic motivation. "Relatedness" refers to the basic need to connect with others, as social relationships are fundamental to survival. "Autonomy" refers to the ability to influence one's own direction, as lack of freedom or voice creates stress. " Mastery" is the need to dominate and be admired. Finally, "Purpose" refers to the need to understand the "why" of things, as it provides clear objectives and a sense of measuring results. This model is based on Self Determination theory (SDT) [30] and what is established in the book Drive by Daniel Pink [26]. The proposed typology of players in the older adult population in this research is based on the motivational aspects identified in our previous work [31], grouping them according to this motivational model.

### *Existing player type models*

The classical model of player types proposed by Bartle in 1996 [1], which does not take into account the age and gender of the participants, is based on the actions and interactions of players within the game world or with other players. This model defines four main types of players: "killers", "achievers", "socializers" and "explorers". However, this model has needed to be updated over the years to adapt to new contexts and realities. For example, Fullerton proposed in 2014 [10] a new proposal with 9 types of players, and there are many other approaches aiming to categorize all possible existing types of players.

To date, the proposals that have reached a higher level of detail and understanding are proposed by Marczewski with his "Hexad" model, published in 2016 [41], and the proposal established by Manrique V. called "Time-Engagement Pyramid" (TE), which is an extension based on the first versions of the Hexad model [22]. These more updated and complete models provide an accurate and deep insight into the different types of players and their behavior in games.

The Hexad model provides a detailed explanation of how the different player types relate to the RAMP motivational model. This approach proposes 12 player types with ramifications and subcategories, often represented as a dodecagon or a summarized Hexad, which describes the different user profiles in a GBS. Each of these elements is divided into categories of extrinsic motivations, which are related to players seeking rewards in the game; intrinsic motivations, which focus on the pleasure gained from the game process; and disruptors, who seek positive or negative change in the game system.

In the model proposed by Manrique [22], an extension to the Hexad model is introduced by incorporating the concept of "Quick Fun", aimed at those players who seek to experience positive emotions and pleasure in a short period of time, without having expectations outside of that [18]. To achieve this, the PERMA happiness model, developed by Seligman M. Seligman [38], is used and integrated with the SDT Theory. Integration is achieved with the definition of three levels of motivation versus four as in the previous model, since "Autonomy" is considered an element that potentiates the other motivations. In addition, a relevant change is introduced by reducing to only seven types of players, and incorporating Engagement and time dedicated to the game as transversal elements of the model.

## Materials and methods

To define a typology of older adult players, it was necessary to first identify the dynamics and mechanics most used and accepted in this population in the context of GBS. In addition, it was necessary to identify the motivating aspects that lead this population to interact with this type of experiences. For this, the identification of previous works was carried out through a systematic review (J. A. [33]), oriented to answer different research questions aimed at older adults. Some of the questions were focused on identifying the acceptance of the use of games through technology, and which game mechanics and dynamics were the most used and accepted by this population.

This systematic review was guided by the methodology established by Kitchenham and Charters [15], which defines a series of stages for the application of systematic reviews in the software field. To choose the different papers to be considered, a search string was defined using logical operators and relevant words to efficiently filter the results to be

obtained. Following the guiding methodology, a series of inclusion and exclusion criteria were defined to reduce the total number of articles to be treated for the definition of what is proposed here.

Subsequently, the methodology defined by Quiñonez et al. Quiñones et al., [27] was applied in order to generate a model representing the different motivational aspects of the older adult population [35]. This guiding methodology establishes the route by which a set of heuristics and their respective validation can be objectively and rigorously defined. This process was carried out and resulted in the expected model that would serve as a fundamental input for the typologies proposed in this paper [31].

*Identified motivational aspects*

As a result of the systematic review of the literature [24] and the methodological application defined by Quiñonez et al. Quiñones et al., [27], the first steps were taken to identify and define the model of motivational aspects in older adults [31]. Furthermore, it was possible to conclude that this population has its own characteristics not only at a physical and cognitive level, but also with respect to the motivations to interact, play and enjoy the experiences offered by GBS [5]. Although digital game experiences have traditionally been related to entertain, the concept of GBS extends the possibilities of application allowing its use in other contexts, as it depends on the game and its purpose [32]. An example of this are serious games, which do not have fun as their main purpose, being this characteristic relegated to the background. It is here where it is identified that the motivation to play and fun are different concepts that can be found together in an ideal state [14]. All these findings and previous processes resulted in the identification of 12 aspects that should be considered in the design and evaluation of GBS to motivate older adults and thus increase engagement (see Fig. 1).

*Dynamics, mechanics and game elements*

The concepts of dynamics, mechanics and game elements are closely related, and because of this the concepts are often confused. The dynamics in GBS establish in a general way how the mechanics and the player interact in real time. Mechanics are the various actions, behaviors and control mechanisms, defining how the GBS will work [32]. Then there are the game elements, which refer to the different resources that make up the game itself, such as points, checkpoints, badges, stories, and the like. In summary, the dynamics establish what is to be achieved with the game, the mechanics establish how they are achieved, and the game elements are the resources that will be available in the game experience.

As established in previous work (J. [34]), the context or the type of game has a strong influence in determining whether a property behaves as a dynamic or a mechanical one. For this, the priority of these according to the means and the end of the game is determinant. An example of this is that a game could be designed in which the central dynamic is collaboration between players, with a mechanic based on the achievement of challenges. In this type of game, the aim is to encourage teamwork, establishing challenges that require collaboration and coordination among players to be overcome. On the other hand, another type of game could also be created in which the main dynamic is competition, but with a mechanic based on cooperation among players. In this case, the objective of the game would be to promote competition among the players, but using mechanics that require collaboration and mutual help to achieve victory [32].

With these concepts understood and based on the results obtained in the systematic review previously conducted (J. A. [33]), a set of dynamics, mechanics and game elements that can be used in the studied population were identified. In addition, these were subsequently distributed by each player type proposal as a facilitating means in the design of game experiences for this population. In total, a set of 34 dynamics (see Fig. 2), 38 mechanics (see Fig. 3) and 25 game elements (see Fig. 4) were identified that can be applied to game experiences offered to the older population. This can be done in a transversal way or according to the characteristics of a certain type of player. It should be noted that these elements identified so far are constantly evolving, and can change, eliminate or incorporate many more dynamics, mechanics and game elements than those proposed here.

**Proposed model**

It is emphasized that the following proposal for the classification of players is not an element that limits or restricts each older adult, it is only a means to understand the motivations of this population and thus be able to generate more enjoyable gaming experiences adjusted to their particularities. In addition, depending on the type of game a person can be oriented to one type of player or another, or simultaneously share several characteristics of these typologies. This proposal has had initial versions that have been superficially exposed, but here is the final and detailed version of this typology (J. [34]). The proposal is divided into 2 sections, the first one being the characterization of each type of player, and the second one the relationship of these types of players with the engagement and the gaming experience.

*Characterization of types of players in the older adult population*

With the model of motivational aspects in the older adult population and taking as a reference the existing models on types of players without distinction to their age, a set of types of players specifically oriented to older adults was characterized. In the definition process, it was evidenced that the previously identified motivational aspects fit with the human motivations established in the RAMP model ([20]; Office of Financial Management, State Human Resources Developed.: [24]) and


