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Gamification: A Key Determinant of Massive Open Online Course (MOOC) Success

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Abstract:

Massive open online courses (MOOCs), contribute significantly to individual empowerment because they can help people learn about a wide range of topics. To realize the full potential of MOOCs, we need to understand their factors of success, here defined as the use, user satisfaction, along the individual and organizational performance resulting from the user involvement. We propose a theoretical framework to identify the determinants of successful MOOCs, and empirically measure these factors in a real MOOC context. We put forward the role of gamification and suggest that, together with information system (IS) theory, gamification proved to play a crucial role in the success of MOOCs.

Keywords: Massive Open Online Courses, MOOC, Gamification, e-Learning, Information Systems, MOOC Success Model.

Gamification a Key Determinant of Massive Open Online Course (MOOC) Success

1. Introduction

Massive open online courses (MOOCs) are a key strategic pillar of national digital economies because the acceptance of information and communications technology (ICT) is fundamental for enabling an array of opportunities for societies, organizations, and individuals (OECD, 2014, 2015). Organizations are in a continuous flux of change and the adoption of MOOCs to enable a lifelong learning context, empower people with capabilities and transform them into strong agents of change in any model (Pillay, Hackney, & Braganza, 2012). MOOCs allow teachers to lecture more students on one course than in a lifetime of teaching.

MOOCs appeal to a high number of people, even though a high dropout rate seems to be a common characteristic of many of the courses. Dropout rates of over 90% have cast doubt on the usefulness and viability of these courses (Halawa, 2014; Parr, 2013). Jordan (2013, 2014) observes a high dropout rate on MOOCs when comparing enrollments with the number of students that completed a course. Understanding what determines the success of MOOCs has become a critical research challenge and one that enables the development of new strategies that reduce these dropout rates. We believe that there is a lack of understanding for the reasons of this happening. Consequently, it is critical to develop strategies to reverse this trend.

Some studies note that gamification is correlated with learner interaction, success, and positive experience of MOOCs (Vaibhav & Gupta, 2014; Wu, Daskalakis, Kaashoek, Tzamos, & Weinberg, 2015). However, no study has been conducted to measure the impact of gamification on the overall success of MOOCs (Vaibhav & Gupta, 2014; Wu et al., 2015). Consequently, the objective of this paper is to understand the principal factors behind successful MOOCs. MOOC success here is measured by the system usage, user satisfaction, and perceived individual and organizational performance as a result of participation and engagement in a MOOC. We base our research on information systems (IS) success (DeLone & McLean, 2003) and gamification (Deterding, Dixon, Khaled, & Nacke, 2011; Fu, Su, & Yu, 2009) to propose a new theoretical framework within a MOOC context. To validate the theoretical model, we conduct an empirical study in the setting of a real MOOC. To this end, we have collected and analyzed 215 complete valid responses to a questionnaire. The proposed model tests the key role of gamification as a success determinant in context of MOOCs, namely in use, satisfaction, individual impact, and organizational impact of MOOCs. The main contributions of this paper are fourfold. First, to the best of our knowledge, there is no IS success theory analysis (DeLone & McLean, 1992, 2003) in a MOOC context. For this reason, this is the first empirical test of IS success theory in this setting. Second, we extend the IS success theory (DeLone & McLean, 1992, 2003) to a MOOC context by adding the gamification construct, as a second order reflective-reflective type, leading to a new model that we call "the MOOC success model." The new model increases the explanation power of the IS success theory in a MOOC context and adds knowledge to it. Third, our research brings a new construct of gamification, as a major driving force to explain the use of MOOCs and their impact on individuals and organizations. Finally, we present gamification as a positive moderator between individual and organizational impact. Also, it contributes to the validation of gamification theory as a driver in a MOOC context. These contributions are relevant to both industry and academia in the design phase of the course.

2. Theoretical background

The theoretical review rests on two main pillars. The first pillar consists of the definition of the MOOC concept and its evolution in the various studies on the topic. The second pillar is formed by a review on how success has been studied in IS field.

2.1. Earlier studies of MOOCs

MOOCs are the "black swans" foreseen for 2012 in the education field (Cormier, 2011). From 2008 to 2015, the concept has received an increasing popularity according to Google trends (2016). The first online course named as a MOOC appeared in 2008 (Cormier, 2008b). The MOOC concept expresses a way of knowledge sharing, using digital channels of Internet. MOOCs gather "*thousands of people talking about the same topic on the open web*" (McAuley, Stewart, Siemens, & Cormie, 2010, p. 15). The MOOC definition derives from the combination of various concepts such as electronic learning (e-learning), massive communication, knowledge sharing, and openness. In e-learning concept that evolved from a distance learning approach (Morri, 1997), this concept focuses on time and space, and the MOOC concept leads to the sharing and discussing of ideas with peers in an open environment through digital communication artifacts (Cormier, 2008b, 2008c; McAuley et al., 2010). The MOOC concept developed into two other concepts: (1) connective MOOC (cMOOC) and (2) extended MOOC (xMOOC) (Bates, 2012; Cormier, 2008a; Rodriguez, 2013). cMOOC concept comprehends a connected and sharing digital context, which follows a philosophy of connectivism. The xMOOC concept is based on a behaviorist pedagogical approach and is focused on content prepared by universities.

