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Does gamification engage users in online shopping?

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ABSTRACT

Since prior research has shown that engagement might exert positive effects on value creation and continuous purchase intention, this study aims to examine the influence of gamification on user engagement in e-commerce. An online consumer panel was used to collect data from 253 Spanish Amazon users. Principal component analysis was performed first to validate the scale through an exploratory analysis. Subsequently, partial least squares structural equation modelling calculations were performed to test the research model and hypotheses. This study found that gamification has direct effects on user engagement in e-commerce. In addition, the User Engagement Scale (UES) is presented as a valid and reliable instrument for measuring engagement in Spanish e-commerce. This research investigated and verified a five-factor structure of the UES; however, a reduction in its factors is recommended. Additionally, four key factors through which gamification exerts a direct influence were identified. Finally, specific marketing actions were proposed for application in e-commerce.

1. Introduction

In recent years, we have witnessed how e-commerce retailing has gradually gained acceptance, and an increasing number of consumers are choosing to make their purchases through this channel. Moreover, e-commerce has become a key contributor to the economy of many countries. Nevertheless, online shopping is still far from being the norm. Despite its prevalence among younger consumers, there is a considerable proportion of potential consumers who are not yet familiar with e-commerce (Soh et al., 2020) (see Table 1).

Although e-commerce continues to grow in popularity, coping with the intricacies of engaging inexperienced users or newcomers in online purchasing shapes a critical topic that concerns online sellers. Such concern becomes even more pressing in light of the shift that the retail industry has abruptly experienced due to the lockdown measures derived from the COVID-19 outbreak, which has permanently modified certain consumer behaviours (Briedis et al., 2020). Which practices or strategies online sellers use to achieve increased levels of consumer engagement with their e-commerce platform is a topic that has been scarcely examined. The purpose of this paper is to explore the extent to which gamification might exert a positive impact on users' engagement in e-commerce.

Gamification is known as the "use of game design elements in non-game contexts" to make a product, service or application more amusing, attractive and exciting (Deterding, 2011, p. 1). In recent years, gamification has become an innovative and promising tool that has been adopted very quickly in multiple sectors and applied in different contexts, such as education (Hakulinen et al., 2013; Domínguez et al., 2013), environment (Prestopnik and Tang, 2015), health (Jones et al. 2014; Hamari and Koivisto 2015), work (Gerdenitsch et al., 2020), marketing and advertising (Terlutter and Capella, 2013), teamwork (Vegt et al., 2015; Marlow et al., 2016) and crowdsourcing (Sigala, 2015; Rapp, 2020). The phenomenon of gamification has not gone unnoticed by companies that use electronic commerce (e-commerce) (Bittner and Shipper, 2014; Hamari, 2013; Hamari and Koivisto, 2015). Large companies such as Amazon, eBay, Nike, Samsung Nation, Teleflora and Gilt Groupe use gamification on their e-commerce platforms (NetworkNewsWire, 2018). Many of the following elements of gamification can be used to influence individuals' behaviour: points, levels, badges, leaderboards, competitive bidding systems, real-time feedback,

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Table 1
Sample Descriptive Statistics.

Characteristic	Value	Frequency	Percentage
Age	18–55	253	100%
Gender			
	Male	136	53.8%
	Female	117	46.2%
Education			
	High school diploma	17	6.7%
	College diploma	99	39.2%
	Master's degree	98	38.7%
	More than master's degree	39	15.4%
Make product reviews			
	Sometimes	192	75.9%
	Always	61	24.1%
Read product reviews			
	Never	2	0.8 %
	Sometimes	64	25.3%
	Always	187	73.9%
Reviews of other users			
	Never	67	26.5%
	Sometimes	136	53.7%
	Always	50	19.8%
Importance of reviews			
	Not at all important	4	1.6%
	Indifferent	16	6.3%
	Important	88	34.8%
	Extremely important	145	57.3%
Videogame Player			
	Yes	166	65.6%
	No	87	34.4%

challenges, progress bars, countdowns, epic meaning, and lotteries, among others (Chou, 2013). For example, Amazon employs a ranking by reviewers, basing reputation on the opinions of other users; eBay uses reputation points to position the best sellers; and other companies, such as Teleflora, use a loyalty system to reward the actions of their users, such as commenting, providing product reviews or responding to other users, with points (Chou, 2019a).

Gamification elements on e-commerce websites can be used to promote the generation of content and user loyalty. Due to gamification, users comment on products, provide reviews and share content. If we consider the specific ratios, gamification can lead to an increase in the number of comments on products, shared content, questions and answers, active users and repeat visits. Samsung Nation increased its customer product reviews by 500% and site visits by 66%, Teleflora increased traffic by 105% and conversion rates by 92%, and measurement of IBM's long-term engagement has shown a 299% increase in comments posted (Chou, 2019b).

This research is based on a study investigating Amazon's e-commerce website (www.amazon.es), which uses game elements to encourage the activity of its users. The volume of e-commerce in Spain is increasing yearly, and Amazon is a market leader. In 2017, Amazon grew by 23.6% compared to the previous year, reaching a turnover of 31,347 million euros according to ONTSI estimations (2018). The use of gamification within the scope of reputation will be studied by making product comments on the Amazon website. In accordance with several authors (Hennig-Thurau et al. 2004; Labrecque et al., 2013), reviewers participate in user rankings by helping the market altruistically while satisfying their personal motivations. Amazon introduces a public ranking system to acknowledge reviewer contributions and reward sustained excellent reviews. The contribution of reviewers before, during, and after the buying experiences is highly valuable (Ostrom et al. 2015), suggesting that knowledge of information about the reviewers is very important and can be achieved by gamification (e.g., ranking position and medals obtained).

Although gamification generally produces positive effects, the mere application of game mechanics does not necessarily translate into automatic increases in activity (Hamari, 2013; Xi and Hamari, 2019). Behavioural changes are not easy to achieve, given that individuals need time to internalize them (Loria and Marconi, 2021). In this sense, an engagement maintained over time is crucial for success (Fritz et al., 2014). Since previous research has shown that engagement can impact co-creation value (Wei et al., 2017) and purchase intention (Higgins and Scholer, 2009; Algharabat, 2018), e-commerce companies use gamification to increase engagement with their platform users (Razavi et al., 2012). According to M2 Research (2012), 47% of companies demand gamification services to achieve greater user engagement. Likewise, engagement has been acknowledged as a central element in regard to grasping the behaviour of users in advertising (Wang and Calder, 2009) and computer-based environments (Wiebe et al., 2014). During the development of interactive systems, it is essential to involve users and create technologies that facilitate their engagement (Overbeeke et al., 2003). The measurement of engagement is complex, and there is no unique or commonly accepted definition of this term since engagement depends on the approach taken. From the user's point of view, engagement is the quality of the experience, represented by the depth of an individual's investment while interacting with a platform (O'Brien and Cairns, 2016). From the consumer's point of view, engagement is represented by manifestations of behaviour that are promoted by motivational drivers (Van Doorn et al., 2010) or a psychological state derived after interactive, co-creative customer experiences with a focal object/agent that extends beyond the purchase (Brodie et al., 2011).

Over time, different authors have proposed different scales for the measurement of engagement. This research study adopted the scale proposed by O'Brien and Toms (2008), in which engagement is related to a user's experience of interacting with technology, using an application or using a computer system. Attributes, such as the functionality and appearance of the page and the ability of users to maintain their attention while interacting with the page, were considered. From the point of view of the companies, it might be interesting to study the engagement of users using online shopping platforms; however, this approach requires the use of an appropriate and reliable scale for the measurement of engagement. Using this approach, whether an e-commerce platform is well designed and provides a good user experience could be determined. Similarly, the elements needed to enhance a website and those in need of improvement could be identified. If users do not feel sufficiently engaged by a website, they leave the page more quickly, even without making a purchase.

One of the main innovations of this research is the analysis of the influence of gamification elements on global user engagement. This approach is novel since gamification is studied based on the reputation of reviewers rather than the simple accumulation of points for obtaining rewards, such as discounts or commercial advantages. Similarly, this study considers points, badges and classifications as a set, not separately. While engagement has been examined by academia (Javornik and Mandelli, 2013, Dwivedi et al., 2019), the extent to which gamification improves or affects user engagement is not yet clear, mainly due to the lack of a robust conceptual and empirical background (Suh et al., 2018, Koivisto and Hamari, 2019). This contribution is intended to expand the limited existing literature by providing results based on a scientific study. To measure user engagement, this research extends the existing work carried out by O'Brien and Toms (2008), O'Brien and Toms (2010), O'Brien and Toms (2012) and O'Brien et al. (2018) by validating their UES. In particular, the number of factors that ought to be incorporated will be reviewed to shed light upon the existing debate concerning this issue (Banhawi and Ali, 2011; Wiebe et al., 2014). At the same time, UES attributes will be verified in the context of Spanish e-commerce.