**Fig. 1.** Motivational aspects in older adults [35].

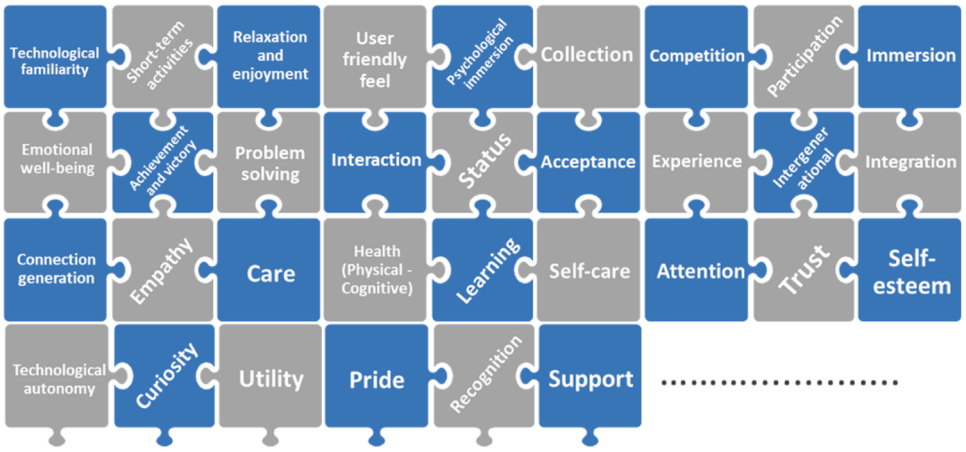


**Fig. 2.** Pool of dynamics for older adults.

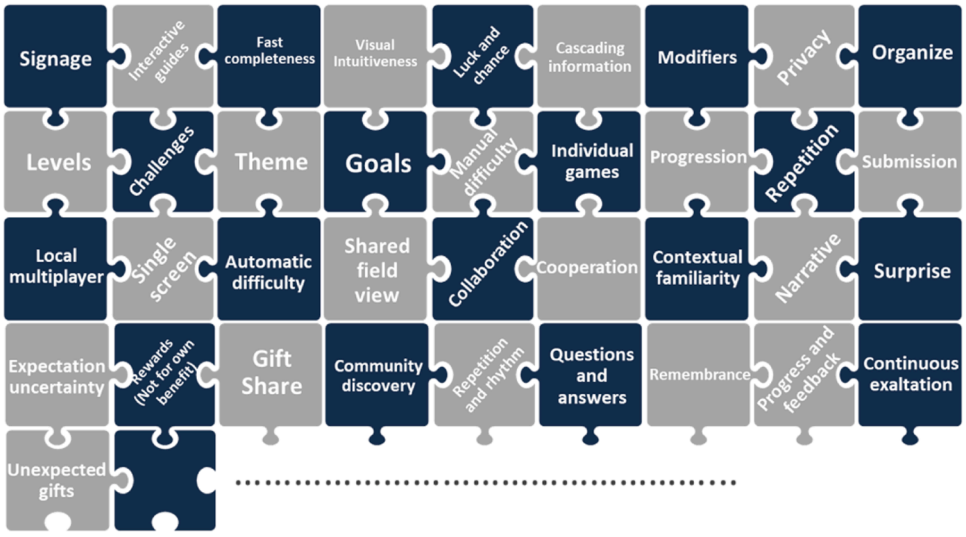


**Fig. 3.** Pool of mechanics for older adults.

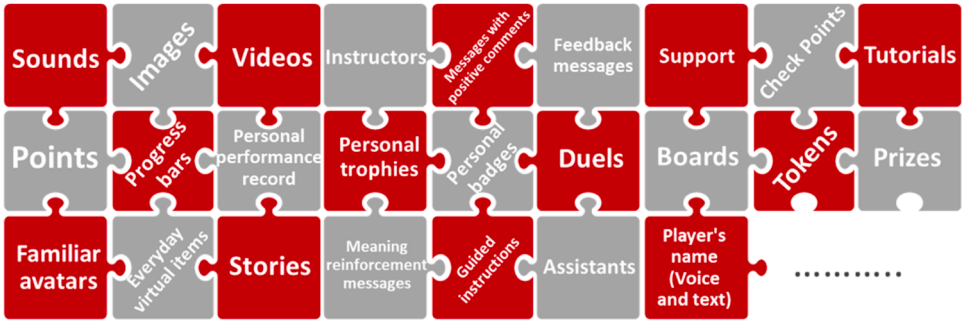


**Fig. 4.** Pool of game elements for older adults.

with the base types of fun in a balanced way. Regarding the RAMP motivational model, it was necessary to make some adjustments to fully adapt it to the older population. “Autonomy", "purpose" and "relating" were kept intact, because the older adult also seeks to be autonomous, to relate to other people and to give purpose to the play experience, strengthening the interaction with this one. Regarding "mastery" it was necessary to redefine it, so it was renamed to "achievement", because the older adult does not seek to generate a mastery in the play experience, but to achieve a feeling of accomplishment and victory.

In the older adult, the manifestation of motivation and the human need to "relate" can be observed. This is reflected in motivational aspects of the older adult, such as their participation in intergenerational activities and their desire to be recognized and interact with close relatives, such as children and grandchildren. These actions provide an enriching experience for the older adult and promote positive interaction between different generations. At the level of "autonomy" the processes of interaction, adaptation, personalization and the use of games lead the older adult to fully experience such independence in their

actions in the GBS. In relation to "achievement", it can be achieved through competition, the game flow, and affinity with their tastes or interests. Finally, "purpose" is presented to the older adult through the narrative that gives meaning, utility or benefit obtained through the actions, granting meaning and familiarity. Regarding the last one, it is clarified that the narrative is only an effective means to give meaning or make sense to the play experience, but any other means can be used to give meaning to the play actions performed by the older adult.

Each motivation can have an intrinsic and extrinsic origin, and unlike the Hexad model, older adults do not act on the system or on the other players, they only have a process of interaction with them. In addition, the concept of "Disruptive" does not apply to this population, since "change" is not a motivating factor for them, nor do they seek to negatively affect the system or other users. Another aspect to highlight, is that the concept of "virtual rewards" obtained for internal use in the game such as coins, experience points or similar is not used for this population (with exceptions), but they do tend to seek "benefits" oriented to their health or well-being in general [11]. From the above findings, the following 8 types of players were defined for the older adult population, segmented into 4 main motivators which are meaning, autonomy, relatedness and achievement (see Fig. 5). In this characterization is associated the "Quick fun" defined in the TE Pyramid [22], which refers to obtaining quick positive emotions in the gaming experience, but without being an initial consolidating element. This concept will be discussed in more detail in the following section, where this concept is integrated into the model of player types and their relationship to engagement.

Next, it is detailed how each motivation is applied to older adults and how it is extended from the motivational aspects to define the types of players proposed. In addition, from the set of dynamics, mechanics and game elements identified in the systematic review process carried out, a distribution of these is made according to the profile of the players. All this as a recommendation for the design of game experiences oriented to the elderly population.

*Achievement motivation*

Achievement motivation in older adults is given by the need to succeed in some particular field by demonstrating it to oneself or to others [28]. This is achieved by accomplishing goals in a given environment, experiencing a feeling of achievement and victory by overcoming the different obstacles presented. Although they like to feel this type of sensation, it is not to their liking to make others feel bad, which is why leaderboards and public display of results do not attract their attention [37]. This achievement motivation can be achieved at the intrinsic or extrinsic level, each with specific particularities and generating different types of players:

**Self-Demanding:** This type of player is intrinsically motivated by the desire to compete with himself by proving that he can improve even more with previously performed actions. In this particular case, the scores for tracking are interesting, but only as a personal record without being publicly displayed. Only if the game has an affinity with the personal tastes of the older adult will the player look for completeness of achievements, badges and the fulfillment of objectives. This type of player will be interested in the evolution of their performance, being this achieved through repetitive actions, with a control over the difficulty experienced to achieve feelings of achievement, victory and self-improvement which is more important than the game experience.

To provide experiences focused on this type of player, dynamics can be used to encourage competition, immersion, emotional well-being, a sense of achievement and victory, and the application of problem solving. In addition, some of the different mechanics that can be used in a GBS to achieve the objectives set out in the dynamics include the use of levels, challenges, senior-oriented themes, goals, manual control of difficulty, games oriented to be experienced individually, progress and repetition. Finally, some game elements that can be used in the system to support the mechanics and regulation of the game are the implementation of points, progress bars, and performance records, but only for personal viewing, as well as trophies and badges (see Fig. 6).

**Competitor:** This type of player is extrinsically motivated from the status obtained by competing with other players and winning. This occurs in very particular cases with very close people such as the couple, family or friends and with themes with which they find great affinity, with fun and recreational spaces. It should be noted that this behavior is more marked in the male gender than in the female gender, but this is not always the situation. For this type of player, the experience, although relevant, is not the most important thing since it is centered on the victory over the other player.