Table 1- MOOC studies

MOOC Study Objective	Methodology	Results	Authors
Case study of MOOC CCK08	Survey of opinion of learners about course multiple tools.	Results showed controversial views on the tools usage, explained by the users' different objectives, and by their organization skills.	(Fini, 2009)
Business dimension of MOOCs	Literature review	Proposed a framework for organizing MOOC business models and identified the main players.	(Dellarocas & Van Alstyne, 2013)
Definition of MOOCs	Literature review	Discussion on the proliferation of MOOC concept regarding massiveness vs. openness.	(Baggaley, 2013)
Success rate of MOOCs	An empirical study of engagement of students and analyses of course resources used.	Course resources were used differently according to the momentum of the course.	(Breslow et al., 2013)
MOOC strategies	Literature review	The study presents references on adoption, implementation, and innovation.	(Murphy et al., 2014)
MOOC adoption	Survey US HEIs, linear probability model.	Found a positive association between human resources and MOOC exploration. Findings suggest that human resources, competitive pressure, and research play a role in MOOC adoption.	(Huang & Lucas, 2014)
How video affects engagement with MOOCs	Empirical study with mixed methods (video analytics and interviews).	Shorter videos, informal talking-head videos, and Khan-style videos are more engaging in a MOOC context.	(Guo, Kim, & Rubin, 2014)
Students' interest when using games	Case study with two-course groups, one with a game, and another with no game.	A gamified platform (edX with games) increased the number of succeeding learners and decreased the failing number.	(Vaibhav & Gupta, 2014)
MOOC business models	Empirical study of various cost scenarios.	Identification of costs: qualification and quantification of the MOOCs costs.	(Fischer et al., 2014)
Completion of MOOCs	Quantitative methods on public data of completion.	The majority of MOOCs have completion rates of less than 10% of those who enroll, with a median average of 6.5%.	(Jordan, 2014)
Adoption of MOOCs in Europe	Online Survey in Higher Education Institutions (HEI).	Results show that the majority of HEIs are planning to offer MOOCs; most HEIs agree that MOOCs are relevant to on-line learning pedagogy. MOOCs are relevant regarding visibility, students reach, and innovation.	(Jansen, Schuwer, Teixeira, & Aydin, 2015)
MOOC adoption	Survey & model using Structural Equation Model (SEM).	Technology acceptance model (TAM): Reputation, usefulness, cost, and ease of use influence MOOC adoption.	(Huanhuan & Xu, 2015)
MOOCs integration with traditional classes	Literature review	Findings revealed that major studies reported modest positive impacts and lower satisfaction levels in integrating MOOCs in traditional classrooms.	(Israel, 2015)
MOOC trends and public sentiment	Sentimental analysis of social media mining from Twitter.	Twitter discussions related to the MOOC were active, although were registered with large daily variations on the topic. This variation also registered variations when some tweets news mentioned MOOCs in general.	(Shen & Kuo, 2015)
MOOC continuance and satisfaction	Empirical study with survey and SEM-PLS data treatment.	Satisfaction, usefulness, enjoyment, reputation, and confirmation affect the continuance intention positively.	(Alraimi, Zo, & Ciganek, 2015)

Table 1- MOOC studies

MOOC Study Objective	Methodology	Results	Authors
Psychological characteristics of Learners	Literature review	Identify psychological challenges, skills, enablers, and barriers posed by MOOCs	(Terras & Ramsay, 2015)

Some MOOC studies consist of literature reviews, and stress massiveness and openness as main distinguishing characteristics (Baggaley, 2013; Israel, 2015; Murphy et al., 2014; Terras & Ramsay, 2015). Other studies discuss financial aspects and business models of MOOCs (Dellarocas & Van Alstyne, 2013; Fischer et al., 2014) and the pedagogical models. Several researchers focus on aspects of success, such as on engagement (Breslow et al., 2013), sentiment analysis, continuous usage and satisfaction (Alraimi et al., 2015; Shen & Kuo, 2015), course completion (Jordan, 2014), and on adoption of MOOCs (Huang & Lucas, 2014; Huanhuan & Xu, 2015; Jansen et al., 2015). From Table 1, we conclude that there are no structural models designed to measure the success of MOOCs. We believe that it pertinent to understand the main factors behind the success of MOOCs. Although there are some studies of learner satisfaction with MOOCs, satisfaction is not the only measure of IS success. Studies modeling the success of MOOCs, even partially, are scarce, and we think it is important to rectify this situation.

2.2. Success studies in IS

The definition of IS success is based on several studies (DeLone, 1988; Igbaria, Zinatelli, & Cavaye, 1998; Louis Raymond, 1985; Yap, Soh, & Raman, 1992), and success is measured by the level of adoption, satisfaction, and perceived positive impact. IS success variables were studied in depth by Larsen (2003). The author conceptualizes the IS success antecedents (ISSA). IS success includes the chronological flow of the dependent variables of ISSA, according to IS pre-adoption and post-adoption (Karahanna, Straub, & Chervany, 1999). Dependent variables for IS success are organized into three clusters: first, variables that refer to the implementation process (Cooper & Zmud, 1990; Kwon & Zmud, 1987); second, the variables of behavior perceptions (Davis, 1989; DeLone & McLean, 1992); and third, the variables that belong to a performance dimension (DeLone, 1988; DeLone & McLean, 1992). DeLone & McLean (D&M) (1988) published the seminal paper on IS success and found that success is related to the use and impact of computer applications. In a later study, they proposed that the dependent success variables are use, user satisfaction, and the impacts of perceived benefits of IS usage on individuals and organizations (DeLone & McLean, 1992). The proposition of IS success theory was then modeled upon the verified relationships between theoretical constructs derived from several studies (DeLone & McLean, 2002; Larsen, 2003; Petter, DeLone, & McLean, 2012). The D&M model proposed three IS success independent variables: information quality, system quality, and service quality. Table 2 lists several studies that empirically verified the D&M model in several contexts of IS usage.

Table 2- Empirical studies using IS success dimensions

Study field	NB	OI	II	Use	US	IQ	SysQ	SerQ	Other Dimensions	Authors
Accounting/financial & production, and marketing areas				✓	✓				Information output, firm size, maturity, resources, time frame, online/offline and IS sophistication.	(Raymond, 1990)
Integrated Student Information System					✓	✓			Ease of use, usefulness, and system dependence.	(Rai, Lang, & Welker, 2002)
Data Warehousing **Software**					✓	✓	✓		Usefulness, ease of use, attitude, and intention.	(Wixom & Todd, 2005)
e-Business				✓					Value, e-business integration, front-end functionality, back-end integration, impact on sales, impact procurement, impact internal operations, competitive pressure, environment, technology, size, financial commitment, and international scope.	(Zhu & Kraemer, 2005)
Organizational Performance						✓	✓		IS plan quality, benefits of use (usefulness & impact), total operational cost, size, and industry type.	(Byrd, Thrasher, Lang, & Davidson, 2006)
Knowledge Management System	✓			✓	✓	✓	✓		n.a.	(Wu & Wang, 2006)
e-Learning System	✓			✓	✓	✓	✓	✓	n.a.	(Wang, Wang, & Shee, 2007)
Employee Portal		✓	✓	✓	✓	✓	✓	✓	Process quality, collaboration quality, and management support.	(Urbach, Smolnik, & Riempp, 2010)
Knowledge Management System		✓	✓			✓	✓		Enterprise system success, knowledge management (KM) competence, KM creation, KM retention, KM transfer, and KM application.	(Sedera & Gable, 2010)
Enterprise Resource Planning (ERP)		✓	✓			✓	✓		Management support, business vision, external expertise, and workgroup impact.	(Ifinedo, 2011)
Business Intelligence						✓			Information access quality, data integration, analytical capabilities, BI maturity systems, analytical decision culture, and use of information in business processes.	(Popovič, Hackney, Coelho, & Jaklič, 2012)
Virtual Communities			✓		✓	✓	✓		Continuance intention to consume, and continuance intention to provide.	(Zheng, Zhao, & Stylianou, 2013)
Social Network					✓				Loyalty, identification, wellbeing, word-of-mouth, continuance intention, size, prestige, compatibility, and complementarity.	(Chiu, Cheng, Huang, & Chen, 2013)
Clinical Information System	✓				✓	✓	✓		Social influence, facilitating conditions, and systems dependency.	(Garcia-Smith & Effken, 2013)