On the other hand, studies on gamification in e-commerce are still scarce. Koivisto and Hamari (2019) analysed 273 empirical studies concerning the results of gamification. A frequent approach has been the analysis of psychological outcomes, which has produced findings on the overall perceptions of using the gamification system, and only a minority (2.9%) of the reviewed papers on gamification have been

developed within the field of e-commerce/e-services. Therefore, this study aims to reduce this gap by providing empirical evidence of gamification's influence in the e-commerce field.

In summary, this study intends to determine whether the game features embedded in a platform affect the total engagement generated by the webpage and the specific elements affected. In the future, this knowledge could allow e-commerce pages to be better adapted by directing and prioritizing gamification towards factors that affect engagement.

2. Theoretical background

In e-commerce platforms, users behave as consumers by reading judgements written by other users (Zhang et al., 2014) and as reviewers by writing their own appraisals (Davis and Agrawal, 2018). Before making a purchase, individuals often read the opinions of others (Yang et al., 2009), and after a purchase, they have the option of writing their own reviews (Lee et al., 2013). The quality of the information provided can help increase the credibility of information search results (Zhao et al., 2020). Gamification features might enhance the user effect, as reviewers attain reputations through their degree of experience, while they are considered trustworthy sources of information (Schuckert et al., 2015). From the point of view of the reviewers, this shows a status achievement (Insley and Nunan, 2014). On the other hand, the possibility of providing product comments on e-commerce platforms is considered a value-creating engagement practice (Schau et al., 2009).

2.1. Gamification

Gamification seeks to establish a connection between functionality and engagement (Morschheuser et al., 2017). Similarly, gamification aims to enhance usability and satisfaction, create more enjoyable experiences and produce a positive business impact (Saha et al., 2012; Liu et al., 2017).

Gamification is frequently associated with the use of points, levels and classification tables (Zichermann and Cunningham, 2011;Hamari et al., 2014; Seaborn and Fels, 2015; Chou, 2015). However, many game elements are used, including levels, feedback, providing clear goals, challenges, progress, rewards, and themes (Cugelman, 2013). These gamification features have been applied in different sectors, including education and training, where game attributes have an impact on learning outcomes (Wilson et al., 2009), health and business (Johnson et al., 2016).

Gamified e-commerce applications include achievement systems, auctions, status, and game mechanics, such as competitions, feedback and collaborations. Thus, these applications usually include an array of gamification features commonly called PBL (points, badges and leaderboards) (Werbach and Hunter, 2012). Badges, rating tables (rankings) and public status are principally suggested to increase engagement and other user actions on the web pages of online retailers (Razavi et al., 2012).

In e-commerce, points are awarded to users as a reward for commenting on products, answering questions from other users and identifying the most truthful comments. The generation of new content by making comments on and offering recommendations for products can increase the engagement of the person performing these actions and those who seek more information on the web (Zhang and Lin, 2018). Obtaining points by users (due to evaluations received from other users) has social effects, such as improving status and reputation (Vassileva, 2012). Up to five-point systems can be used in gamification as follows: skill, reimbursable, experience, karma and reputation. The most complex system is the reputation point system (RPS), which is related to the integrity and consistency of the assessments made by a user (Zichermann and Cunningham, 2011). Numerous e-commerce sites, such as Amazon and Epinions, calculate a user's reputation as the average of his/her ratings. The Amazon RPS is based on the helpful votes received by users and the proportion of the usefulness of their comments. Amazon's ranking system employs proprietary algorithms to provide buyer feedback. Based on the usefulness of the answers and considering the number of opinions that have been written, the reviewers are placed in a classification. The user profiles include the user scores, badges obtained by their comments and their position in the ranking of opinions (classification table). On the Amazon site, 10,000 reviewers have been ranked (Amazon.es, 2019).

Another form of reward is the delivery of badges to users for interacting with the platform. Badges have been regarded as the blueprint of gamification and the main game mechanism within common gamified applications (Hamari, 2013). Attractive badges or points aim at enhancing an individual's wish to achieve the required goal to be rewarded through acknowledgement (Hamari and Koivisto, 2015). Badges stand as a symbol of a user's prominence or prestige within a system. Hence, badges might have diverse functions, such as the depiction of accomplishments, determination of users' integrity or representation of the reliability of the content that users provide. Amazon uses badges such as Top 1000 Reviewer, Top 500 Reviewer, Top 100 Reviewer, Top 50 Reviewer, Top 10 Reviewer, #1 Reviewer, and Hall of Fame Reviewer.

Finally, classification tables are lists of users ranked according to certain parameters (e.g., points or utility), which permit users to compare their position to others, stimulating competitiveness. In the context of online social communities, the inclusion of rankings as a part of an incentive system improves user contributions (Farzan et al., 2008).

With regard to the way in which the concept of gamification has been modelled, several authors have proposed compilations of recurring game design elements (Zichermann and Cunningham, 2011;Kapp, 2012; Robinson and Bellotti, 2013; Werbach and Hunter, 2015). Other authors have modelled gamification as second-order (multidimensional) constructs, including game mechanics (Huang et al., 2019), while others use game elements (García-Jurado et al., 2019; Bitrián et al., 2020). In line with such methodological approaches, we propose that gamification be modelled as a second-order construct shaped by three dimensions, namely, points, badges and leaderboards. Such dimensions form the so-called "PBL triad" (Werbach and Hunter, 2012), which includes elements to induce users into a continuous cycle of active participation. In our case, PBL game elements are included to reinforce the theory of their use in a unified way. Grouping them and validating this fusion will allow an application in future works in a unified and simpler way. It will also provide a stronger PBL foundation thanks to its empirical support.

In summary, the inclusion of PBL in a commercial setting implies certain game mechanisms, such as reward, rivalry, collaboration and feedback. Users can compare themselves with others through PBL and attempt to improve their reputation or status, which can affect users' motivation to promote better user experience and engagement (Harms et al., 2015) and, finally, their intention to use the web. In addition, gamification creates new forms of communities in which users share opinions and influence behaviours (Scheiner et al., 2017; Ramadan, 2018).

2.2. Engagement

Engagement has been studied in different academic social science disciplines. Specifically, engagement has been analysed in education, organizational behaviour, e-commerce, and video games, among others (Bañuelos et al., 2009, Whitton and Moseley, 2014, Mazzarol, 2015). In these disciplines, gamification helps students develop motivation and become more engaged with studying (Alsawaier, 2017) and help workers be actively engaged and entertained (Yang et al., 2017). In e-commerce, engagement is considered crucial to gain user participation on the web and collaboration in online communities (Ray et al., 2014; Cheung et al., 2015).

An increasing number of companies are implementing gaming practices and rewards to promote customer engagement (Gartner

Research, 2011; Hamari, 2013; Ashraf et al., 2016). Different researchers have studied engagement and its consequences on "consumers/customers", including the concepts of satisfaction (Bowden, 2009a), trust (Casaló et al., 2007; Hollebeek, 2011a; Hollebeek, 2011b), commitment, emotional link or attachment (Chan and Li, 2010) and loyalty (Bowden, 2009a; Bowden, 2009b). Of these concepts, commitment, empowerment and loyalty are prominent in online community contexts (Andersen, 2005; Schouten et al., 2007; Chan and Li, 2010). However, in the field of human–computer interaction, the concept used is "user engagement", which refers to how individuals interact with the technology that captivates them. Our research focuses on user engagement while using an online shopping website.

Usually, engagement represents a multidimensional concept comprising different dimensions that may vary across contexts (Hollebeek, 2011a; Hollebeek, 2011b). Authors often hypothesize a second-order engagement factor structure using the selected dimensions based on the existing literature (So et al., 2014; Dwivedi, 2015; Abbasi et al., 2017). In our case, it is intended to validate the determining elements of engagement, and once detected, it is important to know their behaviour in a grouped way. According to several authors, engagement includes the following components of the user experience (Wright et al., 2003): cognitive (Laurel, 1993), behavioural (Kappelman, 1995) and affective (Jacques et al., 1995). Regarding the affective component, engagement is defined as the "act of emotionally wrapping the user" (Jacques et al., 1995). According to the theory of the state of flow (Csikszentmihalyi, 1990), an individual is fully involved in the task at hand, and engagement is presented as a state of flow without control by the user. Other authors define engagement by focusing on the emotional, cognitive and behavioural connection that occurs when a user interacts with technology (Lalmas, 2013). According to O'Brien and Toms (2008), engagement is a consequence of this interaction. Their engagement model is based on aesthetics, the state of flow, the game, and theories of information interaction. This model is based on studies in the following four areas: educational software, search for information on the web, video games and online shopping.