To promote achievement motivation in this type of player, dynamics can be used to provide incentives for competition, interaction, a feeling of status through achievement, victory and the application of problem

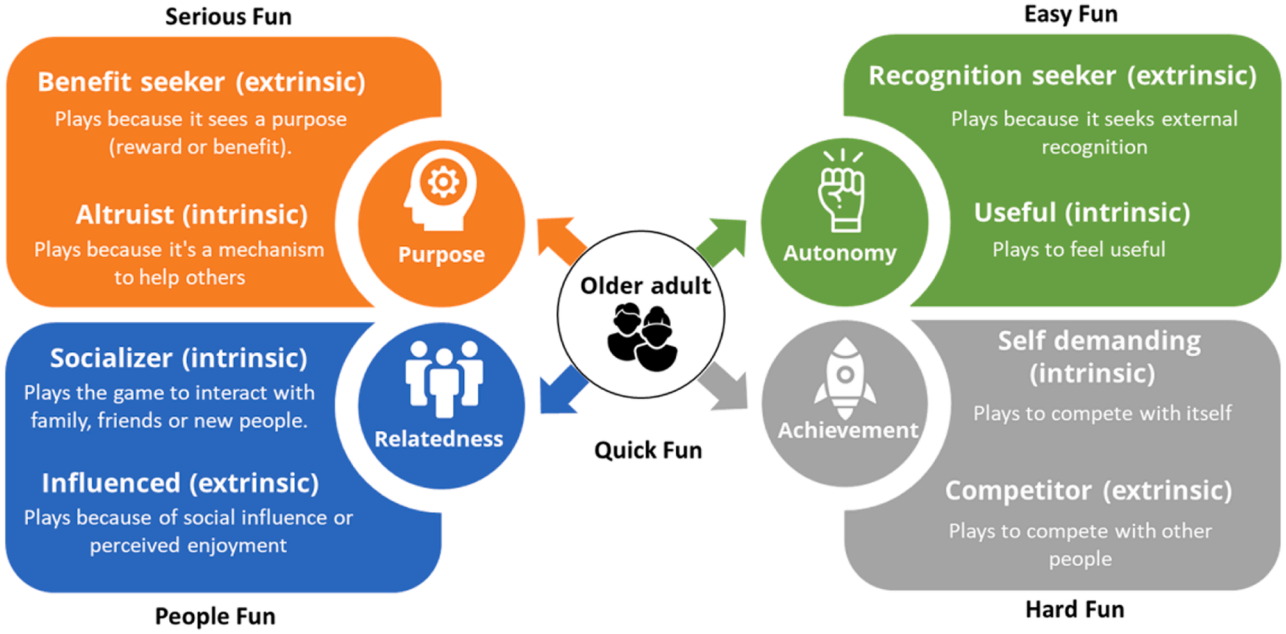


**Fig. 5.** Characterization of types of older adult players (J. [34]).

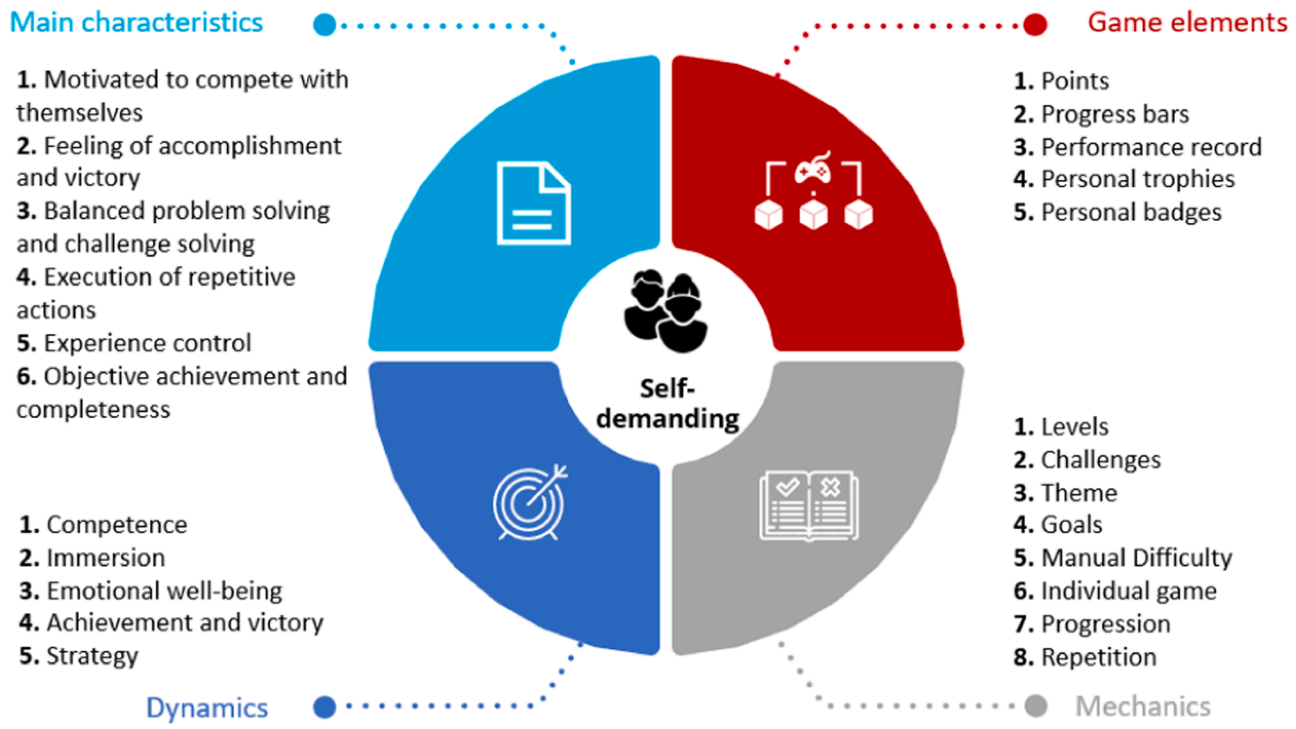


**Fig. 6.** Self-demanding player characteristics.

solving. Some of the different mechanics that can be used in a GBS to achieve the objectives set out in the dynamics include the use of local multiplayer, challenges, senior-oriented themes, single-screen gameplay with shared field vision, and automatic difficulty adjustment. Finally, some game elements that can be used in the system in order to support the mechanics and regulation of the game are the implementation of points, duels, boards, tokens and the gaining of prizes as a representation of momentary victory (see Fig. 7).

*Relatedness motivation*

Older adults may be motivated by the need to socialize, interacting with other people and sharing with them [7]. For this they prefer face-to-face than online games, because they do not want to acquire additional obligations such as connection time or waiting for other players to perform the actions corresponding to their turn. In this type of experience, cooperation/collaboration predominates as a means of socialization, working together with others in order to achieve goals, but this does not completely exclude competition regardless of victory [25]. Additionally, older adults prefer games on the same screen shared with their counterpart, experiencing the same field of vision and thus avoiding confusion.

**Socializer:** This type of player is intrinsically motivated by the desire to relate to family members such as children, grandchildren, or close friends, seeking acceptance and companionship. They see the game as a facilitating means to achieve this approach and to be able to socialize with them, valuing the processes of communication and fun, obtaining their own feeling of well-being, in addition to the generation of empathy, positive affection and participation. When the socializer participates in an intergenerational environment such as with their grandchildren, they seek to be recognized as an equal where there is no ageism or an environment where the elimination of these barriers is encouraged.

To provide environments focused on this type of player, it is possible to use dynamics oriented to encourage participation, competition, intergenerational activity, experience, social well-being, integration and collection of elements. In addition, some of the different mechanics that can be used in the experience to achieve the objectives set out in the dynamics include face-to-face multiplayer games, challenges to be faced cooperatively or collaboratively, such as community discovery, themes according to the profile, game on the single screen with a shared field of vision and balanced automatic difficulty. Finally, some game elements that can be used in the system to support the game mechanics and regulation are the implementation of points, duels, prizes, boards, and tokens (see Fig. 8).

**Influenced:** This type of player is extrinsically motivated by social influence or by the perceived enjoyment of other people, seeking to escape loneliness and boredom. Here players interact with people with similar hobbies. Also, they seek additional social activities or simple communication mechanisms, exchanging experiences facing the same challenge together or in competition. In these experiences they are not interested in victory as such, only in generating empathy, positive affection and participation.

To provide experiences aligned to the particularities of the influenced player, it is possible to use dynamics focused on participation and competition. However, the focus should be on the experience, generating environments of entertainment, social well-being and connections. Some mechanics that can be used to achieve the fulfillment of the dynamics are the application of local multiplayer, challenges overcome cooperatively and collaboratively, the use of the single screen with shared vision and balanced automatic difficulty. Finally, some game elements that can be used in the system to support the game mechanics and regulation are the implementation of points, duels, prizes, boards and tokens (see Fig. 9).