Long-term care in hospitals			✓	✓				Task-technology fit (TTF), performance, and use continuance intention.	(Chang, Chang, Wu, & Huang, 2015)
e-Learning			✓	✓	✓	✓	✓	Intention to use, ease of use, and usefulness.	(Mohammadi, 2015)
e-Government System				✓	✓	✓	✓	Ease of use, usefulness, risk, and intention.	(Rana, Dwivedi, Williams, & Weerakkody, 2015)
Knowledge Management System		✓			✓	✓		Intensity of usage, employees' acceptance, and results quality.	(Leyer, Schneider, & Claus, 2016)

Notes: NB- Net Benefits, OI- Organizational Impact, II- Individual Impact, US- User Satisfaction, IQ- Information Quality, SysQ- System Quality, SerQ- Service Quality, n.a. - not applicable.

From Table 2, we can infer that in several studies, the D&M model explains the factors behind IS success. However, almost all other IS success studies included other constructs: e.g., size of the organization; ease of use; usefulness; attitude; intention; value; integration; cost; process quality; collaboration quality; knowledge management capture and creation; management support; internal and external expertise; data integration; access quality; analytical capabilities; systems maturity; culture; loyalty; prestige; wellbeing; word of mouth; technological fit; social influence; and dependency on other systems. Following analysis of Table 2, we infer that the D&M model is often extended because it provides a better understanding of the context in which we use the system. Consequently, it is important to identify which are the main factors influencing success in learning contexts and MOOCs.

2.3. Gamification as a predictor of success in MOOCs

Gamified learning environments are considered to be the next competitive key value in higher education institutions (HEIs) (Niman, 2014). Gamification is a non-game environment that includes game elements, with the objective of creating a better user experience and increasing engagement toward achieving specific goals (Deterding et al., 2011). Game elements provide an enjoyable and challenging way of pursuing a non-game environment (Deterding et al., 2011). In this context, it is important to provide the differentiation between two concepts: gamification and gaming. Gamification may or may not entail a playful environment, whereas a gaming environment necessarily includes a ludic component (Zichermann & Cunningham, 2011). Another related concept is "serious game," which is defined as the use of gaming with a pedagogic objective (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012; Deterding et al., 2011; Michel & Mc Namara, 2015). Figure 1 illustrates the relationships between these three concepts.

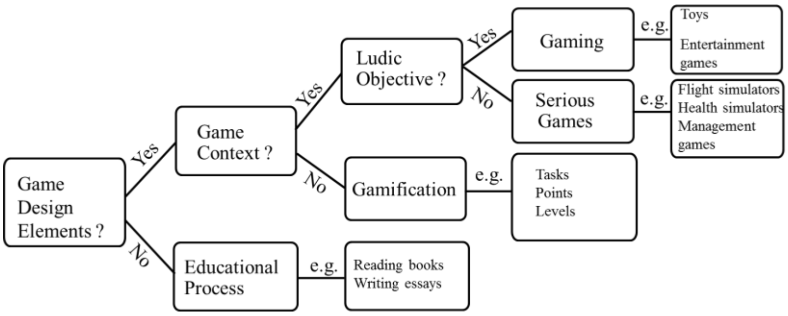


Figure 1- Relationship of gamification with neighbor concepts

Flow is also distinct from gamification. Flow is described as a complete immersion in an experience, while someone has a sense of effortless action in exceptional moments (Csikszentmihalyi, 1996, 1997). In learning, immersive effortless situations followed by immediate feedback are not a constant in MOOCs. Therefore, gamified elements may play a relevant role on overcoming learning obstacles, rather than flow. Game design elements are a set of elements that we specify individually and combine according to our objective. Examples of game design are narrative and context; rules; a way of enforcing rules; teams or groups; a 3D environment; avatars; reputation; feedback; levels and rankings; time pressure; parallel communication; and marketplaces (Reeves & Read, 2013).

Gamified environments and serious games have a positive correlation with the motivation of learners and with the level of participation in learning activities (Buckley & Doyle, 2014; Guillén-Nieto & Aleson-Carbonell, 2012). Chau et al. (2013) found that immersive game environments, referring to Second Life (3D virtual game), could facilitate constructivist learning, by creating a simulation of an on campus environment. These authors (Chau et al., 2013) found that students were interested in the way they interacted with their colleagues in real life through a game interface. However, they also found that some technical aspects could raise issues, such as instable connectivity, and some students found that the virtual environment was difficult to control. In a MOOC context, gamification of the grading system of essays by peers has shown good results when rewarding points of the grading system (Wu et al., 2015). Game elements increase engagement of students, and as a result, fewer students fail the course (Vaibhav & Gupta, 2014). According to Deterding, Dixon, Khaled & Nacke (2011), game design elements refer to the use of engaging mechanisms, which are not for play purposes. In a MOOC context, examples of such elements can be the use of a grading points system, with a clear definition of the rules.

Another example of a game design element in this context is the use of peer assessment. Gamification strategies can increase enjoyment of the learning experience with a game interface element. Elements of gamification design are not all necessarily applicable into gamification contexts. From the earlier studies, enjoyment and challenging situations, e.g., overcoming a time constraint in viewing videos, doing tests and quizzes, and at the same time grading peers, are also examples of gamified design elements. Based on previous studies, we conclude that gamification increases engagement in learning contexts and that gamification leads to a certain level of enjoyment and challenge. Consequently, the presence of game design elements transforms a MOOC into a gamified context, which leads to a higher level of participation and engagement. Successful MOOCs cannot *"be defined in terms of some stated outcome, but rather result from engaging*" (Niman, 2014, p. 32) learners into the course activities.

Based on the theoretical background, in this study, MOOC success consists of the MOOC usage, user satisfaction of MOOC, and perceived individual and organizational performance resulting from the user participation in the MOOC. In this study, MOOC success is not considered as directly related to specific course content. It reflects the user perception of considering themselves as frequent and satisfied users of a MOOC, and of their improved performance as a result of using a course which is distributed freely and widely. At the time we conducted and reported this study, to the best of our knowledge, no study had been carried out using the D&M model.

3. Research model and hypothesis

We propose a model based on the studies referred to above that combine IS success theories with gamification theory to explore the impact on MOOC success. The research model is composed of 10 dimensions: information quality (IQ); systems quality (SysQ); service quality (SerQ); use; user satisfaction (US); gamification (GAM); enjoyment (E); challenge (CH); individual impacts (II); and organizational impacts (OI). Table 3 contains the proposed definitions of the model constructs.