According to with O'Brien (2016), user engagement is a feature of the user experience portrayed by the depth of an individual's investment while interrelating with a digital system. In a computer-mediated context, both pragmatic or instrumental features (referring to the usefulness and usability of a system) and noninstrumental features (hedonia or pleasure elicited by the use) exist. Pragmatic features have been widely used in the Technological Acceptance Model (TAM) (Davis, 1989) and its subsequent versions. It has been shown that positive responses to the pragmatic qualities of usefulness and usability are prerequisites for user engagement (O'Brien and Toms, 2010). Currently, objective and subjective measures are used to measure engagement. The objective measures are based on physiological metrics, such as brain and cardiovascular activity, breathing or certain movements (eye tracking, mouse tracking). The main advantage is that these measures are performed while the user interacts with the website. However, these measures can be difficult to interpret since different mental states can yield similar physiological readings (Bardzell et al., 2008). Other objective metrics are based on interactions and activity on the web. These metrics include indicators, such as the number of pages viewed within the site and time spent by an individual per page or in total during a session (Palmer, 2002). Despite their importance, objective measures do not capture the subjective aspects of the experience when interacting with information. Some examples of these aspects include the emotional response to the use of or the motivations to use a certain system. Self-assessment measures are most commonly used to represent the users' psychological state. However, only a few well-validated instruments use this type of measure in the context of engagement (Wiebe et al., 2014).

Therefore, the investigations conducted by O'Brien and Toms (2008), O'Brien and Toms (2010) and O'Brien and Toms (2012) must be highlighted for the development and improvement of their UES as a self-assessment instrument. The UES is based on research in the educational multimedia area by Jacques (1996) and Webster and Ho (1997). This scale analyses a series of utilitarian and hedonic attributes that influence engagement. Jacques (1996) proposed a questionnaire focusing on attention, motivation, time perception, needs, control, attitudes and engagement in general. Webster and Ho (1997) developed a 15-item questionnaire to estimate engagement using centred attention, curiosity, and intrinsic interest as attributes and the influence of elements, such as feedback, challenge, variety and control, on engagement. However, the reliability of both instruments has not been properly verified. The measure proposed by Jacques (1996) has not been used in subsequent studies, whereas the measure proposed by Webster and Ho contains few elements per attribute (O'Brien and Cairns, 2015). O'Brien and Toms (2010) developed and validated their self-assessment instrument based on large groups of online buyers. The participants were interviewed regarding their experience with online learning, video games, internet searching and online shopping. Based on their studies, the authors identified engagement as a multidimensional construct. The original UES proposed by O'Brien and Toms (2010) comprised 31 elements and 6 factors. These factors included the following: Focused Attention "FA" (focused concentration, absorption, and the loss of the notion of time); Felt Involvement "FI" (whether the experience is fun or interesting); Novelty "NO" (interest or curiosity generated by the system during the purchase task); Endurability "EN" (holistic response to the experience and overall success of the interaction); Aesthetic Appeal "AE" (visual appearance, i.e., the contents of the interface, images and graphics that generate a certain sensory appeal to the user); and Perceived Usability "PU" (affective and cognitive aspects derived from the use of the system).

The UES has been broadly employed, not only in the electronic commerce field but also in distinct areas, such as search systems, social networks and games. Nevertheless, scholars have rarely employed the UES in its entirety (O'Brien, 2018). Usually, some of its items have been removed, and the number of factors shaping the scale have been reduced (Banhawi and Ali, 2011; Wiebe et al., 2014; O'Brien and Cairns, 2015). This implies that evaluating UES generalizability becomes an arduous task. Determining the main factors is essential to clarify the composition of the scale. In the present research, the original UES and its six factors will be implemented primarily, and next, the examination of its reduction will be developed. In this way, it will be possible to obtain a scale that includes only the main factors and that avoids any future reductions by other researchers.

2.3. *Proposed model: Gamification and engagement.*

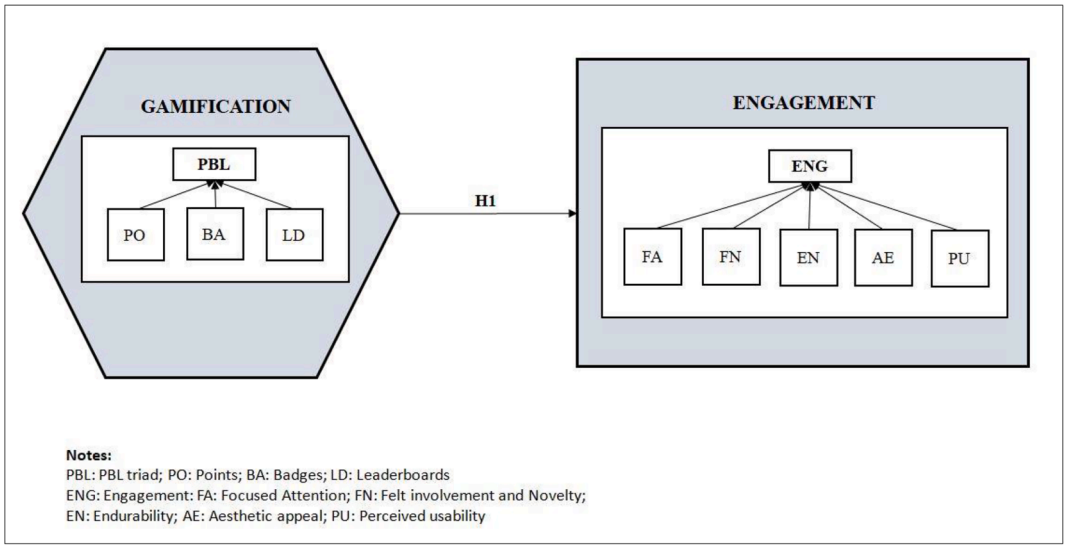
The research model is based on the following main hypothesis:

H1: Gamification is positively related to the engagement of users of e-commerce websites.

To ascertain whether gamification can influence user engagement, prior validation of the UES is necessary. Once the UES is tested, the main attributes of engagement can be used in the model.

The gamification of an e-commerce website is manifested by the reputation system of its users, which is primarily based on the usefulness of the comments that they make about the products. Votes, such as reputation points, badges, and positions in the ranking of commentators, are reflected in the user profiles. RPS systems that include PBL favour a comparison of users and even competition. During a state of competition, such as in sports or a game, an individual may experience a temporary distortion of time, such as that occurring when surfing the Internet (Skadberg and Kimmel, 2004). While individuals are in the "flow", they lose the notion of time (Csikszentmihalyi, 1990).

Focused attention (FA) refers to the degree of awareness of the user and the absorption and perception of the passage of time. Due to their eagerness to improve the quality of their comments and reputation, users can become more focused and absorbed while interacting with the web. Some authors affirm that extrinsic rewards are not necessary to experience flow since the activity is carried out because of the