*Meaning motivation*

The purpose in older adults is important because it gives meaning and relevance to the use of a GBS. If they not only have an entertainment purpose, but for example see a benefit in their daily life such as health or the acquisition of useful knowledge, an added value will be given to the experience obtained [4]. This purpose is not only for self-benefit through external rewards as an extrinsic focus, but also at the intrinsic level in the empathy felt with an external self and the internal desire to help the external other [16]. This should not be confused with "epic meaning" as the latter refers to the motivation of feeling that one is working to

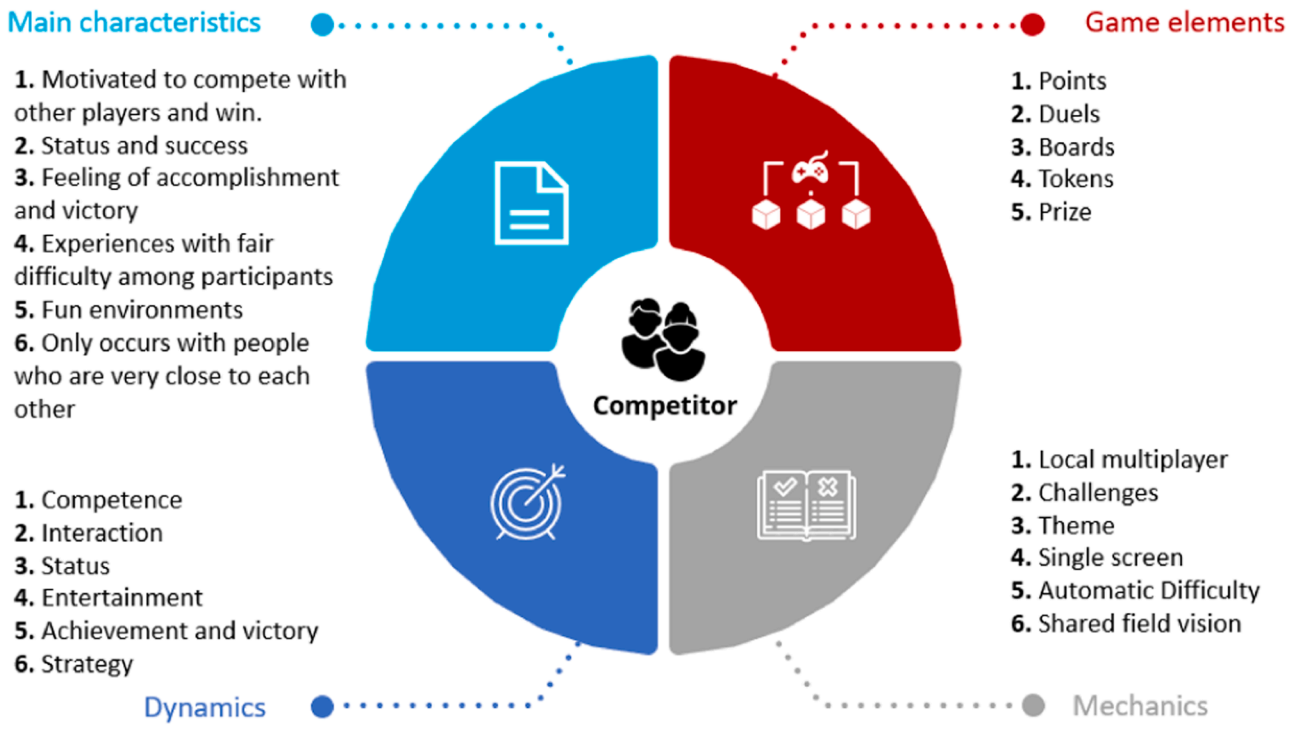


**Fig. 7.** Competitor player characteristics.

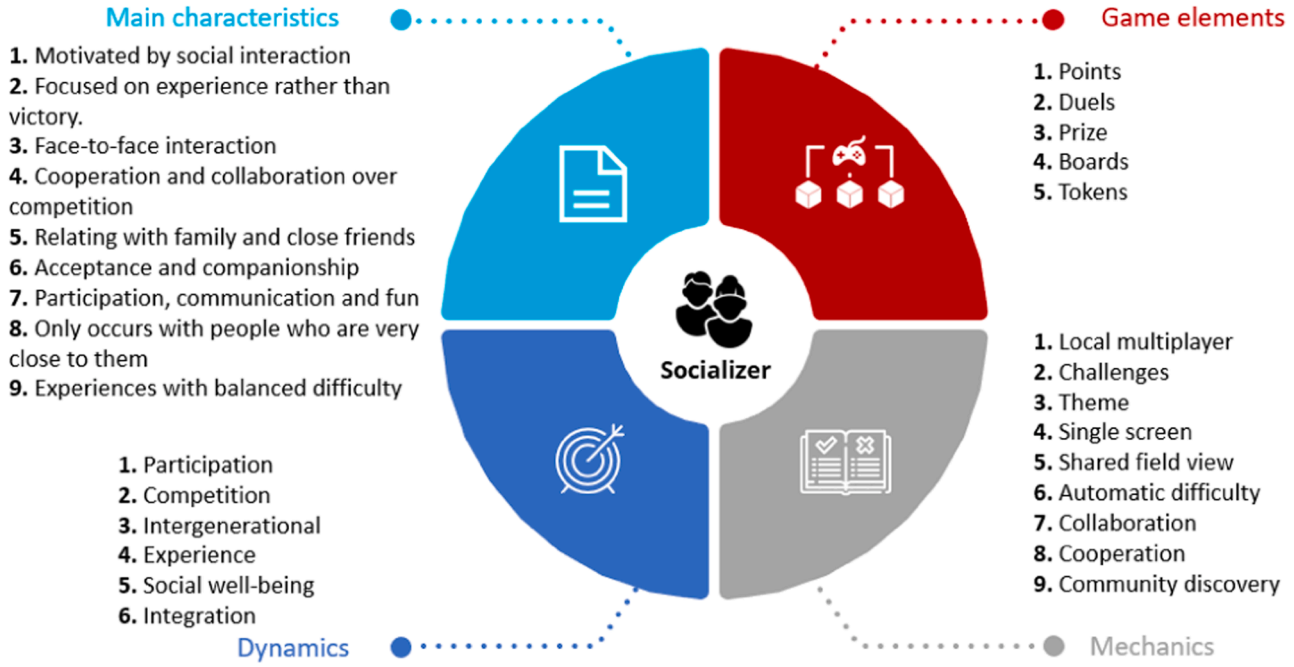


**Fig. 8.** Socializer player characteristics.

achieve something great, something much greater than the player themselves. This is not to say that the older adult does not experience this type of motivation, but it is less frequent.

**Altruist:** This type of player is intrinsically motivated from the desire to help others through the games and connect with people, contributing in some way to their well-being with their wisdom, knowledge and life experiences, improving the experience by sharing with others. This type of help can also occur in virtual elements such as a virtual pet or plant, where the older adult's help is required for the good condition of the virtual elements, being achieved in the empathic generation with such elements. For this type of altruistic player the narrative and thematic are fundamental elements that strengthen their personal motivations, since this is a mechanism that gives meaning and importance to the help they will provide.

Although this type of player could be compared to the "philanthropist" type defined by Marczewski A. Marczewski [22], the "philanthropist" concept does not really apply in this context, because it encompasses the dedication and promotion of all things human in general, which implies knowing how to give (to whom and why), while "altruism" focuses on the concern or disinterested attention for others

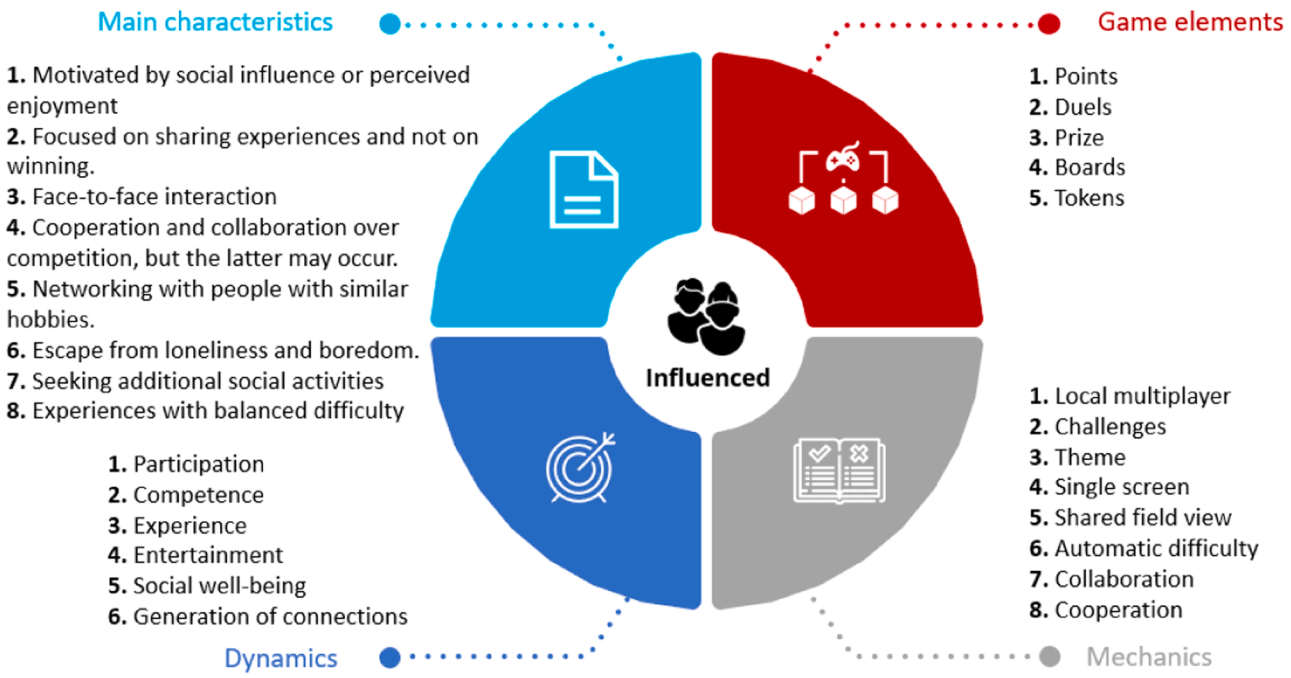


**Fig. 9.** Influenced player characteristics.

without such a deep need for (To whom and why), this being more in line with the context of the older adult.