Table 3- Model constructs

Construct	Definition	Author
Information quality (IQ)	Information provided in the MOOC has quality when contents are useful, reliable, complete, and understandable.	(DeLone & McLean, 2003)
Systems quality (SysQ)	System quality consists of a good system performance, availability, and usability of the MOOC platform.	
Service quality (SerQ)	Service quality corresponds to the responsiveness and empathy of the MOOC platform support staff, as well as the competence of the responsible service personnel.	
Use	Measures the frequency of use of the MOOC Information system to perform learning activities.	
User satisfaction (US)	Students' opinion on the way the MOOC covers their experience of usage. Learner satisfaction measures the adequacy, efficiency, and overall satisfaction with the MOOC.	
Individual impacts (II)	Corresponds to the individual learners' perception of accomplishment in the individual tasks and increase of productivity. Individual impacts measure learners' individual performance in the frequency of the MOOC.	(DeLone, 1988; DeLone & McLean, 2003)
Organizational impacts (OI)	Corresponds to the learner perception of the organizational level of success regarding efficiency, working results and overall productivity improvement.	
Gamification (GAM)	Corresponds to the inclusion of game design elements in the MOOC for serious and non-playful purposes. Gamification has enjoyment and challenging elements.	(Davis, Bagozzi, & Warshaw, 1992; Deterding et al., 2011); (Fu et al., 2009).
Gamification (GAM): Enjoyment (E)	Measures the level of enjoyment and pleasantness of the MOOC learning process.	
Gamification (GAM): Challenge (CH)	Corresponds to the presence of hints and MOOC support material to achieve engagement in learning challenges	

Figure 2 represents the proposed model. The success of MOOCs is measured regarding use, user satisfaction, individual impacts, and organizational impacts. The model proposes that information quality (IQ), system quality (SysQ), service quality (SerQ), and gamification (GAM) affect the success of MOOCs.

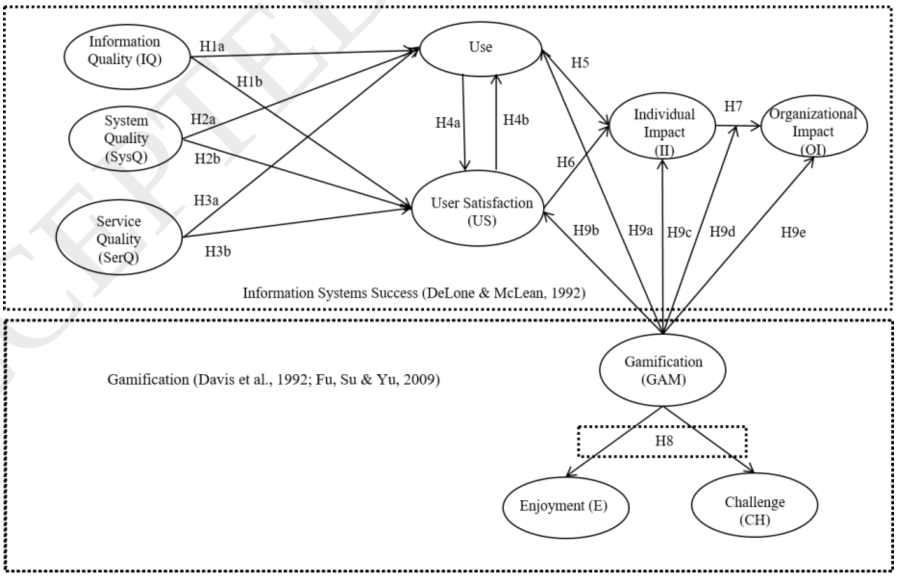


Figure 2- MOOCs Success Model

Information quality plays a determinant role in the IS usage (DeLone, 1988; Rai et al., 2002). In e-learning environments, information quality refers to understandability, reliability, and usefulness provided by content resources. According to several studies, in an e-learning context, information quality determines the use of IS (Piccoli, Ahmad, & Ives, 2001; Wang et al., 2007). In a MOOC context, information resources have also been studied (Breslow et al., 2013; Guo et al., 2014). Information quality also determines satisfaction (DeLone & McLean, 2003; Rai et al., 2002; Urbach et al., 2010). Therefore, this paper hypothesizes that:

***H1a**: Information quality has a positive effect on the use of MOOCs.*

***H1b**: Information quality has a positive effect on user satisfaction.*

According to DeLone & McLean (2003), system quality influences IS usage and satisfaction (Petter, DeLone, & McLean, 2012; Piccoli et al., 2001; Urbach et al., 2010). Technology availability and reliability influence learners satisfaction (Sun, Tsai, Finger, Chen, & Yeh, 2008). System quality is based on usability and performance. Although automatic techniques can be helpful to identify and track issues (Oztekin, Delen, Turkyilmaz, & Zaim, 2013), further evaluation is needed, specially using SEM (Structural Equation Modeling). Oztekin et al. (2013) agree that there is a cause-and-effect relationship between input and output usability variables. Wang, Wang & Shee (2007) studied the impacts of e-learning system quality on use and satisfaction and operationalized this construct. Sun, Chen & Finger (2009) found that e-learning systems should be designed in an intuitive way, rather than, having too many functionalities many of which are regarded as technological burden to users. Therefore, the current study hypothesizes that:

***H2a**: System quality has a positive effect on MOOC use.*

***H2b**: System quality has a positive effect on user satisfaction.*

Service quality in IS is defined as the staff support given to users when addressing eventual issues of a given technological infrastructure (DeLone & McLean, 2003; Pitt, Watson, & Kavan, 1995). According to these studies, the level of responsiveness and empathy in solving user-problems has an impact on use and satisfaction. We recognize that when user support services address difficulties for users, this can affect their level of usage and satisfaction (Wang & Chiu, 2011). If the MOOC service is good, then learners are encouraged to use the system. Therefore, this paper hypothesizes that:

***H3a**: Service quality has a positive effect on MOOC use.*

***H3b**: Service quality has a positive effect on user satisfaction.*

System usage and the perceived user satisfaction are two success measures in IS. DeLone & McLean (1992, 2002, 2003) established that system use paves the way to user satisfaction, and consequently user satisfaction causes continuous usage. Learner satisfaction thus has an impact on MOOC usage, and if students use the system frequently, they experience satisfaction on accomplishment of tasks. This satisfaction results in continued use of MOOCs. Therefore, the current study hypothesizes that:

***H4a**: MOOC use has a positive effect on user satisfaction.*

***H4b**: User satisfaction has a positive effect on MOOC use.*

Research on IS shows that increased use of systems makes the user more aware of system benefits (DeLone & McLean, 1992, 2003). Several empirical studies confirm this positive relationship (Goodhue & Thompson, 1995; Ifinedo, 2011; Sedera & Gable, 2010; Urbach et al., 2010). We also study the significant effect of information and technology use on perceived learning outcomes (Wan, Wang, & Haggerty, 2008). In an e-learning context, learners who adopt digital systems and have digital literacy can increase their individual performance (Mohammadyari & Singh, 2015). Based on these studies, we infer that use of MOOCs can improve individual performance. Therefore, we hypothesize that:

***H5**: MOOC use has a positive effect on individual impact.*

Learner satisfaction is one reason for IS success (Doll & Torkzadeh, 1988; Petter et al., 2012). Earlier studies of user satisfaction focus more on the IS implementation phase, although recently, satisfaction has been considered as a measure of success. User satisfaction leads to IS success and increased individual impact (Seddon, Staples, Patnayakuni, & Bowtell, 1999). Based on previous theories, we infer that learners reporting a good experience and a high level of satisfaction, experience more individual impact. Positive experiences for students lead to increased student satisfaction and a positive individual impact when MOOCs match the needs of learners with their self-efficacy. Therefore, the current study hypothesizes that:

***H6**: User satisfaction has a positive effect on individual impact.*

A result of the study of the impact of individual performance on the measurement of organizational performance concluded that IS success measures are positively related to one another from a managerial perspective (Teo & Wong, 1998). Other studies established a positive relationship between end user performance and organizational performance (Etezadi-Amoli & Farhoomand, 1996; Jurison, 1996; Saarinen, 1996). These authors studied various measures of effectiveness for IT and their impact on the performance of the organization. DeLone & McLean (1988; 1992, 2003) recognize that users' perception of their own performance has positive effects on organizational performance. Based on these studies, we believe that the performance of MOOC learners positively affects the organizational impact on the overall success of their universities, companies, or other organization. Therefore, the current study hypothesizes that:

***H7**: The individual impact has a positive effect on organizational impact.*

Gamification is the use of elements of game design in non-game environments (Deterding et al., 2011). Studies report positive results of games usage in learning environments (Boyle et al., 2016; Fu et al., 2009; Guillén-Nieto & Aleson-Carbonell, 2012), although games and serious games are different from gamification. Games have ludic goals, and serious games usually include simulation and game components. A study by Vaibhav & Gupta (2014) tested a gamified platform on a MOOC and verified an increasing number of engaged learners and, simultaneously fewer failures in tests, in comparison to a non-gamified environment. In contrast, some game components might not be adequate for all MOOCs. Constantly giving badges and points to users, as a result of their interaction with a system, is not enough, because eventually users lose interest (Csikszentmihalyi, 1997; Paz, 2013). With the objective of maintaining or increasing learners interest and engagement, gamification needs to include an emotional energy by giving learners challenging situations and enjoyment (Csikszentmihalyi, 1997; Niman, 2014; Paz, 2013; Wu et al., 2015). Based on these theories, we propose that gamification is a second order construct expressed by enjoyment and challenging situations, which includes tasks to induce learners into a continuous cycle of active participation. Therefore, our paper hypothesizes that:

***H8**: Gamification is a second order reflective construct that is composed of enjoyment and challenge.*

MOOCs provide a collaborative learning experience by challenging participants to overcome several situations. The success of MOOCs can be measured by a successful learning experience; this requires more than a passive student role and requires a certain interaction within the process. Success is supported by the transformation from a passive role to an active role of learners (Niman, 2014). Learners enroll on MOOC courses for a variety of reasons: to widen their knowledge of a certain topic; to obtain as many course certificates as possible; to achieve credits at university; to develop their professional skills or even for simple curiosity and altruism (El-Hmoudova, 2014; Gillani & Eynon, 2014; Hew & Cheung, 2014; Terras & Ramsay, 2015). MOOCs allow the extension of communications from the traditional instructor-student driven model to a different architecture of communication where instructors or lecturers scaffold and facilitate peer-to-peer communication. For example, in some learning tasks, participants evaluate and comment on their peers' work, leading the traditional relationship into a multidirectional individualized feedback evolution (Cope, 2015; Cope & Kalantzis, 2015; Gillani & Eynon, 2014). Clear goals for tasks positively influence learners' perception of the flow of the challenges of the course and indirectly influence user satisfaction and reduce dropout rates (Guo, Xiao, Van Toorn, Lai, & Seo, 2016).

Gamified MOOCs have elements of game design to increase engagement and participation. Some examples of game elements include: time constraints such as doing tests within a time limit and with a particular schedule; reviewing peers' essays and posting comments on discussion boards whilst receiving bonus points or badges (Buckley & Doyle, 2014; Niman, 2014; Wu et al., 2015). A gamified MOOC changes communication patterns between users (Dicheva, Dichev, Agre, & Angelova, 2015). Consequently, communication patterns change and learners engage in an active way during the learning process. Moreover, learners feel satisfied by the interaction on discussion boards (Abdolmohammadi & Boss, 2010; Frank, 2012; Hew & Cheung, 2014; Levy, 2011). Several authors studied the effects of gamification on the perceived individual outcomes and benefits (Csikszentmihalyi, 1997; Dicheva et al., 2015; Miller, 2013; Vaibhav & Gupta, 2014). The individual performance of learners increased in gamified environments (Vaibhav & Gupta, 2014), and when the individual motivation for enrollment in a MOOC is to develop professional skills, this can lead to a positive effect on organizations.

Gamification can also increase the impact of individual performance at an organizational level (Kapp, 2012). Therefore, the current study hypothesizes that:

H9a*: Gamification has a positive effect on MOOC use.*

H9b*: Gamification has a positive effect on user satisfaction.*

H9c*: Gamification has a positive effect on individual impact.*

H9d*: Gamification moderates the individual impact on organizational impact, and as a result, this effect will be stronger for gamified MOOCs.*

