Influence of gamification on perceived self-efficacy: gender and age moderator effect

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Abstract

Purpose: In advanced societies, lifestyles are increasingly sedentary, and it is important to identify strategies to help people acquire healthy habits, such as exercise. The present study proposes the use of gamification as a strategy for encouraging users to exercise regularly, based on the possibilities offered by 'smart' devices such as smartbands.

Design: The work analyzes how individuals experience their participation in a gamification program, on the premise that it should provide an experience that is intrinsically motivating and fun. Also the moderator effect of the gender and age is examined on the relationship between their experience of participating in a gamification program and perceived self-efficacy.

Findings: The results show that individuals' experience of participating in a gamification program exerts a positive influence on their perceived self-efficacy in the practice of sport or exercise. The study also finds that the variables 'gender' and 'age' moderate the relationship between their experience of participating in a gamification program and perceived self-efficacy, such that it exerts a greater influence on women and older people.

Practical and social implications: The practical implications for the professionals and institutions involved in promoting the adoption of regular sport and exercise in society are about taking advantage of the potential of wearable technology such as smartbands. The present study finds that the use of gamification for encouraging people to adopt regular physical activity is more effective for women than for men, and for older people than for younger users.

Originality/value: The findings of this study provide a better understanding of whether gamification is an appropriate strategy for helping participants to perceive themselves as

having greater self-efficacy in their chosen sport or exercise, taking into account the moderating effect of participant gender and age.

Keywords: Gamification, smartbands, motivation, fun, perceived self-efficacy, moderating effect.

1. Introduction

In advanced societies, it is common for lifestyles to become increasingly sedentary—a phenomenon that combines with a progressively ageing population (WHO, 2014). This scenario has become one of the most pressing challenges to be addressed by developed countries, due to the major social and economic consequences to which it can lead (Warner, 2019). There are many campaigns led by public bodies in an attempt to promote practices that encourage people to remain active as they get older. As part of these efforts, there is a call for practical tools to help the population acquire healthy lifestyle habits, including playing sports or exercising regularly (Penedo and Dahn, 2005; Warner, 2019).

Efforts to increase take-up of sports and exercise among the population requires the variables that are critical in changing user behavior to be identified, such as perceived self-efficacy, for instance. Perceived self-efficacy is concerned with the person's belief about how capable they are of performing given tasks (Bandura, 1982), and it therefore fundamentally affects the actions they take or intend to take (Bandura, 1986, 1989, 1998). In the sports and exercise context, perceived self-efficacy contributes to the promotion of greater physical activity and health improvements (Bandura, 1998; Dadaczynski *et al.*, 2017) and is considered one of the best predictors of physical exercise performance (Litman *et al.*, 2015).

One strategy that can help increase perceived self-efficacy is gamification (Dadaczynski *et al.*, 2017; Richter *et al.*, 2015). In the realm of sports, currently the

potential offered by smart devices (wearable technology) is particularly striking (Ha *et al.*, 2017, 2015; Kim and Chiu, 2019; Song *et al.*, 2018; Tu *et al.*, 2019), such as smartbands (Castelnuovo *et al*., 2014; IPSOS, 2017, 2020). Smartbands typically offer gamification features designed to generate motivating and fun user experiences and thus facilitate change and/or the adoption of new habits (Hamari *et al.*, 2014).

Currently, the use of wearable devices is widespread and attracts both males and females and users of different ages (Kim and Chiu, 2019; Janssen et al., 2017). Although the literature demonstrates that men present a higher degree of adoption of technology than women (Li and Kirkup, 2007) and that young people present a higher degree of adoption than older users (Kim and Chiu, 2019), the data specifically relating to the adoption of wearable technology for sports practice indicate that the gender division is practically non-existent and that the age gap is narrowing significantly (IPSOS, 2017, 2020). In view of these data, it is interesting to identify strategies based on the use of wearable devices (such as gamification) that help promote regular physical exercise and sport among the different groups in society.

In the sports context, empirical studies have been conducted to establish the effects of gamification (e.g. Hamari and Koivisto, 2014, 2015a, b). While these studies focus on the factors that facilitate the adoption and use of gamification and its influence on user behavior, they do not analyze the effects of using game-based features on one of the key variables in taking up sports or exercise: perceived self-efficacy. The literature affirms that well-designed gamification should take the user perspective into account (Eppmann *et al.*, 2018). Therefore, given the effort required to keep up any exercise or sport routinely, the present study seeks to demonstrate that well-designed gamification features do indeed create a user experience that is intrinsically motivating (based on the

dimensions of competence, autonomy and relationship) and also fun (Hamari *et al*., 2014; Merhi, 2016).

The effectiveness of gamification as a mechanism to achieve perceptions of greater self-efficacy may be influenced by the characteristics of the users themselves, such as the socio-demographic variables of gender and age (Conaway and Cortés-Garay, 2014; Haro-González *et al.*, 2018; Hazari, 2018; Janssen *et al*., 2017; Song *et al*., 2018). In the sports context, it has been observed that women are less active than men and that older people are less active than younger people (European Commission, 2018; Spanish Ministry of Education, Culture and Sport, 2018).

The literature also finds that people use different models of motivation and present different degrees of determination to remain firm in their decisions and/or different learning capabilities vis-à-vis a given task, depending on their gender and age (e.g. Kautonen *et al.*, 2011; Lévesque and Minniti, 2006; Whittingham, 2017; Zhang *et al*., 2009). It is therefore interesting to question whether an individual's experience of participating in gamification may be more or less effective (in terms of its impact on their perceived self-efficacy in regular exercise or sporting activity), depending on the gender and age of the participant.

In view of the above, the purpose of this study is to analyze whether gamification is an appropriate strategy for helping participants to perceive themselves as having greater self-efficacy in their chosen sport or exercise, taking into account the moderating effect of participant gender and age. More specifically, the specific objectives of this research are: (a) to examine whether participation in a gamification program using smartbands generates an internal experience for the individual that is intrinsically motivating (considering the dimensions of competence, autonomy and relationship) and fun; (b) to establish whether the experience of participating in gamification helps participants to

perceive greater self-efficacy when practicing sport or exercise; and (c) to analyze the moderating effect of the variables ‘gender’ and ‘age’ on the relationship between the experience of participating in a gamification program and perceived self-efficacy.