To provide experiences that promote the altruism of the player, it is possible to use dynamics oriented to encourage empathy, participation, experience, emotional well-being, care and collection. In addition, some of the different mechanics that can be used in a GBS to achieve the objectives set out in the dynamics include the use of narrative, expectation-uncertainty, contextual familiarity, surprise, themes related to older adults, cooperation or collaboration on a single screen with shared vision and locally, challenges, rewards and mechanisms for gifting and sharing with others. Finally, some game elements that can be used in the system to support the game mechanics and regulation are the implementation of progress bars, stories, characters - familiar avatars to promote empathy, and everyday virtual items (see Fig. 10).

**Benefits Seeker:** This type of player is extrinsically motivated by the utility or benefit that is evidenced in playing the game, that is, the meaning of the game. The older adult who identifies with this type of player usually finds meaning in learning processes with practical and transferable knowledge to their daily life. In addition, they focus on obtaining emotional well-being such as the release of stress and daily exhaustion and the improvement or preservation of health from a cognitive and physical approach, also seeking a process of self-care. This type of players must be persuaded by showing them in a clear way the benefits they will obtain by using the GBS. This generates a process of commitment to engage with the game through repetitive activities with an adjusted rhythm, with feedback processes and if possible, in company to generate additional motivation.

To promote participation in the game experiences through the benefits that can be obtained, use is made of dynamics oriented to encourage the achievement of emotional well-being, physical and

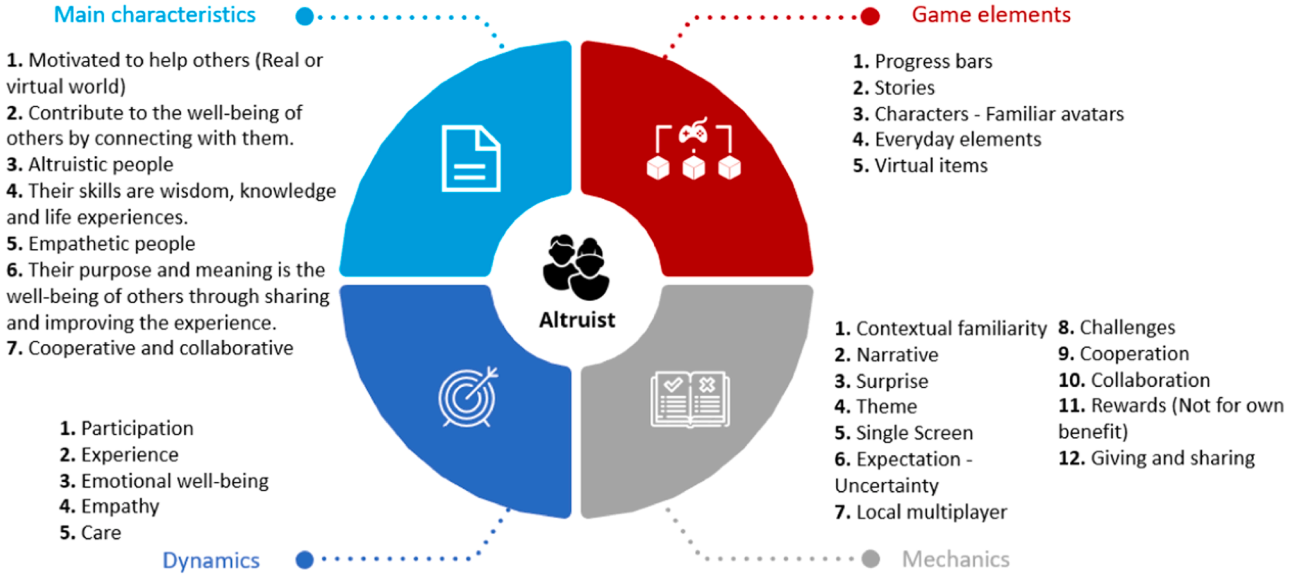


**Fig. 10.** Altruistic player characteristics.

cognitive health, learning, participation, competition, self-care and attention. Also, mechanics such as challenges, goals, levels, themes related to obtaining benefits, cooperation or collaboration on the single screen locally, use of narratives, questions and answers, remembrance and persuasive mechanics can be applied. Regarding the game elements, progress bars can be used to establish goal measurement, stories to generate a connection with the participant, the use of characters - familiar avatars and everyday virtual items (see Fig. 11).

*Autonomy motivation*

The autonomy motivation in older adults is given by the need to be independent in their activities and to achieve it, they require feedback, support and guidance to achieve such independence. In addition, autonomy is also sought because of the need of the older adult to feel useful in an environment that because of different socio-cultural factors, may be isolated in their family and social environment [39]. Another relevant aspect is the need for recognition of the older adult in the process of achieving autonomy and independence. This is an element that strengthens the permanence of the experiences in a game-based system, turning them into independent users in the use and proficiency of technology and information and communication technologies (ICT). It also helps the player to explore and describe for themselves what the technology can offer through the confidence this generates.

**Useful:** This type of player is intrinsically motivated by the need to feel useful either by learning new things out of curiosity or by applying their current skills. This type of player likes to interact with experiences that make them feel proud of themselves. All through overcoming challenges such as interaction processes and technological proficiency, to GBS challenges in environments where confusion and anticipated frustration are avoided. This type of player values the narrative context that gives a meaning of usefulness to the actions performed, giving importance to their actions, with an empathetic, coherent and interesting story that does not encourage depression and pessimism, with a character that generates empathy and makes them feel useful. To achieve all the above, they seek to know the process as completely as possible in order to execute it and experience the feeling of usefulness.

To promote the sense of usefulness to the older adult, dynamics oriented to exalt the participant's confidence, self-esteem, learning, curiosity, usefulness and pride can be used, all this through experiences oriented to technological autonomy and emotional well-being. Mechanics such as narrative, levels, themes that encourage dynamics using persuasion, goals, challenges, repetition and rhythm can also be used (see Fig. 12).

In addition, some game elements that can be used in the system to support the game mechanics and rules are the use of familiar characters and avatars to drive the feelings you want to generate in the participant, everyday elements, progress bars, stories and messages with motivational reinforcement and meaning.

**Recognition Seeker:** This type of player is extrinsically motivated by the recognition that can be obtained. This should not be confused with the recognition granted at a social level related to status. Rather, it is focused on the execution of actions that are performed by the older adult and that are recognized and appreciated by an external entity such as a person or the GBS itself. The latter can offer this feeling of recognition through different messages that stimulate the player to continue, since the actions that are being performed in the game are recognized in a positive and motivational way. This type of player is not at all interested in immediate victory, only in enjoying the experience and receiving the recognition desired during the process.

To increase the feeling of recognition in the older adult, it is possible to make use of dynamics oriented to promote this recognition not at a social level, but of their actions in the game, fomenting support, emotional well-being, technological autonomy, emotional well-being, usefulness, expression and acceptance. In addition, some of the different mechanics that can be used include progress and feedback, continuous exaltation, repetition and rhythm, related themes, goals, challenges, and unexpected rewards. Finally, some game elements that can be used in the system in order to support the mechanics and regulation of the game are the use of familiar characters and avatars that give this recognition, guided instructions, progress bars, everyday virtual elements and in-game assistants that generate a direct approach to the older adult, for example calling the older adult by name through the voice (see Fig. 13).