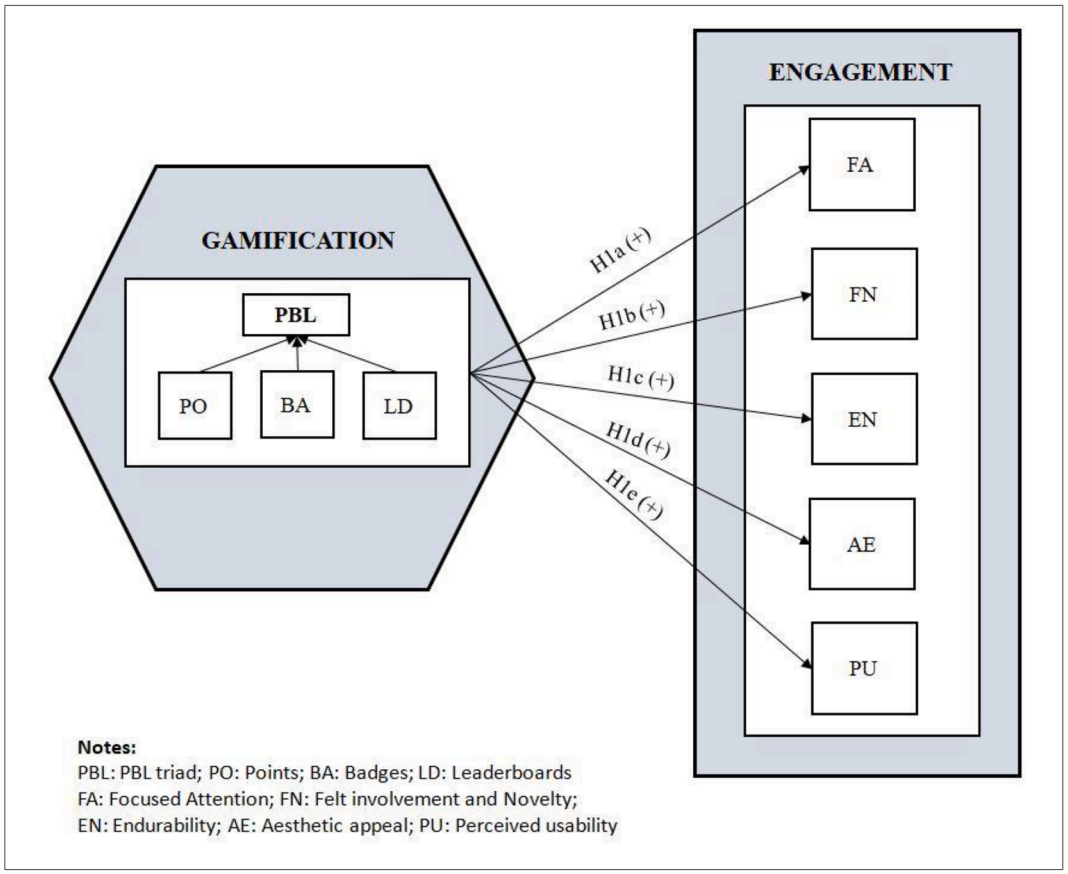


Fig. 1. Conceptual Model.

satisfaction inherent in the activity (Ryan and Deci, 2000). However, these rewards could have both positive and negative influences on intrinsic motivation. To clarify the relationship between gamification and focused attention, the following sub-hypothesis is proposed in the model:

H1a. Gamification is positively related to FA.

The perceived usability factor (PU) contains items related to the ease of use and negative emotions, such as frustration, boredom or fatigue, while interacting with the website. Ease of use is considered a very important variable influencing the intention to use a website (Gefen and Straub, 2000; Venkatesh and Bala, 2008). Gamification elements have been proven to influence the perceived ease of use on shopping and e-banking websites, among others (Rodrigues et al., 2013; García-Jurado et al., 2019). The use of PBL can make it more entertaining to stay on the website for the user and makes it easier to make decisions about purchasing products knowing the reputation of other users who make comments. However, PBL elements could make the web easier to use because they directly provide information and are easily interpreted. Therefore, the following hypothesis is proposed:

H1b. Gamification is positively related to PU.

Gamification is often used to make experiences fun (Deterding, 2011). The FI factor refers to the degree to which a task is fun or interesting. Furthermore, the NO factor is associated with the interest or curiosity generated by the web. Individuals tend to engage in activities

that they find playful and interesting (Kim and Ahn, 2017). Additionally, gamified activities also provide rewards such as points, badges, or even status in exchange for engagement in particular activities (Seaborn and Fels, 2015; Hanus and Fox, 2015). PBL elements identify and position users and can arouse their curiosity to determine their status and their interest in reading more opinions of other users. The subsequent grouping of FI + NO factors by validating the UES could result in an FN factor; thus, the study can pose a single hypothesis instead of two. The hypothetical influence of gamification on these two factors is proposed in the following sub-hypothesis:

H1c. Gamification is positively related to FN.

The implementation of gamification is intended to make the user experience more complete (Deterding et al., 2011). The EN factor reflects whether the experience has been a success (satisfaction) or whether the user would recommend the web to others (Webster and Ahuja, 2006). Gamification aims to enhance a service with affordances for gameful experiences to support the user's overall value creation (Huotari and Hamari, 2012). The greater the input of information and reliability of the comments offered and generated due to gamification the more rewarding the experience for a user, resulting in his/her general satisfaction. The following sub-hypothesis establishes this possible relationship:

H1d. Gamification is positively related to EN.

Finally, the AE factor is related to the aesthetics of an e-commerce page. Appearance matters in creating an engaging experience (Hofacker et al., 2016). Gamification uses elements that appear in games, causing the interface to change (Siang and Rao, 2003). In our case, the user appears positioned in special reviewer tables with scores, rendering the web appearance different from that of websites that do not have gamification implemented, which can influence a user's overall perception of the platform's aesthetics. Therefore, the following sub-hypothesis is proposed:

H1e. Gamification is positively related to AE.

The proposed model consists of the following 2 main constructs: gamification and engagement (Fig. 1). Gamification is based on PBL as a reflection of the RPS and comprises 10 elements, while engagement comprises 31 elements and is formed by the resulting components after validation.

3. Methodology

3.1. Sample

After the O'Brien and Toms (2010) scale and the remaining portion of the questionnaire were translated to Spanish and adapted to the Spanish context, the scale was directed as a pretest to an Andalusian sample of 52 participants. This initial sample was successively extended to a sample comprising 253 Spanish citizens. To attain this sample, this study employed an online consumer panel belonging to the firm Iddealia Consulting, which is supported by the European Society for Opinion and Marketing Research (ESOMAR), the Spanish Association of Market Studies, Marketing and Opinion (AEDEMO) and the International Organization for Standardization (ISO). The usage of the consumer panel ensures the quality of the selected sample size, as well as the superior reliability of the outcomes. Particularly, this study chose Spanish e-commerce users who visited Amazon's website during the week prior to the survey (the first week of January 2016) and posted reviews of products on the website. Diverse profiles of individuals were selected regarding criteria such as their age, gender, social status, educational level and frequency of online purchases, to attain a sample as representative and balanced as possible. The final sample comprised male (53.8%) and female (46.2%) Spanish citizens aged between 18 and 55 years, with a high education level, an active role in making and reading reviews and experience as a videogame player.

3.2. Instrument

The survey technique was used. Game element empirical research normally adopts survey-based methods focusing on a different group of characterizable individuals (Hamari et al., 2014). The definitive questionnaire consisted of 144 questions, including 10 questions belonging to the reduced Scale of Social Desirability, rSD (Strahan and Gerbasi, 1972). In total, 31 questions constituted the UES, and 42 questions corresponded to gamification: 32 questions about human desires, game mechanics and player types and 10 questions about PBL construct (based on Werbach and Hunter, 2012).

Similar to the original UES, 31 elements and 6 attributes were used to measure the UE. A Likert scale was used to evaluate the responses to the elements. Likert scales measure the degree of acceptance or rejection of the statements shown. The Likert scale was evaluated using 5 points ranging from strongly disagree (1) to strongly agree (5). The same Likert scale was used by the respondents to express their opinions regarding gamification.

3.3. Scale validation

The procedure followed to validate the engagement measure relied on the techniques described below. A sample pretest was carried out to validate the content and use of the reduced version of the Social Desirability Scale (rSD) to avoid potential bias that could occur if the respondents answered based on societal expectations. Once the quality of the answers was guaranteed, the UES was validated. A principal component analysis (PCA) was carried out to validate both the dimensionality of the scale and the reliability of its elements. The sample adequacy for a factorial analysis was assessed with the KMO and Bartlett tests. Due to the possibility of grouping the elements by factor, a PCA was carried out. These analyses were performed using IBM SPSS Statistics 25.

The following phase of the empirical study includes modelling with structural equations based on variance to analyse and evaluate the reliability, validity and significance of the measurement and the structural models. Specifically, the partial least squares (PLS) technique was used.

3.4. Structural equation modelling

The empirical assessment of the conceptual model and hypotheses proposed in this paper is performed using partial least squares (PLS) path modelling, which is a variance-based structural equation modelling (VBSEM) technique (Roldán and Sánchez-Franco, 2012). The principal motive for using this technique is that the constructs shaping the research model are conceptualized as composites. Many conceptual and empirical studies endorse the usage of PLS when a composite measurement model is supported (Felipe et al., 2017). Additionally, this paper mainly focuses on the prediction of endogenous constructs (Hair et al., 2011). The exogenous construct (gamification) was modelled as a second-order composite construct shaped by three dimensions (BA, LD and PO), while the endogenous construct (engagement) was modelled as a second-order composite construct shaped by five dimensions (AE, EN, FA, FN, and PU). The partial least squares (PLS) method has recently become increasingly popular, partly for its flexibility to model concepts that depend on different facets or dimensions. More specifically, the use of higher-order (multidimensional) composite constructs has enabled the examination of more advanced and complex research models (Crocetta et al., 2020). Both the second-order constructs and the first-order constructs that shape them were modelled as reflective constructs (i.e., relationships flow from the construct to the manifest variables, and the outer weights are the correlations between the construct and the indicators). In such cases, the PLS algorithm computes reflective constructs as composites using Mode A by default (Sarstedt et al., 2016). In this vein, Becker et al. (2013) sustain that using correlation weights

Table 2
Percentages of explained variance of factors.