2. Literature review and hypotheses

2.1. Perceived self-efficacy and participation in sports or exercise

The literature shows that there are numerous elements that may influence people to take up physical exercise or sport and maintain the habit of regular practice (Wang et al., 2018). Among these elements are the socio-cultural environment surrounding the individual, the prevalent economic conditions, sports traditions among regions and communities and the priorities established by local authorities, as well as the degree of economic development, consumption, and local authority support for sport-related leisure in the region in question (Wang et al., 2018). It is also useful to consider the preferences that different profiles of people may present when exposed to the offer of sports centers (Haro-González et al., 2018). For this reason, if the population is to be encouraged to practice sport and/or physical exercise as part of their healthy habits, it is essential that there are policies in place to ensure the availability of sports facilities and equipment for the general public, in addition to programs that promote sports.

The literature has also demonstrated that the provision of sports facilities, equipment, and programs—or the lack thereof—can influence the decisions people on whether to practice physical exercise and/or sport or not (eg: Wang et al., 2018). While such external conditioning factors will result in individuals having certain options for practicing regular physical exercise and/or sport, it is equally necessary to study the internal factors specific to each person—those that are under their control—in terms of how they, too, influence the degree to which individuals adopt a regular physical exercise practice and/or a sport. One such internal factor is self-efficacy.

Self-efficacy can be defined as the individual's perception or personal belief about their ability to perform certain tasks in pursuit of the objectives set or to deal with a given situation (Bandura, 1977, 1982). In the specific field of sport, self-efficacy in exercise has been defined as how confident the individual feels about his or her ability to handle specific exercises in specific circumstances (Sallis and Owen, 1998).

The perception of self-efficacy is experienced on the basis of several criteria or sources of information: (a) the level of performance achieved or experiences of complete mastery; (b) the observed performance or achievement of others, or vicarious experiences provided by social models; (c) verbal persuasion and social influences (so-called social persuasion); and (d) the individual's psychological state (Bandura, 1977, 1982, 1989).

Self-efficacy has therefore been found to be a fundamental variable that defines the behavior of individuals, and has been shown to contribute significantly to both behavioral intention and current behavior (Ajzen, 2002). It has also been affirmed that, given that people's day-to-day lives can sometimes be full of difficulties and challenges to deal with, to achieve the desired goals and a good level of well-being, the individual needs to have an optimistic sense of self-efficacy (Bandura, 1989).

Therefore, to build the habit of routine exercise or sporting activity, it is important to consider perceived self-efficacy because this will be fundamentally affecting the actions the individual wants to take (Bandura, 1986, 1989, 1998). In the context of sport, a low perception of self-efficacy may deter the individual from their intention to keep up the routine. Hence, self-efficacy has been linked to the promotion of greater physical activity and improved health (Bandura, 1998; Dadaczynski *et al*., 2017; Litman *et al*., 2015; Sallis and Owen, 1998), and is now recognized as one of the best predictors of performance in physical exercise and sport (Litman *et al*., 2015). People with a high level of perceived self-efficacy work harder and recover more quickly from failures, persevering in working

toward their goals (Schwarzer *et al*., 1997). In turn, strong perseverance generally produces high-performance achievements (Bandura, 1982).

Given that perceived self-efficacy is a variable that can help individuals to produce the dedication and effort necessary to keep up routine exercise or sporting activity, it is of interest to identify strategies that may contribute to achieving greater perceived self-efficacy, and to consider gamification as a possible means of enhancing this self-perception.

2.2. Gamification and its effect on perceived self-efficacy

The most well-known and widely-applied definition of gamification is that of Deterding *et al.* (2011), who described it as "the use of game design elements in non-game contexts." The elements of a game that commonly feature in gamification are patterns, objects, models, principles and methods. Gamification is often proposed as a solution to encourage certain desired behaviors, such as exercising, sustainable consumption or learning. The main difference between games and gamification is that the latter is commonly used to make progress toward objectives beyond the game (e.g. supporting healthier lifestyles, greener consumption or better financial decisions), while playing games is considered purely autotelic or intrinsically motivating (Hamari and Koivisto, 2014).

Another very common definition is that of Huotari and Hamari (2016), who formulate their view based on Service-Dominant Logic (Vargo and Lusch, 2004), as follows: "Gamification refers to a process of enhancing a service with affordances for gameful experiences in order to support users' overall value creation." According to Hamari *et al.* (2014), this definition focuses on the user's experience when they participate in gamification, which is considered key to the design and use of gamification features.

The approach proposed by Huotari and Hamari (2016), which positions the concept of gamification within Service-Dominant Logic, on the basis that the gaming literature and the service-marketing literature are complementary. They start by considering the design elements of games as services, and by approaching games as if they were service systems comprising operant and operand resources. Thus, the games are co-produced by the game-creator (who offers the service), and the players are always co-creators of value. The skills of the players, their previous experience and their knowledge become resources contributing to the game and giving rise to a unique and subjective experience (Huotari and Hamari, 2016).

From this perspective, it is the experience of the participant that makes it possible. To distinguish when a program can genuinely be understood as an example of gamification (in which the participant must find the experience intrinsically motivating and fun) and when it is merely a collection of different elements of a game (such as points, rankings or badges) in which no such experience associated with gamification is generated.

Seaborn and Fels (2015) conduct a comprehensive review of the research performed in this field, and find there is a need to focus on how the participant *experiences* a gamification activity, because the results of most applied research in this field have been based on systems of game elements, and not on the experiences of users while participating. Eppmann *et al.* (2018) reach the same conclusion, as do Tu *et al.* (2019). The former analyze gamification based on a review of the literature from the gaming area, highlighting the perspective of the participant, while the latter analyze the influence of certain game elements on user behavior. This suggests that, to progress in the study of the effects of gamification use, it is essential to adopt the perspective of the participants themselves and to identify the key variables that influence the experience in the context

of exercise or sporting activities, where intrinsic motivation is essential (competence, autonomy and relationship), as is a sense of fun (feeling of happiness, enjoyment and momentary entertainment) (Merhi, 2016).