*Player type model for older adults*

For the generation of this proposed proposal, the model was based on the model established by Manrique V. Manrique [18] as a refinement of that proposed by Marczewski A. Marczewski [22], which establishes a route of fun with its specific types of players. This model, although

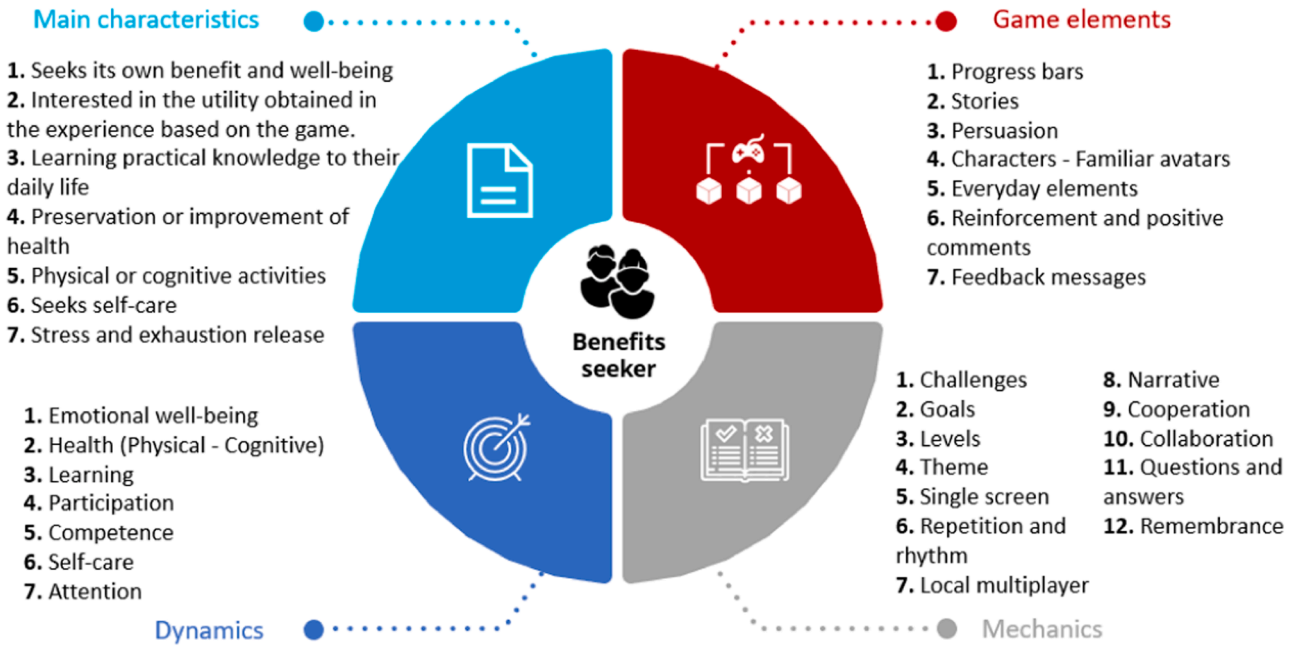


**Fig. 11.** Benefits seeker player characteristics.

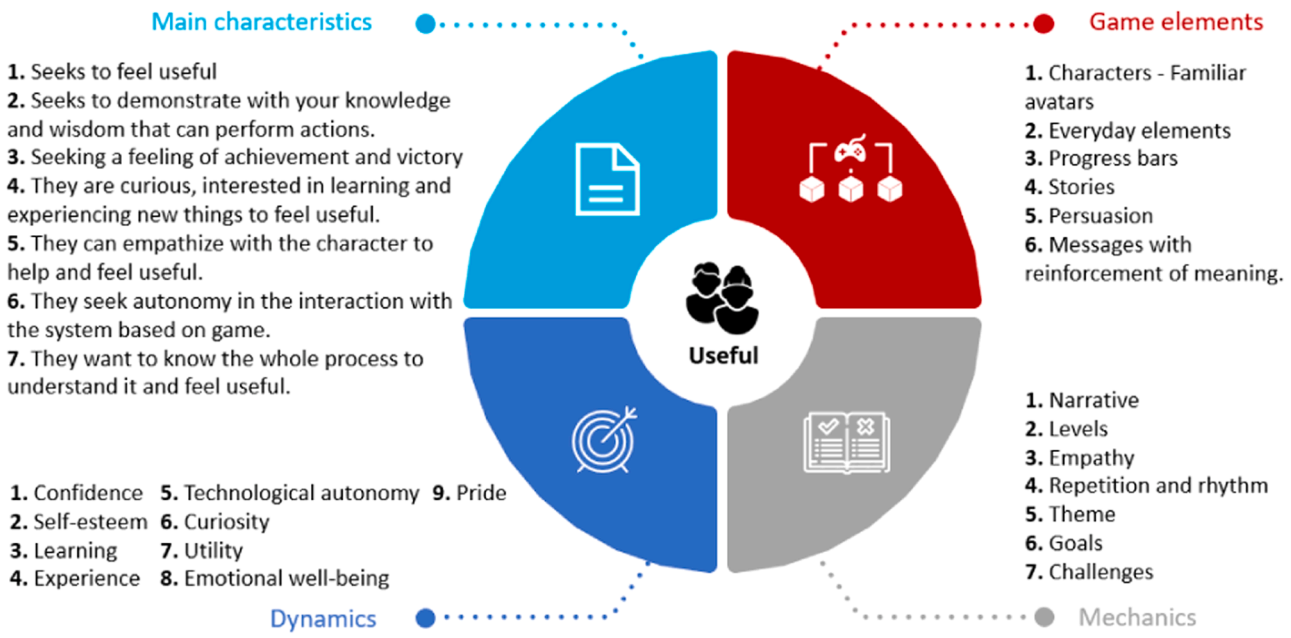


**Fig. 12.** Useful player characteristics.

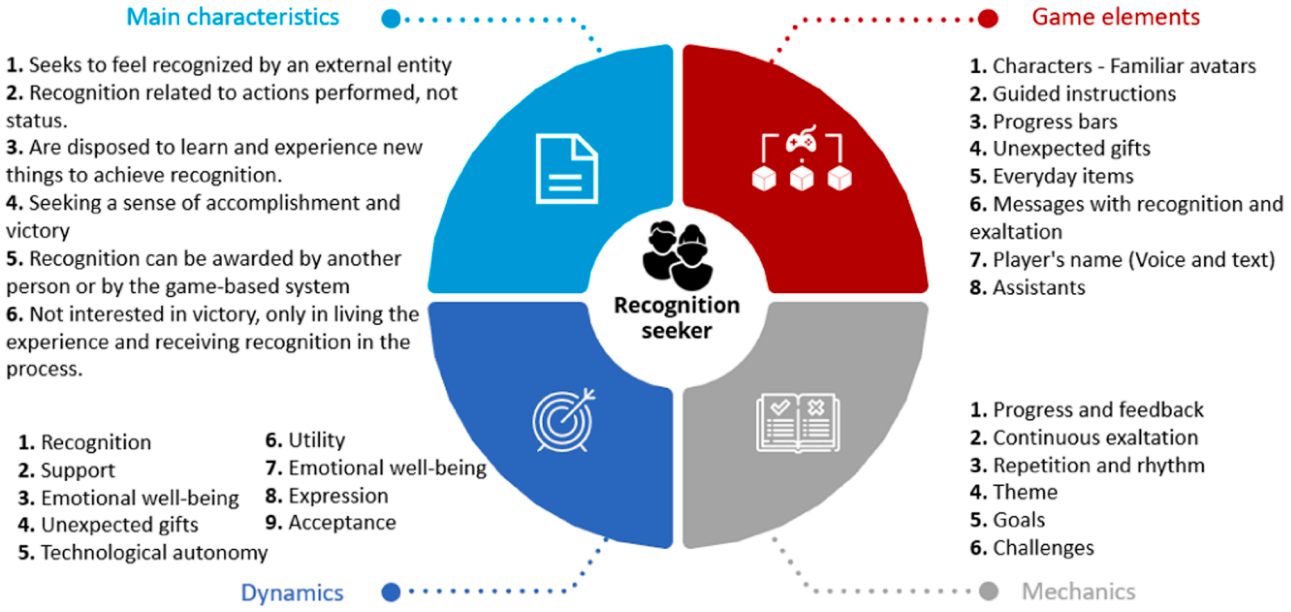


**Fig. 13.** Recognition seeker player characteristics.

adequate to describe the traditional players of GBS, does not completely fit the characterization of the types of players identified in older adults. First, in the case of older adults it cannot be established that they play specifically for fun, which is referred to in the TE Pyramid model as "X.0 fun", therefore, the term "X.0 motivation" has been used as the types of drivers that lead an older adult to experience and remain in a GBS. Secondly, the TE Pyramid model takes "pleasure" as a base driver in the so-called "fun 1.0" which has been changed directly to "positive emotions", because "pleasure" is a characteristic of intrinsic motivation and cannot be taken independently, but positive emotions can, because although they can lead to a state of pleasure and satisfaction this is not necessarily the case, they can be quick experiences that although they generate a brief degree of well-being may not reach a complete state of satisfaction and pleasure. Third, although the types of players may be like the Hexad and TE Pyramid models, the approaches and/or particularities of each one change drastically, adjusting to the characteristics of older adults. As a fourth aspect, the base TE Pyramid model has been structured in relation to the PERMA motivations defined by Seligman M. Seligman [38], while the model presented here is based on the RAMP motivations (Office of Financial Management, State Human Resources Developed.: [24]) and the types of fun used in the Hexad model [17]. A fifth differentiating aspect is that a set of key transversal aspects have been established, categorized into "basic aspects" necessary for an older adult to have a first contact with the GBS and "consolidating elements" that are necessary to consolidate intrinsic and extrinsic motivations during the experience. Finally, as a sixth difference is that the concept of the "Enjoyer" player changes from being a player to a "user" of the GBS. This is called "occasional" and is not initially considered a player, because the older adult occasionally uses the GBS without a strong motivation to increase game time and engagement.

Although the above are differentiators with the base models, the TE Pyramid model has highlighted a set of aspects that are a success not only for the younger players of the GBS, but also adjust to the older players. First, "Quick Fun" also applies to this population, being used in the proposal made. As a second aspect, the relationship between the type of motivation, the time dedicated and the engagement of the player has also been used in the model presented, being these aspects totally similar to the base model (see Fig. 14).

Motivation 1.0 refers to the motivation felt by older adults who occasionally play a GBS and dedicate very little time to it. This is because they do not feel a total interest in this type of experience or because it is the first time they play a certain game to obtain positive emotions. Here the player can find joy, interest, surprise, curiosity or amazement, being all these ways to experience positive emotions quickly and temporarily [18]. For the older adult to evolve into an extrinsically (Motivation 2.0) or intrinsically (Motivation 3.0) motivated player, a series of essential basic aspects are necessary, such as technological familiarity, adaptability and interaction. Then there are the consolidating elements such as flow, use of the game, variety and contextual familiarity. All these elements described above are found transversally in the different types of players (ver Fig. 15).