	Self Values		
Component	Total	% Variance	% Cumulative
1	9.086	31.330	31.330
2	6.250	21.551	52.881
3	3.189	10.997	63.878
4	1.938	6.683	70.561
5	1.718	5.925	**76.487**

Extraction method: Principal Component Analysis

the survey allow for the validation of the Engagement Scale.

4.1. Scale validation

It was observed that the sample was very suitable for carrying out a factorial analysis since the index Kaiser-Meyer-Olkin (KMO) was 0.913, which is an excellent value for proceeding with the reduction according to Hutcheson and Sofroniou (1999). Similarly, Bartlett's sphericity test was significant (Chi-square = 5,814.71, gl = 466, Sig. = 0.000), confirming the existence of compact correlations between the elements.

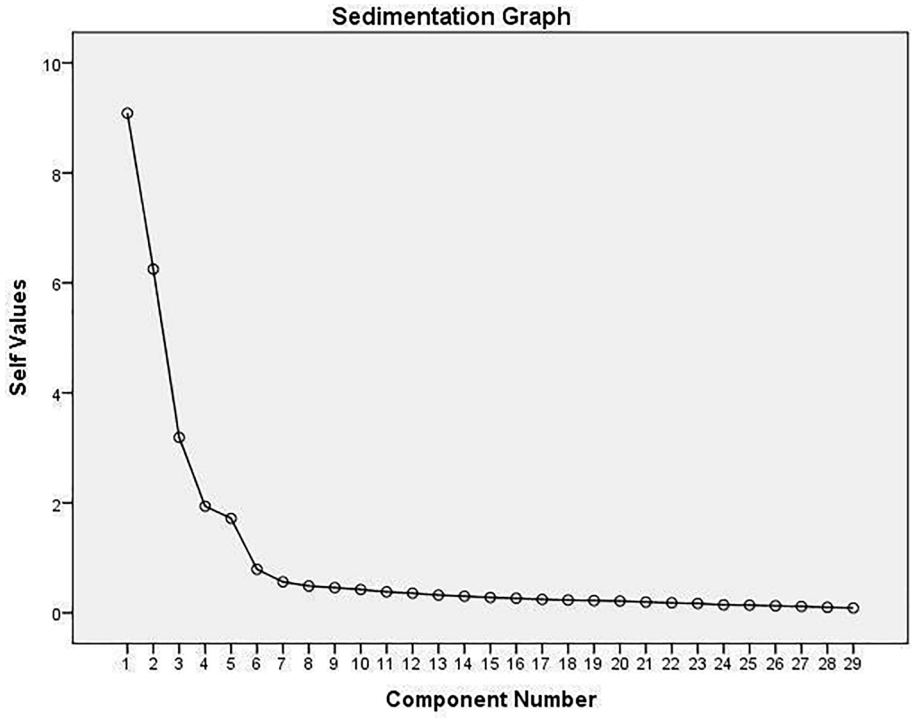


Fig. 2. Sedimentation Graph.

(Mode A) usually leads to enhanced out-of-sample predictive power under a wide set of circumstances as well as superior parameter accuracy. Moreover, this paper used SmartPLS 3.2.9 (Ringle et al., 2015).

4. Results

The pretest led to improvement in the UES questionnaire, as two questions were not understood correctly when translated into Spanish and were modified to allow for better interpretation. The results obtained by applying the rSD[1] of Strahan and Gerbasi (1972) in the final sample (sample mean M = 4.34 and standard deviation SD = 2.03) presented similar values proportional to the original Marlowe Crowne scale (Crowne and Marlowe, 1960). Likewise, we guaranteed that the individuals in the consumer panel were urged to respond freely and without fear that their responses would not be socially desirable. Given the abovementioned results, it is possible to affirm that there is no social desirability bias in this research; therefore, the responses obtained from

After studying the correlation matrix among the elements, the element PU7, i.e., "I felt in control of my shopping experience", was eliminated since it did not show correlations greater than ±0.32 with any other element of the UES, following the criterion of Tabachnick and Fiddell (2007); in addition, its communality was the lowest (0.287) and less than 0.5. The EN3 element, i.e., "This shopping experience did not work out the way I had planned", presented the second-lowest communality, which was equal to 0.454 (remaining above 0.63), and was eliminated to avoid problems of an illogical allocation to some other factor.

To detect the underlying factors of engagement and study the possible reduction in the dimensionality of the scale, a principal component analysis (PCA) was performed. This analysis assessed whether the UES maintains the theoretical factor structure in the Spanish sample. The PCA was performed by applying a Promax rotation. Promax oblique rotation allows factors to be correlated (in contrast to the orthogonal rotation Varimax used by O'Brien), providing a better conceptual image of the psychological variables. The questions that were not significantly correlated with any factors were eliminated in the previous step, leaving a scale of 29 elements to be validated. The analysis of the components showed that 5 factors explained 76.48% of the variance, as can be observed from the auto values and their cumulative values (Table 2).

Similarly, the curve of the sedimentation graph confirms the desirability of the grouping of the 5 factors (Fig. 2).

The 5-factor structure obtained in this study is very similar to the

[1] The rSD of Strahan and Gerbasi is a shorter and less complex form of the Marlowe Crowne' scale which contains identical items but in less quantity. The use of reduced scales over that of Marlowe Crowne to reduce the low discrimination indices of the items is recommended by several authors such as Ferrando and Chico (2000). Obtaining proportionally similar values (since the scale has fewer items) guarantees the non-existence of social desirability.

Table 3
PCA with Promax rotation of factor loadings.

Subscale UES	Items	Factors				
		1	2	3	4	5
FA4	When I was shopping, I lost track of the world around me.	0.948	−0.021	−0.024	0.021	−0.012
FA3	I blocked out things around me when I was shopping on this website.	0.916	−0.021	−0.024	0.033	0.020
FA6	I was absorbed in my shopping task.	0.898	−0.041	0.045	0.007	−0.008
FA5	The time I spent shopping just slipped away.	0.896	−0.022	0.082	−0.058	0.020
FA7	During this shopping experience I let myself go.	0.878	−0.066	0.097	−0.004	−0.053
FA2	I was so involved in my shopping task that I lost track of time.	0.860	0.064	−0.001	−0.004	0.034
FA1	I lost myself in this shopping experience.	0.826	0.098	−0.106	−0.006	0.026
PU3	I felt annoyed while visiting this shopping website.	0.102	0.913	−0.066	0.009	0.002
PU4	I felt discouraged while shopping on this website.	0.106	0.901	−0.048	0.045	−0.017
PU5	Using this shopping website was mentally taxing.	0.039	0.889	−0.051	0.006	0.005
PU1	I felt frustrated while visiting this shopping website.	−0.730	0.879	−0.002	−0.029	0.024
PU2	I found this shopping website confusing to use.	−0.063	0.879	0.146	−0.117	0.015
PU6	This shopping experience was demanding.	−0.107	0.873	0.068	0.132	−0.051
PU8	I could not do some of the things I needed to do on this shopping website.	−0.001	0.798	−0.027	−0.057	0.026
NO1	I continued to shop on this website out of curiosity.	0.014	0.045	0.829	0.047	−0.201
FI1	I was really drawn into my shopping task.	−0.005	0.020	0.826	−0.075	0.110
FI2	I felt involved in this shopping task.	−0.011	−0.029	0.824	−0.005	0.015
FI3	This shopping experience was fun.	0.017	−0.033	0.822	−0.060	0.093
NO3	I felt interested in my shopping task.	0.011	0.015	0.779	0.074	−0.058
NO2	The content of the shopping website incited my curiosity.	0.043	0.000	0.768	0.072	0.046
AE2	This shopping website was aesthetically appealing.	−0.056	−0.016	0.016	0.930	−0.064
AE5	The screen layout of this shopping website was visually pleasing.	0.043	−0.009	−0.058	0.906	0.049
AE3	I liked the graphics and images used on this shopping website.	0.052	0.009	−0.002	0.881	−0.005
AE4	This shopping website appealed to my visual senses.	0.113	0.018	0.023	0.880	−0.045
AE1	This shopping website is attractive.	−0.167	−0.012	0.067	0.770	0.154
EN2	I consider my shopping experience a success.	0.025	−0.020	0.011	0.011	0.868
EN1	Shopping on this website was worthwhile.	−0.001	0.011	−0.109	0.076	0.856
EN5	I would recommend shopping on this website to my friends and family.	−0.062	−0.021	0.019	−0.006	0.846
EN4	My shopping experience was rewarding.	0.078	0.037	0.093	−0.028	0.835