Increasing a person's intrinsic motivation will lead them closer to a deep commitment and major satisfaction (Deci *et al.*, 1999). Intrinsic motivation, in this context, refers to playing for the pure enjoyment of doing so (Ryan and Deci, 2000), for the hedonistic value of the game. Intrinsic motivation can be heightened through the use of game mechanics, which attract players to the enjoyment of the activities in which they participate.

According to the theory of self-determination, there are three groups of intrinsic reward groups: competence, autonomy and relationship (McGonigal, 2011; Ryan and Deci, 2000; Schell, 2008), as follows:

Competence. Normally, this includes the player's feeling of having the ability to master the system and achieve goals. Instant feedback, progression, leaderboards and levels all contribute to motivation born out of a growing sense of competence (Csikszentmihalyi, 2008). Similarly, the leisure motivation also includes elements of challenge and expertise (Beard and Ragheb, 1983). Through gamification, participants can build competence through practice and enjoy the feeling of achievement and of mastering the game system.

Autonomy. This is the personal will to act (McGonigal, 2011; Schell, 2008). Profiles, avatars or control of privacy are all elements that can be provided in the game, the idea being that gamification offers options through which the participant can achieve a sense of being able to choose freely.

Relationship. Gamification involves interacting and connecting with other players (Schell, 2008). Groups, messages, blogs, chat functions, and connection with social

networks are habitual representations of relationship (McGonigal, 2011). The intrinsic reward of 'relationship' in gamification experiences can lie in the fact that the participant can interact with co-players and share their gaming experiences with other friends who are also connected via the gamification system.

The fun element refers to a specific state of happiness or enjoyment generated by a pleasant experience (Ahn *et al.*, 2007; Liu *et al.*, 2011; Merhi, 2016), beyond the specific result achieved out of that experience (Holbrook, 1994). This feeling should be considered a facet of participation in games (Ha *et al.*, 2007).

In the context of gamification, fun is understood as spontaneity in users' interaction with the gamification system (Hamari and Koivisto, 2015a; Martocchio and Webster, 1992). In other words, fun refers to users' exploratory and creative behavior when interacting with the system (Hamari and Koivisto, 2015a). The generation of fun helps the participant persevere with the longer-term behaviors promoted by the gamification experience (Deci *et al.*, 1999; Deci and Rygan, 1985; Wu and Liu, 2007). In fact, fun influences how consumers respond to the presentation of a product innovation (Aroean, 2012), and it also increases people's interest in exploring new things or products (Ghani and Deshpande, 1994; Hoffman and Novak, 1996).

Although gamification has shown increasingly common in contexts such as the adoption of healthy habits through exercise or sports (Hamari and Koivisto, 2014, 2015a, b), previous studies focus on the factors that facilitate the adoption and use of gamification features and their influence on the behavior of the participant, but they do not analyze the participant's experience of the gamification itself.

One exception in the literature, that of Tu *et al.* (2020), finds that the use of relationship-oriented gamification is more beneficial in maintaining habitual sports practice than the use of fun-oriented gamification. However, despite this notable

contribution, it must be acknowledged that the experience of participating in gamified programs should provide the participant with an intrinsically motivating experience (which includes the need to relate to others, along with autonomy, competence, and fun). It is this dearth of research examining the participant's experience that the present study seeks to address.

According to the extant literature, a well-designed gamification program is considered to generate more significant responses in terms of behavioral change among participants, compared to other options that can be considered merely a collection of game elements or that meet participants' needs only partially. The literature finds that a well-designed gamification experience must be intrinsically motivating (through the variables of competence, autonomy and relationship) and generate a state of fun (Hamari *et al*., 2014; Merhi, 2016) among the participants. Based on the above, the following hypothesis is proposed:

H1: The dimensions of competence, autonomy, relationship and fun are dimensions of the experience of participation in a gamification program.

Self-efficacy is very important in the adoption of regular sports or exercise practice because people with a low perception of self-efficacy may avoid carrying out a given task or settle for inferior results, while those who perceive a high level of self-efficacy are able to get fully involved in the activity, make more effort, spend more time engaging with it and take on greater challenges (Bandura, 1989; Banfield and Wilkerson, 2014; Schwarzer *et al*., 1997). The higher the level of perceived self-efficacy, the greater the effort invested by the individual, who is convinced of being able to reach his or her goal (Wood and Bandura, 1989).

The literature notes that a person's perception of self-efficacy can be improved through gamification (Dewett, 2007; Pavlas *et al*., 2010; Richter *et al*., 2015). Bandura (1986)

notes that one's perception of self-efficacy depends on several factors, such as the difficulty of the task, the amount of effort invested in performing it, the amount of external help one has received to perform it, the characteristics of the situation in which it is performed, one's state of mind when performing it and one's physical state at the time.

Gamification employs various elements that can contribute to improving perceptions of such aspects, as it provides continual feedback that motivates the participant via their use of features such as: progress bars, points, challenges, badges, leaderboards, levels, achievements and the means to share these achievements in social networks (Bandura, 1982; Scheiner and Wit, 2013).

One's perception of self-efficacy is also determined by the objective one sets, the level of commitment to this objective and the result one expects to achieve based on the effort expended (Bandura, 1989). On this point, it is further proposed by the literature that, to intensify self-efficacy in a gamification program, to start with the player must master the easiest challenges, and then, as the game progresses, the level of difficulty must gradually increase. This sense of progress heightens the user's perception of self-efficacy (Scheiner and Wit, 2013). The analysis of intrinsic interest, based on the theory of self-determination (Deci and Ryan, 1985), holds that the interest grows out of the perceived self-efficacy the user gains from their performance in attempting to attain certain goals (Bandura, 1982).