**Technological familiarity:** A fundamental element that allows an older adult the opportunity to interact with the experiences offered by the GBS and can from different motivations to be a player is technological familiarity. If the older adult does not have a previous training and adaptation process with the different peripherals for a basic interaction with the experience, the older adult will experience confusion and frustration and will not generate an engagement with the game. In addition, this process of technological familiarity is not only with the peripherals but with the game itself, being necessary to offer messages, guides and friendly tutorials that allow a fast-learning curve and adaptability. It is for all of the mentioned above that the impression should always be given that the use of the GBS is achieved easily and without much effort, through signaling and with mechanics adjusted to their capabilities and skills.

**Adaptability:** The experiences offered in the GBS should be adjusted to the particularities of older adults. For example, the physical or cognitive challenges presented should not be too demanding, such as, for example, the inclusion of physical jumps and fast movements. In addition, the visual capacity of this population should be considered, being necessary clear elements and texts of sufficient size to be able to be visualized clearly, as well as the use of the native language in the game.

**Interaction:** Regardless of the type of player, older adults find greater acceptance for direct, natural, few-button input devices such as touch screens with simple actions, as different from a traditional console controller or controller with multiple buttons and joysticks for motion control. In addition, the portability offered by smartphones and tablets is relevant because it allows them to play anywhere and with a simple configuration. Regarding natural interaction devices, motion sensors are also found because they offer ease of interaction with a GBS. Interactions with immersive peripherals such as VR glasses are also well received as they allow to maintain attention and concentration by generating sensory immersion.

**Game flow:** Independent of the type of player, players are comfortable with the correct psychological immersion, offering a balance in the difficulty of the proposed challenges versus the skill of the player. In addition, the technical quality of the GBS and the perception of psychomotor, perceptual, visual and cognitive inclusion are important in the achievement of flow in older adults.

**Game use:** No matter the type of player, the choice should be to offer relaxed, patient experiences, without frenetic, with light problem solving and without negative consequences, with a simple regulation, that allow to be played during short periods of time. In addition, in the case of male seniors there is a tendency to prefer themes with real-world graphics and scenarios, and in the case of female seniors there is a tendency for colorful graphics such as cartoons. In both cases, all these elements must be achieved through the personalization of familiar images, videos and sounds.

**Variety:** Older adults, although they may like to perform repetitive actions, should be offered a variety of elements and slight changes. This