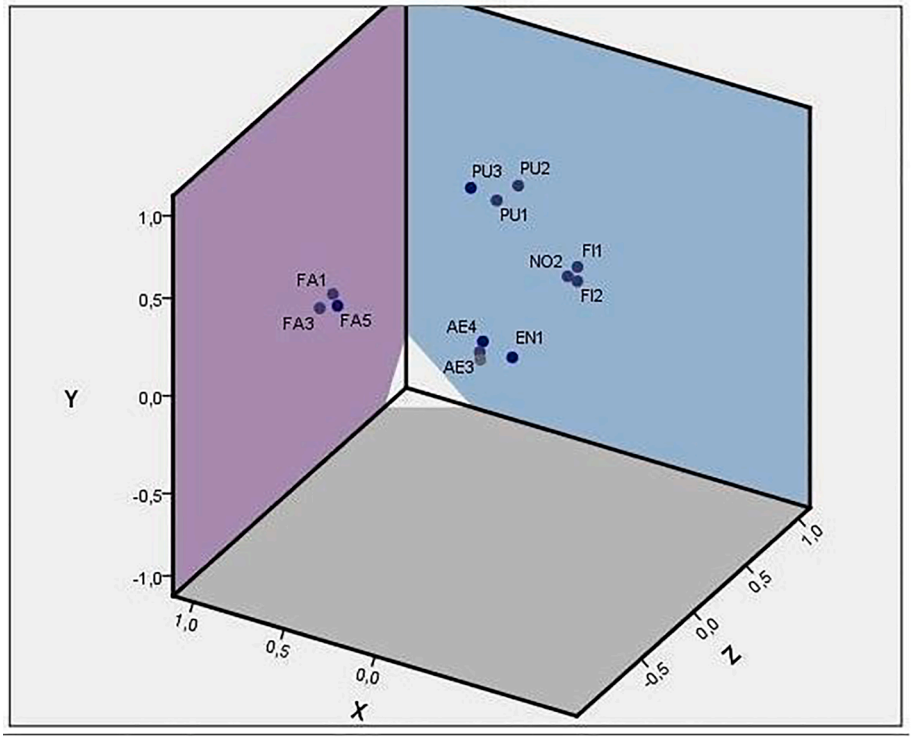


Fig. 3. Grouping of engagement factors after Promax rotation.

model of factors observed in O'Brien's (2010) online shopping environment in terms of the factors and loadings. The original scale proposed by O'Brien and Toms (2010) consisted of the following 6 factors and 31 elements: PU, AE, FA, NO, FI and EN. In O'Brien (2010), the scale is reduced to the following 4 factors and 26 elements: PU, AE, FA and NO + FI + IN. According to the results of this study, no factor of the scale was eliminated, but the factors FI and NO were fused into a single factor, decreasing the scale from 6 to 5 factors with 29 elements. Factor 1, focused attention (FA), explains 31.33% of the variance and is formed by the elements FA1 to FA7 (which coincides exactly with the original

Table 4
Measurement model evaluation: individual item reliability, construct reliability and convergent validity.

Construct/ Indicator	Outer Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AE		0.931	0.947	0.783
AE1	0.798			
AE2	0.892			
AE3	0.902			
AE4	0.910			
AE5	0.917			
BA		0.847	0.907	0.766
BA1	0.851			
BA2	0.908			
BA3	0.865			
EN		0.885	0.912	0.723
EN1	0.817			
EN2	0.901			
EN4	0.911			
EN5	0.764			
FA		0.958	0.966	0.802
FA1	0.791			
FA2	0.875			
FA3	0.912			
FA4	0.938			
FA5	0.922			
FA6	0.916			
FA7	0.908			
FN		0.896	0.920	0.658
FN1	0.812			
FN2	0.803			
FN3	0.831			
FN4	0.794			
FN5	0.800			
FN6	0.825			
LD		0.843	0.893	0.676
LD1	0.863			
LD2	0.815			
LD3	0.855			
LD4	0.752			
PO		0.758	0.852	0.659
PO1	0.770			
PO2	0.783			
PO3	0.878			
PU		0.950	0.960	0.802
PU1	0.869			
PU2	0.895			
PU3	0.931			
PU4	0.930			
PU5	0.886			
PU6	0.859			

UES). Factor 2, perceived usability (PU), explains 21.55% of the variance. Factor 2 comprises the elements PU1 to PU6 and PU8 since the element PU7 was discarded in the previous phase. Factor 3, involvement and novelty (FN), explains 10.99% of the variance and is formed by the elements NO1 to NO3 and FI1 to FI3. This factor is the exact combination of the elements of the novelty and involvement subscales in the original UES scale. The fourth factor, aesthetics (AE), explains 6.68% of the variance and is formed by the elements AE1 to AE5. The fifth and final factor, endurance (EN), accounts for 5.92% of the variance and includes all elements (EN1, EN2, EN4 and EN5) of the original UES, except for the discarded element EN3. The factor loadings and grouping of the subscales after Promax normalization with Kaiser and converging the rotation in 6 iterations are shown in Table 3.

Fig. 3 shows how the 5 engagement factors are clearly differentiated and grouped into their centroids and how they are represented by their importance after the Promax rotation.

We find an excellent grouping of the elements by factor with regard to the original structure of the UES, including the fusion of the two constructs FI and NO (FN). There are no elements grouped illogically with factors different from those in their category. Based on the obtained results, the resulting revised scale consists of 29 elements and 5 factors.

4.2. Structural equation modelling assessment

4.2.1. Evaluation of the measurement model

The evaluation of the PLS measurement model presents satisfactory outcomes. First, all indicators satisfy the requirements of item reliability, as their outer loadings surpass the 0.707 threshold (Table 4). In addition, all constructs comply with the requisites of construct reliability, since their Cronbach's alpha and composite reliability are greater than 0.7 (Table 4), and of convergent validity, since their average variance extracted (AVE) is over the 0.5 critical level (Table 4). Finally, Table 5 shows that discriminant validity is attained regarding both the Fornell-Larcker and the Heterotrait-Monotrait (HTMT) ratio criteria (Kline, 2015).

4.2.2. Evaluation of the structural model

Following the indications proposed by Hair et al. (2014), this paper implements a 5,000 resamples bootstrapping technique to engender the standard errors, t-statistics, p-values and 95% bias-corrected confidence intervals (BCCI) that enable the appraisal of whether the relationships hypothesized in the conceptual model attain statistical significance. Table 6 presents the main parameters obtained for the two structural models under evaluation in this study. The coefficient of determination (R^2) is used as the main criterion for measuring the explained variance, that is, the extent to which the exogenous constructs explain the endogenous constructs. The results shown in Table 6 indicate that structural Model 1 reaches satisfactory predictive relevance for the endogenous construct, with $R^2 = 0.176$ (Table 6). In addition, all the direct relationships hypothesized between the constructs are shown to be positive and significant, except for the GAM-EN relationship in Model 2.

The results of the relationships studied are presented graphically in Fig. 4.

4.2.3. Evaluation of the predictive capability of the model

This paper also aims to assess whether the research model has predictive capability. Shmueli and Koppius (2011) define a model's predictive performance as its faculty to produce precise predictions of new observations regardless of whether they are temporal or cross-sectional in nature. Therefore, Shmueli (2010) argues that explanation and prediction encompass distinct goals that might be joined in a research study, which is the view upheld by Dolce et al. (2017).

Therefore, this study evaluates the predictive ability (out-of-sample prediction) of the proposed model by using cross-validation with holdout samples (Evermann and Tate, 2016) while focusing on the key endogenous construct (engagement). Specifically, this paper uses the PLSpredict algorithm (Shmueli et al., 2016) in SmartPLS 3.2.9 software. (Ringle et al., 2015).

To assess whether the model has predictive ability, it is necessary to verify whether the Q^2 values are greater than 0, which would lead to the inference that the prediction error of the PLS results is smaller than the prediction error of merely using the mean values. Thus, obtaining positive Q^2 values denotes that the proposed conceptual model has predictive ability. Table 7 shows that the conceptual model proposed in this paper meets this criterion at both the dimension and indicator levels.

5. Discussion

The first aim of this study was to analyse the influence of gamification on e-commerce users' engagement. To achieve this goal, validation of the User Engagement Scale (UES) and identification of the main components of engagement in Spanish e-commerce were necessary. Based on the obtained results, we can confirm that the UES is a valid and reliable scale for use in the e-commerce field. Although the original six factors had explanatory power, the reduction to a five-factor model was confirmed. A revised UES was proposed in which only two items were eliminated, and the grouping of the scales was modified. The new

Table 5
Measurement model evaluation: discriminant validity.