Meanwhile, fun has also been found to be manifested through the perception of self-efficacy (Dewett, 2007; Pavlas *et al*., 2010) and it can be fostered by participating in a gamification experience. In the context of practicing exercise or sports, the literature finds that individuals who experience greater fun achieve a higher level of perceived self-efficacy, identifying a positive relationship between the two variables (Dishman *et al*., 2005; Gençay *et al*., 2016; Hu *et al*., 2007; Robbins *et al*., 2004).

Based on these findings, it seems logical to assume that the experience of participating in a gamification program will contribute to the perception of greater self-efficacy among users. The following hypothesis is therefore proposed:

H2: The experience of participating in a gamification program exerts a positive and significant influence on perceived self-efficacy.

2.3. The moderating effect of the socio-demographic variables of the participant

Literature specializing in sports has examined different types of variable that influence participant behavior, such as motives (e.g. health, freedom, social experience, fun, and performance enhancement) (Borgers *et al.*, 2015), experience (e.g. both novice and experienced runners), consumer acceptance of wearable sports technology (e.g. Aksoy, Alan, Kabadayi and Gebze, 2020; Kim and Chiu, 2019) or socio-demographic characteristics (Hallmann and Wicker, 2012; Haro-González *et al*., 2018; Vos *et al*., 2014).

Among the socio-demographic variables, gender and age are considered critical in routine exercise or sporting activity (e.g. Greenwell *et al.* 2015; Hallmann and Wicker, 2012; Haro-González *et al.,* 2018; Molanorouzi, Khoo and Morris, 2015; Vos *et al*., 2014), in the use of fitness apps and watches (wearable devices) (Janssen *et al*., 2017), in gamification (Conaway and Cortés-Garay, 2014) and in perceived self-efficacy (Gençay *et al*., 2016, Schwarzer *et al*., 1997). However, there is no consensus in the literature regarding the effects of gender and age on different variables linked to sporting activity (e.g. Conaway and Cortés-Garay, 2014; Greenwell *et al*., 2015; Hazari, 2018; Janssen *et al*., 2017; Molanorouzi *et al*., 2015; Zurita-Ortega *et al*., 2018).

The literature does acknowledge that there are gender differences in terms of decision-making processes (Li and Chang, 2016; Zhang *et al*., 2009) and in the motivational strategies used to tackle new learning (Hederich-Martínez *et al.,* 2018; Whittingham,

2017). These differences are a reflection of the internal mechanisms that influence people's behaviors, including in relation to the adoption of habitual sporting practice (Zurita-Ortega *et al*., 2018). On this point, some researchers have identified gender associations with goal orientations—task orientation often being stronger among women (Erturan-Ilker, Yu, Alemdaroglu and Köklü, 2018; Litalien, Morin and Mclnerney, 2017). For instance, in the context of education, a task orientation is associated with intrinsic motivation for learning and tends to be expressed more strongly by female students (Keegan, Harwood, Spray and Lavallee, 2014). In the context of sports practice, Morris, Clayton, Power and Han (1995) found that achieving a good level of health was rated as being more highly motivating among females than males, while status was found to be more important for males than females.

More specifically, women tend to be oriented toward intrinsic motivation (which is emphasized by gamification), while men focus on more extrinsic motivation (which is more utilitarian in nature and geared to achieving more instrumental results). This scenario means that, before taking on a task, for women the level of effort (Hederich-Martinez *et al*., 2018), the level of achievement (Whittingham, 2017) and being able to relate to other participants (Whittingham, 2017; Zhang *et al*., 2009) are all more important than for men. Furthermore, they are all behaviors that are reinforced by participating in a gamification program, thanks to elements that remind the participant of their ability to make decisions related to their goals, obtain feedback about their level of achievement and enable them to interact with other participants, among other possible features. These elements will influence the person's intrinsic motivation and, as a consequence, can strengthen their perceived self-efficacy in practicing sport or exercising routinely. Therefore, on the premise that women are more orientated toward intrinsic motivation than men, the experience of participating in gamification could be more effective for

women than for men, leading to greater results of participation among women in terms of achieving greater perceived self-efficacy than men.

This calls for a greater understanding of the moderating effect of gender in the relationship between participation in gamification and perceived self-efficacy in routine exercise or sport. To date, the literature has not analyzed whether the effect of participation in gamification (measured from the perspective of how the participant experiences it) on perceived self-efficacy is moderated by the person's gender. It is, therefore proposed that:

H3: The effect of participating in a gamification program on perceived self-efficacy is different between the gender groups.

With regard to the question of age, it has been found that sports practice declines significantly with age (Casperson, Pereira and Curran, 2000; Guthold, Ono, Strong and Chaterrji, 2008). However, Donahue *et al.* (1980) and Dorfberger *et al.* (2009) found that participation in a sports or exercise program may have a greater impact on older than on younger participants.

According to the literature, age differences have been identified relating to decision-making processes and the various strategies that people employ to motivate themselves to practice sports regularly. In this regard, some researchers have identified that maintaining or improving physical appearance motivates younger adults to be physically active, because physical appearance is an important component in many societies and many cultures. In contrast, older adults are more involved with evaluating their lives and searching for meaning. The result of these evaluations shows that older adults can feel better and find greater meaning in their lives if they improve their physical fitness (Kolt, Driver and Giles, 2004; Renner, Spivak, Kwon and Schwartzer, 2007; Wilcox, Tudor-Locke and Ainsworth, 2002). Given that this evaluation process is a psychological task,

we predict that older participants will exhibit more, and deeper, concern for consequences related to the practice of sport and their psychological health than younger adults, which will lead to older people achieving greater intrinsic motivation than younger people.