H9e*: Gamification has a positive effect on organizational impact.*

4. Method

We designed a questionnaire and applied a quantitative empirical methodology to analyze the data. The questionnaire was constructed by applying validated questionnaire scales to operationalize constructs (Appendix A). It consisted of three sections: (i) general characterization; (ii) IS success constructs; and (iii) gamification dimension. Learners responded on a seven-point scale (1- Strongly disagree to 7- Strongly agree). To measure the degree of gamification, we used the validated scales of enjoyment and challenge. Gamification was measured as a latent variable of second-order reflective-reflective type hierarchical component (Ringle, Sarstedt, & Straub, 2012) with measures of enjoyment (E) and challenge (CH) (Davis et al., 1992; Fu et al., 2009). The second-order construct estimation utilized the repeated indicator approach (Lohmoeller, 1989; Wold, 1982). According to Becker, Klein, & Wetzels (2012), this approach allows a simultaneous estimation of all constructs, therefore avoiding misinterpretation. We believe this approach is the most appropriate for reflective-reflective type models (Becker et al., 2012; Ringle et al., 2012). Enjoyment measures the appreciation of learners during the learning process. Challenge corresponds to the demanding tasks supported by hints, guidance, and material, to achieve engagement in the MOOC learning challenges. Questionnaires were distributed on the MOOC platform to all the 1356 MOOC participants. The empirical study is in the context of an introductory geospatial information systems course, which was developed at a European university, and aimed at university students and other interested learners. The course was distributed on a MOOC platform as an xMOOC type. The course ran from May 2015 until July 2015. The course contents followed a syllabus, and for each course module consisted of: a student manual, a set of slides, video, quizzes, and forums. We collected the data during June and July 2015. In Table 4, we present the various activities, resources, and game design elements of the course.

Table 4- MOOC components

MOOC Component		**Course Element**		
Resources	Course syllabus	Video	Question & answer (Q&A) area	
	Manual or e-Book	Video transcript	Discussion forum	
	Slides	Exercises guides	Individual message area	
Activities	Videos	Essay writing	Interaction with others	
	Read e-book	Peer assessment	Vote for peers' participation	
	Taking quizzes	Discussion of topics		
Gamified elements	Clear learning goals per module	Platform allows monitoring of individual progress	Deadline to perform each task	Earn a free participation certificate at conclusion of the course
	Clear point grading system	Credits/points for reviewing peer's essays	Increasing difficulty level with each module	Possibility of earning university certificate with credits
	Voting system in Q&A area	Time constrains during tests/quizzes	Challenging tasks in external platforms/systems	Share status on social media platforms

The questionnaire was distributed in the middle of the course, and learners were reminded of the voluntary survey at the end of the MOOC. A total of 310 students from various countries (Figure 3) responded to the survey (a response rate of 20%), although due to some incomplete questionnaires only 215 were considered valid. To test the non-responsive bias of the 215 responses, the sample distribution was analyzed by applying the Kolmogorov-Smirnov (K-S) test to the late respondents (52) and the early respondents (162) that verified that they do not differ statistically from one another (Ryans, 1974). The Harman test was applied (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), and we confirm that there was no common method bias in the data. The majority of the sample respondents were men; almost 61% with an average age of 37 and 92% of them had a degree in higher education. Table 5 shows in more detail the characteristics of the sample.

Table 5- Descriptive statistics of participants' characteristics

Measure		Value	Frequency
Responses to Questionnaire	Early respondents	162	75.3%
	Late respondents	53	24.7%
Gender	Female	85	39.5%
	Male	130	60.5%
Age	Min	17	7.9%
	Max	67	31.2%
	Average	37	17.1%
Education Level	High School	16	7.4%
	Undergraduate	80	37.2%
	Post-Graduate	62	28.8%
	Master	43	20.0%
	Ph.D.	8	3.7%
	Post-Doc	5	2.3%
Profession	Forestry, fishing, agriculture	20	9.3%
	Utilities	1	0.5%
	Construction	2	0.9%
	Manufacturing	3	1.4%
	Wholesale trade	7	3.3%
	Retail trade	2	0.9%
	Transportation or warehousing	1	0.5%
	Information	56	26.0%
	Real estate or rental and leasing	9	4.2%
	Professional, scientific, or technical services	24	11.2%
	Management of companies	5	2.3%
	Healthcare or social assistance	29	13.5%
	Arts, entertainment, or recreation	35	16.3%
	Accommodation or food services	11	5.1%

Figure 3- Survey Respondents' origin by countries

To test and assess the theoretical causal relationships, we used structural equation modeling (SEM), by combining statistical data and theoretical causal assumptions (Busemeyer & Jones, 1983; Kenny & Judd, 1984; Marsh, Wen, & Hau, 2004). SEM techniques comprise two streams: (i) covariance-based techniques (CBSEM) and (ii) variance-based techniques (VBSEM). CBSEM is strictly theory driven and is used to confirm theory, while VBSEM is data driven and based on theory applied to predictive orientation (Hair, Black, Babin, & Anderson, 2010). Because CBSEM may use statistical algorithms that may produce unreliable results, or the possibility of issues occurring in small samples, VBSEM produces more robust results and is less sensitive to sample size (Hair et al., 2010). Consequently, we use partial least squares (PLS), a VBSEM approach for the analysis. PLS is adequate for theoretical causal models, which have theoretically derived hypotheses, and with empirical data (Hair, Ringle, & Sarstedt, 2011; Ringle et al., 2012; Wright, 1934). We use PLS because: (i) using a PLS algorithm does not require normality data distribution (Hair et al., 2011; Hair, Sarstedt, Ringle, & Mena, 2012) and the K–S test shows that none of the measurement items were normally distributed ($p < 0.001$); (ii) the research model has not been verified in the literature before; (iii) for PLS calculation, the minimum sample size should satisfy one of the following conditions: (1) 10 times the largest number of formative indicators used to measure one construct or (2) 10 times the largest number of structural paths directed at a particular latent construct in the structural model (Chin, Marcolin, & Newsted, 2003). We carried out the PLS method to the recommended two step approach that first tests the reliability and validity of the measurement model, and then assesses the structural model (Anderson & Gerbing, 1988). We tested the data using Smart PLS 2.0 M3 (Ringlr, Wende, & Will, 2005). The following section presents the two-step results of the PLS-SEM method.

5. Analysis and results

In this section, we present the two-step PLS/SEM results. First, the measurement model results are presented, followed by the structural model results.

5.1. Assessment of measurement model

We evaluate the measurement model based on construct reliability, indicator reliability, convergent validity, and discriminant validity. Construct reliability was tested through the results of composite reliability for each construct (Coelho & Henseler, 2012; Hair et al., 2011; Henseler, Ringle, & Sinkovics, 2009). All the composite reliability of constructs are above 0.912, as shown in Table 6. To measure indicator reliability, all item loadings should meet the criterion of being above 0.70. Because all results are greater than 0.70 (Table 6), there is evidence that all indicators are reliable (Henseler et al., 2009). To analyze the convergent validity of the constructs, we calculated the average variance extracted (AVE). Results demonstrated that all the AVEs were greater than 0.68 (Table 6). The threshold indicates that AVE values should be greater than 0.5 to explain more than half of the variance of the indicators (Fornell & Larcker, 1981; Hair Jr., Ringle, & Sarstedt, 2013).