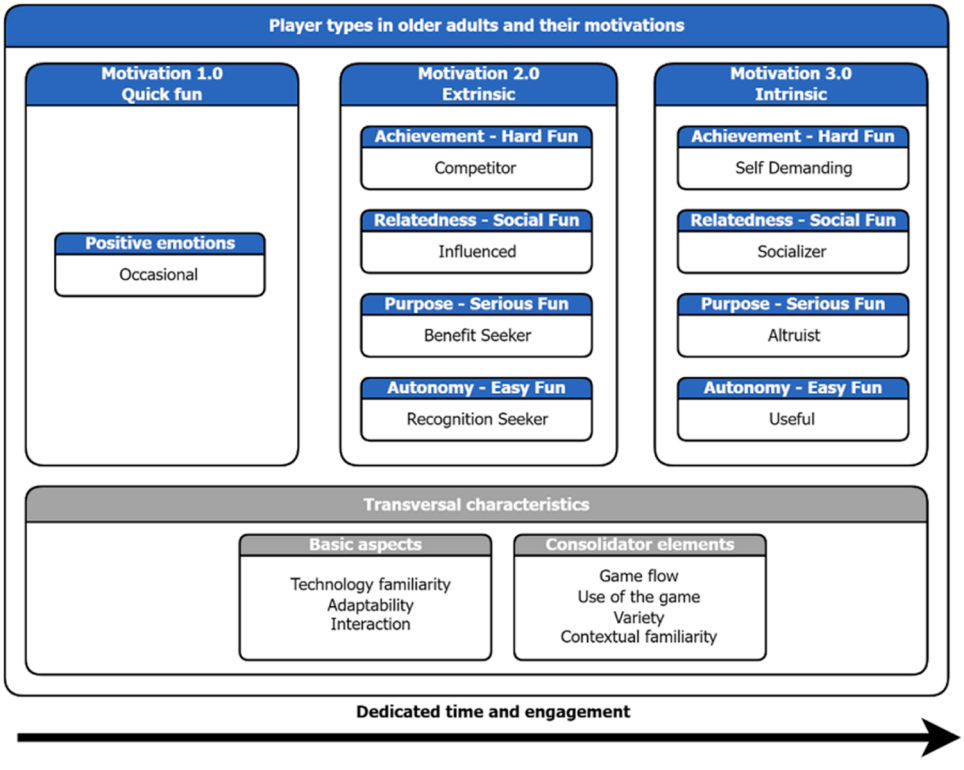


**Fig. 14.** Types model of players and their motivations in older adults.

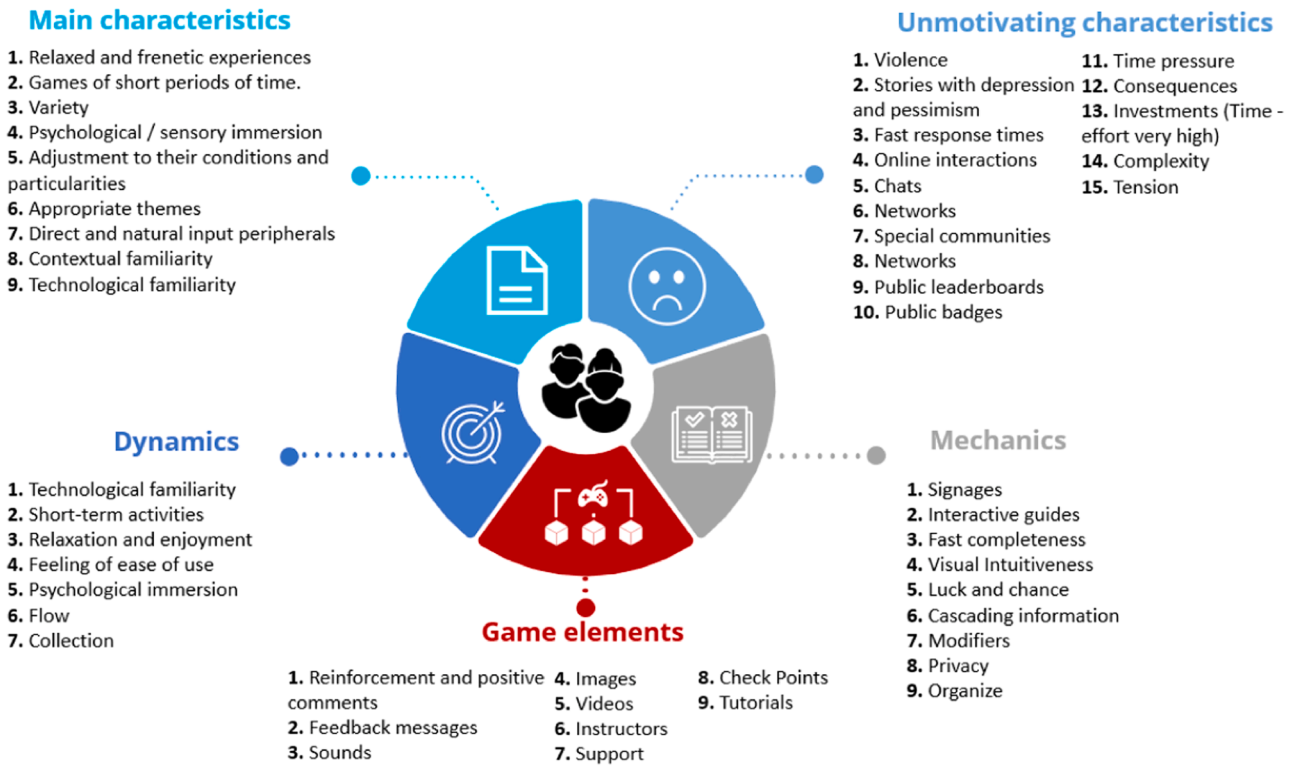


**Fig. 15.** General characteristics of older adult players.

includes colors, sounds and themes, all to modify the experience during their development, so that it does not become monotonous and boring.

**Contextual familiarity:** The experiences offered to older adults should promote elements that can be easily related to everyday life or elements related to this such as their culture and context. In addition, the incorporation of elements that stimulate memories of their lives and generate nostalgic processes are well received by the older players.

**Unmotivating factors:** Violent themes should be avoided for any type of player, as well as narratives that encourage depression or pessimism. Regarding the game mechanics, those that demand fast and dizzying response times should be avoided to prevent anticipated confusion. Neither can the older adult be forced to have online interaction processes such as chats, networks and special communities. Older adults are repulsed by elements that can make others feel bad. Therefore, care should be taken when offering experiences such as competitive experiences, leaderboards, badges and public display of results. They should not be considered as a factor in measuring the fulfillment of challenges and performance.

Extrinsic motivation "motivation 2.0" and intrinsic motivation "motivation 3.0" have been so named respectively, because an intrinsically motivated older adult dedicates more time to the game compared to a user who is only extrinsically motivated. However, one is not superior to the other nor are they necessarily executed sequentially. In addition, these states vary according to the type of game, the context and change over time, being fully dynamic and not a categorical way to classify an older adult player, sharing many characteristics of various types of players to varying degrees [22] (see Fig. 16). An example of this is that some games have the purpose of destroying everything as in "Gears of War"[1] [8] while, in others you must explore and create things as in "Minecraft"[2] [23]. Such approaches cause the dominant type of a given player to change according to context. Another factor that causes

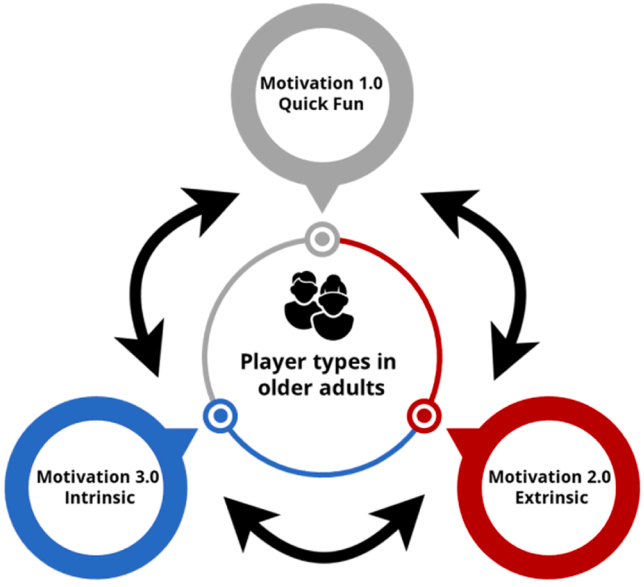


**Fig. 16.** Dynamic motivational states in older adults.

the type of player to change is experience, as the motivations that cause a person to initially interact with a GBS change during the experience, moving between motivations of the same type, from an extrinsic to an intrinsic state or inversely [36]. For this the game "Horizon Zero Down"[3] can be taken as an example (see Fig. 17) [12], which can have as initial motivation the exploration of its vast landscapes, with dynamic elements such as the weather and the various wild machines. Then over time, the person may become interested in improving their battle skills

[1] Game owned by "Epic Games" and "The Coalition".
[2] Game owned by "Mojang Studios" company.
[3] Game owned by the "Guerrilla Games" company.

**Fig. 17.** Horizon Zero Down game (Exploration - Battle) [12].

by fighting with the various enemy machines, seeking completeness in achievements and improving their battle system. These motivational changes are closely related to the types of fun and can be used to further enhance the game experiences. In which you could make use of "Hard fun" before and after a certain victory, and then you can experience "Serious fun" making the feeling of victory more meaningful and prolonged [19].

## Discussion, conclusions and future work

Currently, the design and implementation of the different GBS are oriented to a young audience that has tastes, motivations and particularities different from those found in the older adult population. The results presented here offer a significant advance oriented to facilitate the process of building these technology-based solutions to be oriented to the older adult population. This solution was based on previously identified motivational aspects for its transformation into a base typology of this population with intrinsic and extrinsic approaches to achieve a greater use of GBS. To achieve the proposed typology of players and the model of their relationship with engagement, different existing models such as the Hexad model, the TE Pyramid, the types of fun and the RAMP motivational model were used as a basis. The synergy achieved with these, and our previous results provides a solid basis for considering the characterization of the different types of players.

It should be clarified that the proposed classification of types of players is not an element that restricts, limits or confines each older adult; it is only a means to understand the motivations of this population and thus be able to generate more pleasant game experiences adjusted to their particularities. Furthermore, depending on the type of game and the context, a person can be oriented to one type of player or another, or simultaneously share several characteristics of these typologies. Additionally, it was possible to establish a model that considered not only the different types of players, but also a scale that integrated transversal generalities that should be considered to generate engagement and dedication time in GBS, both at a basic level for people who are not players and for people with a longer trajectory. This was done to generate a route by which to consolidate the interaction of older adults with GBS. In addition, recommendations were generated proposing mechanics, dynamics and game elements that should be incorporated according to the type of player, as well as elements that should be avoided in order not to demotivate them. With this, active aging is promoted in older adults, increasing the use of GBS, achieving physical, cognitive and social benefits.

If a GBS is to be designed and implemented to motivate and entertain the older adult population, an attempt could be made to address the different needs and motivations identified. For this, the game experience can be oriented on the 4 identified extrinsic motivations, integrating reward elements to satisfy them, such as obtaining benefits, enjoyment, recognition and the feeling of victory in competition. Consolidating elements can then be integrated to allow the promotion of intrinsic motivations, through the possibility of social interaction in the game, offering the means to help others, thus allowing them to feel useful, and offering means by which the older adult can surpass themselves.

As future work, the need for formal validation of the typology of players proposed is established, through tests with older adults making use of evaluation and correlation of the PX with the quality, efficiency and satisfaction obtained in the GBS. To achieve this, a heuristic proposal or participant questionnaires can be used to determine the possible player profile, and to validate whether the characteristics of the participants match those presented in the model described here. Finally, not only the profiles can be evidenced, but also a traceability to demonstrate the engagement of the players from the consolidating elements previously mentioned, such as the dynamic change of the player's profiles according to the context, type of game and player's experience.

## CRediT authorship contribution statement

**Patricia Paderewski:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Jeferson Arango-Lopez:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Francisco Luis Gutiérrez Vela:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Johnny Salazar-Cardona:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Fernando Moreira:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization.

## Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Fernando Moreira reports financial support was provided by Foundation for Science and Technology. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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