More specifically in relation to the support that participating in a sport and exercise-based gamified program can provide, the following aspects that differentiate the behavior of younger and older people can also be considered. Older participants may be more receptive to such a program due to their increased developmental capacity for learning. In addition, it was found that, in older age, decisions requiring a high level of involvement are usually made more positively (Fayolle *et al.*, 2011), there is a greater reluctance to go back on decisions, once made (Kautonen *et al*., 2011; Lévesque and Minniti, 2006), and there is a greater level of engagement with the behavior being developed, even when the individual starts off from a poorer state of preparedness compared to that of other, younger people (Miralles *et al.*, 2017).

In sum, gamification is designed to generate a high level of intrinsic motivation, via dimensions such as competence and autonomy. These dimensions are linked to a greater involvement with the decisions adopted (a feeling that is reinforced when participating in a gamification program that includes elements that remind the participant of their ability to make and maintain their decisions), greater engagement and greater learning capacity relative to the activity undertaken (a feeling that is reinforced by participating in a gamification program that includes elements that provide feedback to the participant about their level of achievement in their chosen exercise or sporting activity). These internal experiences can ultimately lead the individual to achieve greater self-efficacy in that activity.

The moderating effect of age in the relationship between participation in gamification and perceived self-efficacy in routine exercise or sport therefore needs to be better

understood. The extant scholarship has yet to analyze whether a person's age moderates the effect of participation in gamification (measured in terms of how they experience it) on perceived self-efficacy. Based on this premise, it is proposed that:

H4: The effect of participating in a gamification program on perceived self-efficacy is different between younger and older people.

Figure 1 shows the set of relationships between the constructs addressed in our study and the moderating effect of the participant's gender and age.

3. Methodology

3.1. Population and sample

The study participants had to fulfill three conditions: being users of a smartband when practicing sports or exercising, not presenting any chronic health problems that might restrict their ability to practice sports; and they had to be resident in Spain. This last requirement was included to maximize the likelihood that, as residents, they would all have a similar level of easy local access to public facilities and programs designed to support regular physical exercise and sport (Ministerio de Educación, Cultura y Deporte, 2018).

Among the different smart devices available, smartbands stand out for their popularity (Castelnuovo *et al*., 2014; IPSOS, 2017, 2020). According to the latest statistics accessed for the present study, 19% of the population use a smartband when practicing sports, this being the country with the second-highest penetration of this type of device in the general population, behind only the United States. In terms of the gender divide in smartband use, this is practically non-existent, and the age divide is becoming increasingly small (IPSOS, 2017, 2020).

Participants were selected by means of an Internet user panel managed by Survey Sampling Spain S.L. (part of Survey Sampling International, or SSI). The rationale for

this choice was two-fold. First, SSI has won several awards for results and rigor in the market research field. The firm has over 30 offices in over 20 countries; it has 17 million panelists from 90 countries on its books; and, in 2016 alone, it successfully completed 40 million surveys across 60,000 projects. By controlling the characteristics of individuals within the sample, SSI has created an online sample that is consistent when measured by comparison with external benchmarks, including telephone sample studies. Second, the SSI panel comprises over 300,000 users in Spain.

In the present study, the final sample comprised 233 cases recruited in September 2016 via a self-administered questionnaire organized by an online panel. According to their socio-demographic characteristics (Table 1), the typical smartband user can be defined as an adult aged between 30 and 44 years, with higher education qualifications and paid work, this profile being similar to that of other studies focusing on the use of wearable devices for routine sporting activity (Kim and Chiu, 2019; Song *et al*., 2018). In terms of sports practice, the majority of the sample (59.04%) practiced regularly between 4 and 6 times a week; and, of these participants, 82.72% did so at moderate intensity. Finally, regarding the use of smartbands (Table 1), most of the sample had been using one for at least a month (83.75%), and they wore it every time (or almost every time) they played sport or exercised (80.46%). An average difference test was conducted for independent samples to verify that the length of time individuals had been using their smartband did not generate significant differences in the sample. Among the sample's favorite sports and forms of exercise were aerobics (such as walking, running or cycling) at a frequency of 3 to 5 days a week at moderate intensity.

3.2. Measurement scales

Based on the literature review, the variables that needed to be considered in the participant's experience of gamification were identified (Annex 1). These were intrinsic

motivation (competence, autonomy and relationship) and fun. To measure each of these variables, scales previously validated by the literature were used. To measure competence, autonomy and relationship, the scales developed by Lieberoth (2014) were used; and to measure fun, the scale proposed by in Hamari and Koivisto (2015a) was chosen. The perceived self-efficacy variable was measured on the scale proposed by Jones (1986).

Individuals responded on a 7-point Likert scale, where 1 equaled 'entirely disagree' and 7 equaled 'entirely agree'. The questionnaire also included the socio-demographic variables of gender and age.

3.2. Analysis strategy

Figure 2 shows that 'the experience of participating in a gamification program' is a second-order construct made up of the dimensions 'Competence', 'Autonomy', 'Relationship' and 'Fun'. Meanwhile, 'perceived self-efficacy' is a first-order construct, while the variables that reflect the interaction effect with the gamification experience ('Experience of participating in a gamification program' x 'Gender' and 'Experience of participating in a gamification program' x 'Age') are directly observable.

The structural equation modeling (SEM) methodology was deemed the most appropriate, given that the research model includes latent variables that are not directly observable (Hair, Black, Babin and Anderson, 2014, pp. 541–591). SEM is a multivariate analysis technique widely used for this type of test and it brings together methodological techniques that have been perfected over time and developed in various disciplines (Hair et al., 2014, pp. 541–591). SPSS 21 and AMOS 21 data analysis software was therefore used to examine descriptive statistics and the factor structure of the proposed scales, and the hypotheses were tested using SEM. SEM allowed us to perform validation tests on the measurement scales (which requires the adequate reliability and validity of the scales

to be shown, to provide empirical evidence in relation to H1) and then test the relationships between the variables of the research model (to provide empirical evidence in relation to H2, H3 and H4).