Discriminant Validity: Fornell-Larcker Criterion								
	AE	BA	EN	FA	FN	LD	PO	PU
AE	**0.885**							
BA	0.227	**0.875**						
EN	0.463	0.165	**0.851**					
FA	0.295	0.285	0.207	**0.896**				
FN	0.438	0.249	0.304	0.633	**0.811**			
LD	0.214	0.737	0.152	0.314	0.188	**0.822**		
PO	0.260	0.622	0.102	0.298	0.199	0.643	**0.812**	
PU	−0.068	0.231	−0.226	0.172	0.069	0.174	0.115	**0.895**
Discriminant Validity: Heterotrait-Monotrait Ratio (HTMT)								
	AE	BA	EN	FA	FN	LD	PO	PU
AE								
BA	0.242							
EN	0.524	0.155						
FA	0.297	0.312	0.187					
FN	0.471	0.276	0.325	0.684				
LD	0.219	0.759	0.141	0.335	0.195			
PO	0.280	0.747	0.117	0.317	0.222	0.787		
PU	0.099	0.253	0.272	0.177	0.091	0.181	0.123	

Note: Diagonal elements (bold) are the square root of the variance shared between the constructs and their measures (AVE). Off-diagonal elements are the correlations between constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Table 6
Structural model results.

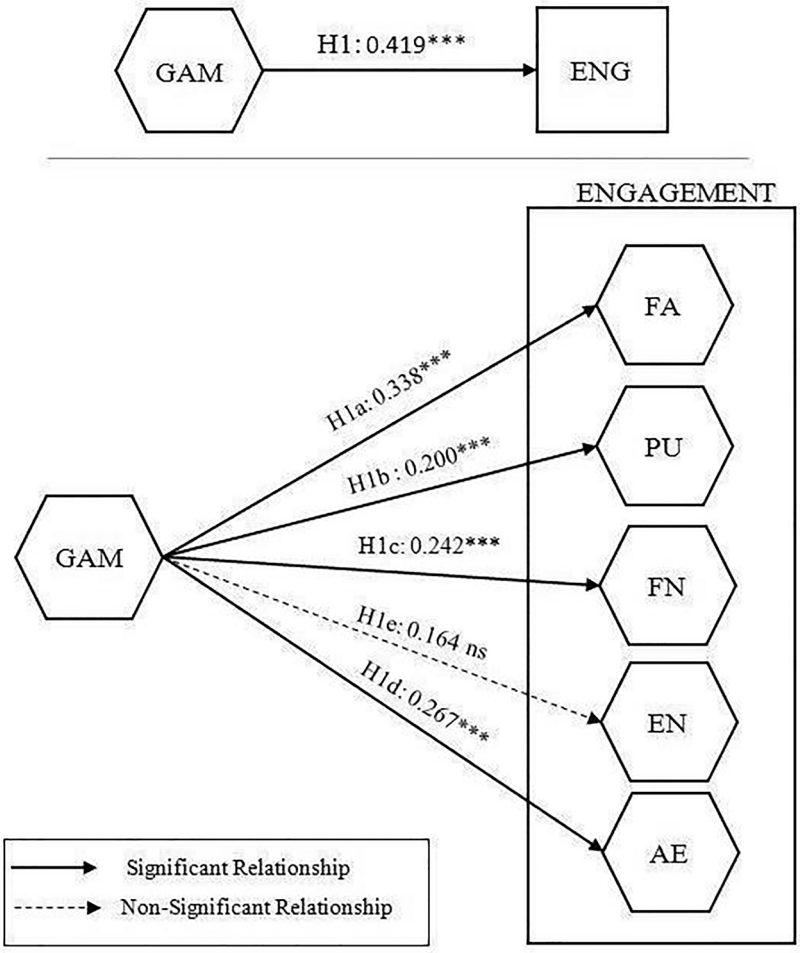
Structural Model 1						
Relationship	Coefficient of determination	Path coefficient	T Statistic	P-values	95% BCCI	Support
GAM → ENG	$R^2 = 0.176$	0.419***	7.077	0.000	[0.285; 0.516]	Yes
Structural Model 2						
Relationship	Coefficient of determination	Path coefficient	T Statistic	P-values	95% BCCI	Support
GAM → AE	$R^2 = 0.071$	0.267***	4.690	0.000	[0.147; 0.371]	Yes
GAM → EN	$R^2 = 0.027$	0.164 ns	1.911	0.056	[-0.263; 0.241]	No
GAM → FA	$R^2 = 0.114$	0.338***	5.475	0.000	[0.205; 0.452]	Yes
GAM → FN	$R^2 = 0.058$	0.242***	3.407	0.001	[0.108; 0.374]	Yes
GAM → PU	$R^2 = 0.040$	0.200***	2.667	0.008	[0.063; 0.334]	Yes

Notes: t values in parentheses. Bootstrapping 95% bias corrected confidence intervals (based on n = 5000 subsamples). ***p b 0.001; **p b 0.01; *p b 0.05.

dimensions of the UES are focused attention, perceived usability, attractiveness, endurability and appeal. According to the results from Spanish e-commerce, focused attention and perceived usability are the main elements that determine user engagement, thus, companies should focus on these elements. The user experience should ensure that individuals fully focus on and perceive the web as easy to use and exciting. The merger of the factors of involvement and novelty forms a new attribute that represents the attractiveness of the site. Although less relevant, we should not forget that the aesthetics and aspects related to user endurability are important to engagement. As in previous research, the use of a smaller scale is suggested, although the four-factor structure generally predominates (Banhawi and Ali, 2011; O'Brien and Toms, 2013; Wiebe et al., 2014; O'Brien and Cairns, 2015). In these studies, three of the UES subscales—focused attention, perceived usability and aesthetic appeal—were relatively stable, while the felt involvement, novelty and endurability scales typically combined into one factor. In this research, endurability remains an independent factor, which has allowed us to study, in isolation, how it is affected by gamification. If the merged factor had been used as in previous studies, the nonsignificant effect of gamification on endurability would have gone unnoticed.

Once the scale was validated, the main objective of the study was to confirm the effect of gamification on engagement in e-commerce. Companies apply standardized packages of gamification on their web pages, including multiple elements and mechanics; however, not all applications are valid for e-commerce. It has been verified that the components of gamification, i.e., points, badges and leaderboards, have high reliability and internal consistency such that they can be grouped as a construct that can be applied as a unit in subsequent studies. Previous research has examined game elements separately and not as a construct (i.e., only badges; Hamari, 2013). This research finds that the use of PBL has direct joint repercussions on engagement, confirming the main hypothesis. Analysing the influence of gamification on the individual elements of engagement also confirmed this positive relationship in 4 of the 5 proposed relationships.

The component on which gamification has the greatest effect is focused attention. If users reach concentration or absorption states while interacting with the web, gamification works properly. In fact, previous studies confirm the influence of gamification on the state of flow (García-Jurado et al., 2019). Commenting on products and participating in the reputation point system encourages a user to observe his/her status and simultaneously concentrate on the online buying process. It has been shown that the use of PBL positively influences users to be more focused while using the web. The more concentrated or focused attention an individual experiences, the greater the temporal distortion. Remaining longer on those sites that involve gamification than on other pages that do not include gamification can help individuals make purchases on that page rather than on those of competitors. Another effect is the improvement in value creation on the web, which is based on making higher-quality comments to increase reputation in the community.



Notes: GAM: Gamification; ENG: Engagement; FA: Focused Attention; PU: Perceived usability; FN: Felt involvement and Novelty; EN: Endurability; AE: Aesthetic appeal; ***p b .001; **p b .01; *p b .05; ns: not significant

Fig. 4. Summary of the structural model results.

The aesthetic component is the second element on which gamification has great effects. Thus, highly appealing websites where PBLs are placed are favourable for engagement. We recommend that the points appear clearly in specific areas that attract attention and that the badges appear not only in text form but also in graphic form; in addition, the classification tables should be presented in different formats (e.g., best reviewers, zone-country graphics, and evolution graphics).

It has been found that the use of PBL also positively influences the interest and curiosity of individuals, rendering the experience more interesting and fun. Having a status and scores as a reviewer on the web affects the curiosity of users. Similarly, finding products that have received comments by users valued by the community influences users' interest and increases their confidence in the web.

Gamification also influences the perceived usability by the user. The inclusion of PBL has positive effects on the perception of demand that requires the use of the page by the individual. The fact that the information of the reviewers is shown facilitates the work of the user when deciding about products. Thus, the user experience can be more comfortable, helping to avoid frustrations or having to exert greater effort.

The only variable on which gamification does not have a significant effect in terms of engagement is endurability. Gamification is used as a tool to improve the user experience. Gamification appears to be a complement to, not the determining element of, satisfaction (endurability). It would be interesting to determine in future works whether this relationship could be validated indirectly through the previous components of engagement. It could also be validated as a part of an independent and more complex construct that encompasses overall satisfaction with the offered service.