Table 6- Quality criteria and factor loadings

Constructs	Item	Loading	Composit Reliability	AVE	Discriminant Validity
Information Quality (IQ)	IQ1	0.965	0.968	0.884	Yes
	IQ2	0.943			
	IQ3	0.952			
	IQ4	0.898			
System Quality (SysQ)	SysQ1	0.947	0.969	0.887	Yes
	SysQ2	0.952			
	SysQ3	0.962			
	SysQ4	0.904			
Service Quality (SerQ)	SerQ1	0.960	0.971	0.893	Yes
	SerQ2	0.918			
	SerQ3	0.969			
	SerQ4	0.932			
Use (U)	Use1	0.795	0.912	0.676	Yes
	Use2	0.837			
	Use3	0.836			
	Use4	0.891			
	Use5	0.743			
User Satisfaction (US)	US1	0.900	0.973	0.899	Yes
	US2	0.972			
	US3	0.969			
	US4	0.951			
Individual Impacts (II)	II1	0.967	0.970	0.891	Yes
	II2	0.961			
	II3	0.961			
	II4	0.884			
Organizational Impacts (OI)	OI1	0.968	0.981	0.927	Yes
	OI2	0.977			
	OI3	0.958			
	OI4	0.949			
Gamification (GAM) (Second order construct)	E1	0.807	0.958	0.884	Yes
	E2	0.906			
	E3	0.878			
	CH1	0.873	0.955	0.876	
	CH2	0.860			
	CH3	0.801			

To analyze discriminant validity, we compared all item loadings with the cross-loadings (Chin, 1998), as Appendix B shows. All items meet the criteria that the loadings are higher than the respective cross-loadings. We also submitted the items to a Fornell & Larcker (1981) test to evaluate validity. This test requires that all the square roots of AVEs (diagonal results) are greater than the correlation among other constructs (off-diagonal results). Gamification is the exception, although this was to be expected because gamification corresponds to a second-order construct of "enjoyment (E)" and "challenge (CH)." The results show evidence of discriminant validity as shown in Table 7.

Table *7*- Factor correlation coefficients and square root of AVE (in bold on diagonal)

	Mean	**SD**	**IQ**	**SysQ**	**SerQ**	**U**	**US**	**II**	**OI**	**E**	**CH**	**GAM**
IQ	6.311	0.904	**0.940**									
SysQ	6.243	1.016	0.846	**0.942**								
SerQ	5.779	1.277	0.586	0.612	**0.945**							
U	5.092	1.425	0.401	0.407	0.396	**0.822**						
US	6.205	0.978	0.797	0.750	0.588	0.459	**0.948**					
II	5.991	1.153	0.714	0.724	0.612	0.503	0.677	**0.944**				
OI	5.537	1.422	0.445	0.396	0.439	0.494	0.447	0.653	**0.963**			
E	6.005	1.021	0.719	0.728	0.660	0.485	0.679	0.737	0.472	**0.940**		
CH	5.960	1.013	0.626	0.604	0.523	0.417	0.576	0.618	0.423	0.662	**0.936**	
GAM	5.983	0.927	0.739	0.733	0.652	0.497	0.691	0.746	0.492	0.920	0.903	**0.855**

Note: Information Quality (IQ); System Quality (SysQ); Service Quality (SerQ); Use (U); User Satisfaction (US); Individual Impacts (II); Organizational Impacts (OI); Enjoyment (E); and Challenge (CH).

5.2. Structural model assessment

The quality of the structural model was evaluated in two main steps: first, the calculation of the bootstrap and PLS algorithm using 5000 subsamples to determine the significance of paths within the IS success model (DeLone & McLean, 2003), and second, the same procedures including gamification: the second-order construct. This procedure allows a more in-depth study of the effects of gamification on the overall success of MOOCs. We repeated these two steps because we could not simultaneously evaluate hypothesis H4a and H4b. Therefore, we tested model 1, which undertakes the impact of use on user satisfaction (H4a) and model 2, which tests the effects of user satisfaction (H4b). We assessed the model for multicollinearity issues. The variance inflation factor (VIF) values were below 3.9, whereas the threshold is 5 (Hair et al., 2011). Therefore, we can conclude that the model does not have a multicollinearity problem. Table 8 reports the results of the estimation models for the two different models.