First, the psychometric properties of the proposed model were estimated and evaluated. Since the Chi-square test of multivariate normality of the variables included in the proposed model was significant, it was appropriate to undertake the estimation using the maximum likelihood method combined with the bootstrap method (Yuan and Hayashi, 2003). Even applying this technique, the Chi-square value remained significant. The fact that the results of the Chi-square were significant was due to its being sensitive to sample size. In this case, a valid reference was the value of Normed Chi-square, which gave a value of 2.46 and was within the limits recommended by the literature. As regards the overall fit of the model, the RMSEA value (0.07) was acceptable, below the recommended limit (Figure 2). The incremental fit measurements CFI (0.95), IFI (0.94) and TLI (0.95) were also acceptable. In its totality, the fit of the model can be said to be acceptable (Figure 2).

4. Results

The dimensions included in a variable reflect the composition of the scale when their validity and reliability can be confirmed (Devlin *et al.*, 1993). To achieve this, the standardized loadings, the individual reliability coefficient (R^2), the confidence interval and the significance of each of the items included must be analyzed (Table 2). The results led to the items COMPETENCE 3 and AUTONOMY 3 being eliminated as they presented individual reliability (R^2) lower than the minimum reference value of 0.50. These items were thus excluded as this helped to achieve an improved statistical fit for the model (Bagozzi *et al.*, 1979). Once these two items had been eliminated, the individual reliability of the rest of the items included in the model was above or close to

the reference threshold of 0.05 (Hair *et al*., 2014, pp. 541–591). On this basis, the refining process was then stopped.

We then verified the internal consistency of each of the dimensions on the first-order scale. Consistency can be measured with composite reliability and variance extracted. In both cases, the values obtained were acceptable, as they were close to (or above) the reference value of 0.70 for composite reliability and 0.50 in the case of variance extracted (ibid.) (Table 3), with the exception of the 'Autonomy' dimension, which presented composite reliability and variance extracted below the reference values. Those dimensions showing a value lower than the recommended levels were not removed from the model, given that their removal would not have significantly improved the overall fit of the model and could have adversely affected the validity of the content (ibid.). The results obtained indicated that the set of first-order dimensions proposed to measure each one of the variables (competence, autonomy, relationship, fun and self-efficacy) was valid, given that it enabled the existence of adequate validity and reliability to be confirmed.

As regards second-order constructs, Table 2 shows the standardized loadings, individual reliability, confidence intervals, and the level of significance for each of the first-order dimensions included, as well as the composite reliability and variance extracted for second-order constructs. It can be observed that the 'Relationship' dimension presents individual reliability levels close to literature reference values. Similarly, the composite reliability and variance extracted values are above the acceptable minimum. Hence, overall, these results indicate that the second-order scale referring to the experience of participating in a gamification program presents a high level of internal consistency.

Finally, the confidence interval test was performed, to check the existence of adequate discriminant validity between the first-order dimensions. According to this test, for discriminant validity to be proven, the value '1' should not be found in the confidence interval of the correlations between the different dimensions of the same level of analysis (Anderson and Gerbing, 1988). The test produced a satisfactory result in this regard.

Overall, the results show that 'Experience of participating in gamification' is reflected via a second-order construct comprising the dimensions 'Competence', 'Autonomy', 'Relationship' and 'Fun'. This result provides empirical support to H1.

Once the adequacy of the scales used for the measurement of each of the variables had been established, the averages of the items used to measure the interactions between the user's experience of the gamification program and the socio-demographic variables (gender and age) were calculated. To avoid multicollinearity, we focused on the variable ' Experience of participating in a gamification program' and its respective averages (Cohen *et al*., 2003, pp. 266–7). On the basis of these results, the following aspects are worthy of note:

H2 proposes that how the user experiences their participation in a gamification program exerts a positive influence on perceived self-efficacy. The results show a statistically significant relationship ($p<0.01$). Furthermore, the effect detected is quite marked (0.71), with a confidence interval of between 0.48 and 0.86. Therefore, there is statistical support for this hypothesis and it can be concluded that participation in a gamification program has a positive effect on perceived self-efficacy (Figure 2).

There are two significant interaction effects on perceived self-efficacy. Specifically, the coefficient of the interaction between gender and the experience of participating in a gamification program is equal to 0.15 ($p<0.01$), meaning that the experience of participating in a gamification program will have a greater influence on perceived self-

efficacy among women than among men. Meanwhile, the coefficient of the interaction between age and participation in gamification is equal to 0.12 ($p<0.01$). This implies that the experience of participating in a gamification program has an increasing influence on perceived self-efficacy as age rises. These findings provide empirical support for H3 and H4 (Figure 2).

5. Discussion

One of the major challenges faced by advanced societies is the growing sedentarism of the population, which calls for mechanisms to help people adopt habits of regular physical exercise (WHO, 2014; Warner, 2019). The present study offers insights into the use of gamification as such a mechanism—an approach that encourages the adoption of sports and exercise as a regular habit through the potential of smart devices (such as smartbands), which include gamification features (Kim and Chiu, 2019; Song *et al*., 2018).

Gamification techniques have been pervasively adopted in many industries, including the sport industry (Tu *et al*., 2019; Baptista and Oliveira, 2017; Hamari and Koivisto, 2015a; Müller-Stewens, Schlager, Häubl and Herrmann, 2017). In the present study, the participant's experience of a gamification program was analyzed and its dimensions identified, along with its effect on perceived self-efficacy, which is considered a key variable and a good predictor of the adoption of regular sports or exercise habits (Dadaczynski *et al*., 2017; Litman *et al*., 2015). The moderating effect of gender and age on the effects of participating in the gamification experience on perceived self-efficacy was analyzed.

Specifically, most of the current studies mainly focus on whether or not gamification can help increase participation in sport and exercise activity. Studies dealing with health management have even provided strong empirical evidence suggesting that gamified

wearable sport devices can promote physical activity or sport participation more effectively, compared with other programs without game elements (e.g. Chung, Skinner, Hasty, and Perrin, 2017; Hamari and Koivisto, 2015a; Lee and Cho, 2017). However, these studies have not addressed the potential difference in effectiveness from the perspective of the user and their experience of participating in a gamified program.