However, users who do not pay much attention to PBL or do not like competitions could still be encouraged to comment because, in addition to intangible rewards, such as points or badges, some discounts or products could be offered to motivate collaboration and thus achieve greater engagement.

Another relevant finding is that this research model demonstrates predictive power in the sample used in this study. This finding implies that we found evidence supporting the out-of-sample predictive validity of the proposed model. Therefore, gamification is an adequate predictor of the five dimensions shaping the engagement construct. Thus, our model provides much more information than noise (Davis and Agrawal, 2018), and gamification can be used to develop accurate predictions of engagement variables in new interpretable observations.

6. Conclusions

The literature on the effects of gamification on engagement is still

Table 7
Predictive performance summary.

	PLS			LM			PLS-LM		
Dimensions	RMSE	MAE	Q^2	RMSE	MAE	Q^2			
AE	0.974	0.787	0.061	0.981	0.795	0.048	**−0.007**	**−0.008**	**0.013**
FA	0.951	0.78	0.104	0.959	0.788	0.089	**−0.008**	**−0.008**	**0.015**
EN	0.997	0.789	0.016	1.004	0.792	0.003	**−0.007**	**−0.003**	**0.013**
FN	0.983	0.789	0.045	0.989	0.797	0.032	**−0.006**	**−0.008**	**0.013**
PU	0.993	0.833	0.022	0.994	0.824	0.021	**−0.001**	0.009	**0.001**
	PLS			LM			PLS-LM		
Indicators	RMSE	MAE	Q^2	RMSE	MAE	Q^2	RMSE	MAE	Q^2
AE4	0.883	0.737	0.067	0.893	0.740	0.047	**−0.009**	**−0.003**	**0.020**
AE1	0.798	0.634	−0.004	0.798	0.627	−0.004	0.000	0.007	0.000
AE3	0.815	0.681	0.061	0.824	0.688	0.041	**−0.009**	**−0.007**	**0.020**
AE5	0.846	0.682	0.040	0.854	0.688	0.023	**−0.008**	**−0.006**	**0.017**
AE2	0.773	0.640	0.044	0.773	0.639	0.045	0.000	0.001	0.000
EN1	0.776	0.582	−0.003	0.783	0.581	−0.020	**−0.007**	0.001	**0.018**
EN4	0.855	0.675	0.027	0.861	0.685	0.011	**−0.007**	**−0.010**	**0.015**
EN5	0.805	0.648	−0.018	0.806	0.650	−0.020	**−0.001**	**−0.003**	**0.002**
EN2	0.848	0.666	0.012	0.855	0.671	−0.004	**−0.007**	**−0.005**	**0.016**
FA1	1.072	0.851	0.081	1.083	0.857	0.063	**−0.010**	**−0.006**	**0.018**
FA6	1.202	0.988	0.077	1.211	0.999	0.062	**−0.010**	**−0.010**	**0.015**
FA5	1.189	0.975	0.076	1.199	0.982	0.060	**−0.010**	**−0.008**	**0.015**
FA7	1.191	0.983	0.080	1.204	0.993	0.059	**−0.013**	**−0.010**	**0.021**
FA2	1.174	0.974	0.076	1.178	0.975	0.069	**−0.004**	**−0.001**	**0.007**
FA4	1.154	0.969	0.117	1.164	0.977	0.102	**−0.010**	**−0.008**	**0.015**
FA3	1.160	0.950	0.072	1.170	0.960	0.057	**−0.009**	**−0.010**	**0.015**
FN1	0.980	0.810	0.017	0.983	0.808	0.010	**−0.003**	0.001	**0.007**
FN4	1.129	0.924	0.039	1.131	0.930	0.036	**−0.002**	**−0.006**	**0.003**
FN6	0.926	0.762	0.021	0.928	0.764	0.017	**−0.002**	**−0.002**	**0.004**
FN3	0.904	0.743	0.038	0.913	0.745	0.019	**−0.009**	**−0.002**	**0.019**
FN2	0.976	0.803	0.032	0.988	0.807	0.008	**−0.012**	**−0.003**	**0.024**
FN5	1.039	0.838	0.010	1.046	0.841	−0.003	**−0.007**	**−0.003**	**0.014**
PU5	1.125	0.944	0.004	1.127	0.933	0.001	**−0.001**	0.011	**0.003**
PU2	1.035	0.865	0.014	1.036	0.863	0.012	**−0.001**	0.002	**0.002**
PU3	1.042	0.873	0.016	1.040	0.863	0.020	0.002	0.010	−0.005
PU6	1.023	0.851	0.018	1.025	0.852	0.014	**−0.002**	**−0.001**	**0.004**
PU4	1.020	0.842	0.031	1.020	0.831	0.032	0.001	0.012	−0.001
PU1	1.023	0.861	0.027	1.032	0.868	0.010	**−0.009**	**−0.007**	**0.016**

Notes: RMSE: Root mean squared error. MAE: Mean absolute error. PLS: Partial least squares path model; LM: Linear regression model.

limited in multiple aspects. There is a gap between theory and practice in the study of gamification. This study expands the research scope of gamification by focusing on the e-commerce sector, representing a field in which scientific research is still scarce. From the joint appraisal of the literature review and the outcomes of the empirical analysis, it can be concluded that:

First, this study found that gamification—studied as a system of reputation points that forms a consistent construct—exerts direct effects on users' engagement in e-commerce. Second, the User Engagement Scale (UES) is presented as a valid and reliable instrument for measuring engagement in Spanish e-commerce. However, a reduction to a five-factor structure is recommended. Third, four key factors through which gamification has a direct influence were identified in this study. Finally, the model proposed for validation entails good predictive capacity.

7. Practical implications and future research

The purpose of this paper was to explore the extent to which gamification might exert a positive impact on users' engagement in e-commerce. Several managerial implications derive from the empirical results contained in this study.

Currently, the importance of product reviews in online shopping is unquestioned. In particular, the average rating of products and the number of reviews play a key role in consumer behaviour (Watson et al., 2018). Additionally, product ratings are considered a very important item in the consumer journey (Santana et al., 2020). In this vein, gamification may become a crucial element to increase product reviews and comments due to its influence on engagement in e-commerce.

From the perspective of marketing, in addition to the empowerment of gamification cited above, a series of actions and strategies are proposed to enhance the factors of engagement. In particular, cross-selling could be used to promote focused attention, thereby encouraging the user to view other complementary products or items related to the selected product.

The inclusion of live chats based on artificial intelligence (i.e., chatbots) could allow the easing of doubts, instantly generating greater attention. Assisted by chatbots, online sales might be reinforced by ensuring a more direct and customized interaction with the users (Shafi et al., 2020).

The aesthetic appearance should be very visual and attractive, with high-quality graphics. The insertion of videos to demonstrate products could improve this appearance.

Regarding usability, both searching for articles, for which including multiple customizable filters are recommended, and the loading of the web pages should be fast. The use of content marketing, creating additional content for articles, such as other forms of use to the usual ones serving as ideas for the consumer, could arouse their interest and engagement.

Regarding the products, it is recommended that the reviews, reviewers' scores and cocreated content be made clearly visible and that the benefits of the products are highlighted above other characteristics. Similarly, using social media to create profiles in social networks could allow closer interaction with customers and greater content sharing, favouring global engagement. Consumers prefer to purchase from websites that they perceive as good in terms of functionality,

navigability and aesthetics (Punyatoya, 2019).

This study opens new lines of research. For instance, the self-report instrument could be supplemented with the inclusion of qualitative and open questions to the users, allowing for a better interpretation of the responses regarding the attributes of engagement.

On the other hand, although engagement is a multidimensional construct, there are no clear causal relationships between its components in previous studies. Since endurability is a factor that explains engagement less and does not affect gamification directly, future studies should consider endurability as an independent factor.

Additionally, the confirmation that gamification influences the main components of engagement can encourage the scientific community to study other elements or mechanics, especially in relation to engagement in other sectors. Such studies might expand from the simple application of bundles of elements of generic gamification, as is the case currently, to the introduction of components that have been adapted and optimized strategically. Finally, it is appropriate to introduce some constructs intervening in TAM or UTAUT models (Davis, 1989; Venkatesh et al., 2003), such as attitude towards use or behavioural or purchase intention (Islam et al., 2017), to study the definitive impact of gamification and engagement on the behaviour and actual use of e-commerce websites.

All the authors contributed equally to the design and implementation of the research, to the analysis of the results and to the writing and revision of the manuscript.

Declaration of Competing Interest

The authors 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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