In the present study, it can be drawn is that participation in a gamification program generates an experience that is intrinsically motivating (comprising the dimensions of competence, autonomy and relationship) and fun. This contributes empirical evidence to the theoretical approach proposed by Merhi (2016). Specifically, our study found that a gamified program can successfully create intrinsically motivating and fun experiences. These results are consistent with the previous literature in the sense that both motivation and fun have been found to be very important elements for sports or exercise (e.g. Molanouruzi *et al*., 2015; Zurita-Ortega *et al*., 2018) and, according to the present study, are component factors of the experience of participating in a gamified program. This result contributes by providing a deeper understanding of the role of gamification in helping consumers to stay physically active in their daily lives, and the internal mechanisms it employs to achieve successful results.

Second, the present study analyzed whether the use of gamification can be considered an adequate strategy for participants to perceive greater self-efficacy when they practice sports or exercise. Perceived self-efficacy is considered a powerful variable in relation to the intention to undertake sport or exercise. The results show that the experience of participating in a gamification program positively influences perceived self-efficacy, demonstrating the suitability of gamification in terms of its capacity to foster healthy habits of regular activity.

Although the antecedents to maintaining the practice of sport or exercise are highly complex (Standage, Gillison, Ntoumanis and Treasure, 2012), one promising approach is to focus on intrinsic motivation and fun because this is a key factor that influences individuals' initiation and maintenance of behavior (Hagger and Chatzisarantis, 2008). Participation in a gamified program not only affects the practice of sport or exercise itself, but is also a critical factor in keeping that activity up consistently, through intrinsic motivation, as determined by self-determination theory (André and Dishman, 2012; Molanouruzi *et al*., 2015). These findings are in line with those of Dewett (2007), Pavlas *et al*. (2010) and Richter *et al*. (2015) in other spheres of application. The present results also provide added value to the work of Dishman *et al*. (2005), Gençay *et al*. (2016), Hu *et al.* (2007) and Robbins *et al.* (2004), as these authors study only fun as an antecedent of perceived self-efficacy.

Finally, the literature acknowledges the importance of using socio-demographic variables to segment the population and identify the most advantageous actions with respect to each sub-group. Among the possible socio-demographic variables, gender and age stand out because of their impact on sport- and exercise-adoption. As such, they are variables of great interest in the literature, as they enable the identification of segments (such as women and older adults) for whom the literature calls for greater scholarly attention (e.g. Ferrand, Nasarre, Hautier and Bonnefoy, 2012; Molanouruzi *et al*., 2015; Stephan, Boiché and Le Scanff, 2010; Zurita-Ortega *et al*., 2018). In this paper, the moderating effect of the gender and age variables on the relationship between the individual's experience of gamification and perceived self-efficacy has been shown.

Regarding gender specifically, the results show that the outcomes derived from participating in the gamification experience are more effective for women than for men—a finding that is in line with previous research that indicated that women are more oriented

toward intrinsic motivation than men. These previous studies also found that women give special importance to the level of effort required (Hederich-Martinez *et al*., 2018), the level of achievement (Whittingham, 2017) and relationships with other participants (Whittingham, 2017; Zhang *et al*., 2009). In sum, these studies indicate that, given that women tend toward intrinsic motivation (Stephan, Boiché and Le Scanff, 2010; Zurita-Ortega *et al*., 2018), gamified programs are likely to have a greater effect on them than on men. The present study goes a step further by testing the effect of these gamified programs on self-efficacy and demonstrating that their greatest effect indeed does occur among women.

Turning to age, in relation to the older adult collective, as we have seen there is a tendency to abandon sport and exercise as the years go by (Ferrand, Nasarre, Hautier and Bonnefoy, 2012; Molanouruzi *et al*., 2015). In other words, older people present a low level of adherence to routine sports and exercise; and this, together with the progressive aging of the population in advanced countries, renders it more necessary than ever to identify effective strategies for encouraging older people to take up regular sports or exercise (WHO, 2014; Warner, 2019).

The literature also shows that the practice of sport or exercise among older people is linked to deeper and more intrinsic motivations, compared to those of younger people (e.g. Kolt, Driver and Giles, 2004; Renner, Spivak, Kwon and Schwartzer, 2007). As participation in a gamified program has been shown to affect intrinsic motivation (e.g. Hamari *et al*., 2014), and older people present greater intrinsic motivation, the present study contributes to the literature by verifying that gamification exerts a greater effect on perceived self-efficacy among older people. This research further contributes by showing that characteristics more typical of older people—such as taking high-involvement decisions more positively (Fayolle *et al*., 2011) or greater engagement in the newly-

acquired behavior, even when starting out from a weaker position to begin with, compared to younger people (Miralles *et al.*, 2017)—contribute to being more receptive to the positive outcomes of the gamification experience.

These results highlight the appropriateness of gamification for these two collectives, women and older people, given that it can contribute to their perception of greater self-efficacy, which in turn will help them build their intention to sustain their efforts in practicing sport and exercise habitually. Identifying the factors that contribute to increasing the adoption of sports or exercise among these collectives is important, since it helps to guide future lines of research dealing with the development and design of intervention programs to improve sport or exercise take-up across the population.

5.1. Theoretical implications

The literature shows an interest in better understanding the effectiveness of gamification in helping achieve behavioral change among participants (e.g. Hamari *et al.*, 2014; Tu *et al.*, 2019). More research is required to show the effects of gamification in specific areas (e.g. Hamari *et al.*, 2014; Seaborn and Fels, 2015; Tu *et al.*, 2019), such as the adoption of sports and exercise habits. When the design of a gamification experience is analyzed in the context of sports or exercise, rather than focusing only on the game elements, it is essential to evaluate the degree of intrinsic motivation and fun perceived by the participant.

The results of this study highlighted that participation in gamified experiences can help the population to adhere to sports or exercise activity (by achieving greater perceived self-efficacy), and that the level of adherence is greater among those groups within the wider population that typically present fewer habits of sport or exercise practice—that is, women and older adults.

5.2 Implications for practitioners

The results of this study offer some interesting implications for individual users and for those professionals and institutions involved in promoting the adoption of, regular sport and exercise in society. The latter, for example, need to identify strategies to make the experience of practicing sports more meaningful for users (Cepeda-Carrión and Cepeda-Carrión, 2018; Molanouruzi *et al*., 2015; Zurita-Ortega *et al*., 2018). One possibility proposed in this study is to take advantage of the potential of wearable technology such as smartbands.

First, in terms of the implications for consumers, sustaining participation in sporting activity or exercise can reduce health risks and increase their well-being (Kumar, Manoli, Hodgkinson and Downward, 2018). However, although consumers are well aware of the benefits of exercising, many of them fail to persist. To address this, some consumers wear a smartband (or a similar wearable devices) to help them stick to exercise and achieve their personal health goals.

The results of this study indicate that the choice of gamified wearable devices should respond to the intrinsic motivations of each person and their sense of fun. That is, given that participation in a gamified experience affects the intrinsic motivation and fun of the participant, and that intrinsic motivation changes, among other factors, according to age and gender, the consumer should choose their model of smartband, from all those available on the market, according to the possibilities that the device offers to achieve intrinsic motivation and fun.

Second, turning to the implications for professionals, as Rowe, Molanouruzi *et al.* (2015), Shilbury, Ferkins and Hinckson (2013) and Zurita-Ortega *et al.* (2018) noted, investigation is called-for into the work of professionals and institutions involved in promoting the adoption of regular sport and exercise in the population at large, to identify opportunities to engage consumers more effectively in participating in sport or exercise.

Findings from the present study suggest that it is of interest to examine gamification design in terms of its suitability, as an effective gamification experience requires more than simply a system that features game elements. In order to evaluate its effectiveness, the participant's perspective must be adopted, to ensure that the experience is capable of generating a sense of competence, autonomy and relationship, as well as fun. This criterion is useful for those responsible for gamification programs, because it allows them to test the suitability of the design. For instance, sport and exercise interventions should be orientated toward creating an intrinsically motivational and fun atmosphere that helps develop positive experiences of practicing sports or exercise (Molanouruzi *et al*., 2015; Zurita-Ortega *et al*., 2018). In this regard, the use of the options provided by smartbands contributes to generating feelings of autonomy (for example through the choice of exercises to be performed, their order, or their degree of difficulty), competence (for example, through the selection of the starting level for which the user shows a sufficient degree of mastery, and the feedback that the device can give the user as they achieve the objectives of the exercise session), relationship (via the possibilities the device offers users to share their achievements and interact with other participants of the sports program), and fun (based on novel features and surprises that the application can offer the user).

It has also been found that the use of gamification is an appropriate strategy for promoting routine sporting activity and exercise, via the variable of perceived self-efficacy. Therefore, if the aim is to design a campaign or program to promote healthy routine activity such as sport or exercise, the use of smartbands and their associated gamification would be a good option, as it can help participants perceive themselves as having greater self-efficacy in their sports or exercise routine, which fosters a greater intention to keep practicing the activity.

Finally, market segmentation has become a valuable instrument in planning appropriate market strategies, as it can help identify the most suitable programs for each target (Mok and Iverson, 2000). This is of major importance in the context of the present findings, given that the offer aimed at each target public could be adjusted to encourage even greater perceived self-efficacy in sports and exercise practice. Such an approach may make it possible to improve users' adherence to regular sports or exercise among collectives that typically present a low take-up in such physical activities (Molanouruzi *et al*., 2015; Zurita-Ortega *et al*., 2018).

It has been found that smartbands and their gamification features are capable of increasing perceptions of self-efficacy among groups that are characterized by being typically less active in the realm of sports and exercise, namely women and older people (European Commission, 2018; Spanish Ministry of Education, Culture and Sports, 2018). These results are highly relevant for the development of programs to promote take-up of routine sports and exercise among specific groups, based on gender and age, which can help rectify the imbalance among the collectives of women and older people. Both groups present opportunities to persist with sports or exercise, based on a well-designed gamified program that succeeds in encouraging intrinsic motivation and fun among participants. One example of this approach is the program developed in Andalusia (Spain) that is supported by smartbands, called 'Toward a Million Steps'. This program has succeeded in encouraging groups of people (comprising mainly women and the elderly) to adopt regular exercise (Junta de Andalucía, 2020). The success of the program has led to its implementation by the institutions and organisms charged with promoting the adoption of regular sport and exercise in the general population across the region of Andalusia from 2008 to the present day, with participation often exceeding 2,000 people in each annual edition.

5.3. Limitations and future lines of research

As with all empirical studies, this study presents certain limitations that may point to possible lines of research for the future. One such limitation is that only those variables considered to be the most relevant for the study's objectives were included in the research model. In this regard it would be of interest to study the moderating effect of other variables among the participants that may influence their perceived self-efficacy when practicing sports or exercise, such as their interests, lifestyle or the objectives they pursue when practicing sports.

On the one hand, it would also be interesting to identify the variables that may be relevant to individuals' development of a regular sports or exercise practice. These could include variables relating to socio-demographics, infrastructure, and environmental programs for sports practice, as well as those relating to the inspiration that other people who practice sports may provide.

On the other hand, while the empirical study was conducted on a population in which gender and age divides in the use of wearable devices are virtually non-existent or very small, it would be interesting to carry out this study in contexts in which there is a greater digital divide (gender- and age-based). This could determine whether the use of smartbands combined with gamification constitutes an adequate strategy with which to promote the regular practice of physical exercise and sport among different groups in society. Other studies could examine whether the use of smartbands together with gamification features may be useful in reducing the digital divide that may exist between genders and ages (in addition to any such divide that may exist in terms of practicing regular physical exercise and sport).

A further future line of research would be to approach the proposed research model in the context of another geographical area. Applying our model to other geographical areas

would enable us to corroborate whether it can be generalized more widely, together with the results obtained. This would contribute to extending the knowledge base regarding gamification and its application in the context of acquiring healthy sports and exercise habits.

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