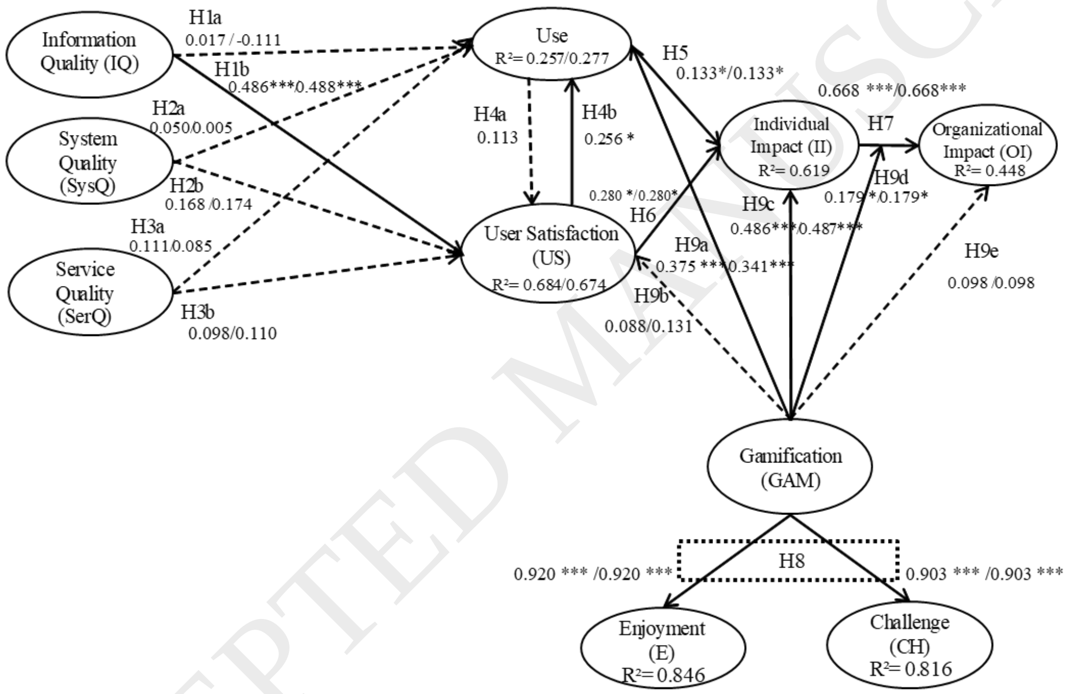
Table 8- Research models' estimations

	IS success theory (DeLone & McLean, 2003)		**IS success theory (DeLone & McLean, 2003) + Gamification**	
	Model 1 U → US	**Model 2 US → U**	**Model 1 U → US**	**Model 2 US → U**
Use:				
R^2	0.207	0.236	0.257	0.277
Adjusted R^2	0.196	0.225	0.244	0.262
IQ→ U	0.148*	0.017 ns	0.017 ns	-0.111 ns
SysQ→ U	0.149 ns	0.085 ns	0.050 ns	0.005 ns
SerQ→ U	0.218**	0.175**	0.111 ns	0.085 ns
GAM→ U	---	---	0.375***	0.341***
User Satisfaction:				
R^2	0.681	0.668	0.684	0.674
Adjusted R^2	0.676	0.663	0.678	0.668
IQ→ US	0.515***	0.534***	0.486***	0.488***
SysQ→ US	0.186*	0.208*	0.168 ns	0.174 ns
SerQ→ US	0.120*	0.148*	0.098 ns	0.110 ns
GAM→ US	---	---	0.088 ns	0.131 ns
Individual Impacts:				
R^2	0.502	0.505	0.619	0.619
Adjusted R^2	0.495	0.498	0.612	0.612
U→ II	0.245***	0.245***	0.133*	0.133*
US→ II	0.564***	0.565***	0.280*	0.280*
GAM→ II	---	---	0.486***	0.487***
Organizational Impacts:				
R^2	0.429	0.429	0.448	0.448
Adjusted R^2	0.421	0.421	0.437	0.437
II→ OI	0.655***	0.655***	0.668***	0.668***
GAM→ OI	---	---	0.098 ns	0.098 ns
II*GAM→ OI	---	---	0.179*	0.179*

Note: Information Quality (IQ); System Quality (SysQ); Service Quality (SerQ); Use (U); User Satisfaction (US); Individual Impacts (II); Organizational Impacts (OI); Enjoyment (E); Challenge (CH) and Gamification (GAM); *Significant at $p<0.05$ level (two-tailed test); **significant at $p<0.01$ level (two-tailed test); ***significant at $p<0.001$ level (two-tailed test).

Results from Table 8 show that dependent variables for the adjusted R^2 values (that take into account the number of independent variables) are always higher for MOOCs success models (IS success theory (DeLone & McLean, 2003) + Gamification) than for the IS success theory (DeLone & McLean, 2003). This means that the original model (IS success without gamification) does not explain as well as the new model does, which includes gamification.

From the comparison of both models, it can be observed that the effect of service quality on use and user satisfaction is statistically significant in the D&M model, although when gamification is included, service quality is not statistically significant. From this comparison, we conclude that gamification is a better driver of success than service quality in a MOOC context. Consequently, we choose the extended model over the IS success model. Results support the hypothesis that the extended model explains substantially more than the original model (Sarstedt, Wilczynski, & Melewar, 2013). From this point on, all results and analysis presented and discussed in this paper, refer to the structural models (Model 1 & Model2) that integrate gamification as a second order reflective-reflective construct in the D&M model (Figure 4).



Note: model 1/model 2; * significant at p<0.05.; ** significant at p<0.01.; *** significant at p<0.001

Figure 4- MOOC success model results

The MOOC success model (D&M model + Gamification) explains 25.7% (model 1) and 27.7% (model 2) of the variation in the use of MOOCs. Information quality, system quality, and service quality are not statistically significant in explaining use. Therefore, H1a, H2a, and H3a are not supported. Gamification ($\hat{\beta}$ = 0.375, p < 0.001 in model 1 and $\hat{\beta}$ = 0.341, p < 0.001 in model 2) and user satisfaction ($\hat{\beta}$ = 0.256, p<0.05) are statistically significant in explaining use; therefore, H9a and H4b are supported, as shown in Figure 4.

The model explains 68.4% (model 1) and 67.4% (model 2) of the variation in user satisfaction. Information quality ($\hat{\beta}$ = 0.486, p < 0.001 in model 1 and $\hat{\beta}$ = 0.488, p < 0.001 in model 2) is statistically significant in explaining user satisfaction, thus H1b is supported. System quality, service quality, use, and gamification are not statistically significant in explaining user satisfaction; therefore, H2b, H3b, H4a, and H9b are not confirmed.

Gamification explains 84.6% of the variation in enjoyment ($\hat{\beta}$ = 0.920, p < 0.001 in model 1 and in model 2). Gamification also explains 81.6% of challenge ($\hat{\beta}$ = 0.903, p < 0.001 in model 1 and in model 2). Therefore, gamification is a reflective second order construct of enjoyment and challenge, supporting H8.

The model explains 61.9% (model 1 & model 2) of the variation in the individual impacts. Use ($\hat{\beta}$ = 0.133, p < 0.050 in model 1 and $\hat{\beta}$ = 0.133, p < 0.050 in model 2), user satisfaction ($\hat{\beta}$ = 0.280, p < 0.050 in model 1 and $\hat{\beta}$ = 0.280, p < 0.050 in model 2), and gamification ($\hat{\beta}$ = 0.486, p < 0.001 in model 1 and $\hat{\beta}$ = 0.487, p < 0.001 in model 2) are statistically significant, thus H5, H6, and H9c are supported.

The model explains 44.8% (model 1 & model 2) of the variation in the organizational impacts. Individual impacts ($\hat{\beta}$ = 0.668, p < 0.001 in model 1 and model 2) are statistically significant, supporting H7. Gamification moderates positively the individual impacts on organizational impacts ($\hat{\beta}$ = 0.179, p < 0.05 in model 1 and model 2), thus confirming H9d.

6. Discussion

The MOOC success model combines IS success theory (DeLone & McLean, 2003) with the gamification theory (Deterding, Dixon, Khaled, & Nacke, 2011) in a MOOC context. According to Table 8 columns 1 and 2 in DeLone & McLean (2003), we can conclude that H1a, H3a, and H3b are significant. However, when we include gamification, the explanation power significantly increases the Adjusted R^2. Moreover H1a, H3a, and H3b lose their importance in the explanation of use and user satisfaction, and what really explains this satisfaction is gamificataion. This is the first MOOC success model, including both theories, and empirically validating theories. According to our findings, gamification improves the explanation of the success of MOOCs. Table 8 shows that gamification magnifies the D&M model, as the adjusted R^2 values are higher in all dependent variables of the model. The research model explains 44.8% of the variation in organizational impacts and 61.9% of individual impacts of MOOCs. The factors that directly influence individual impacts are use, user satisfaction, and gamification. The organizational impact factor is directly influenced by individual impact and also moderated by gamification. We found gamification to have a significant impact as a moderator between individual impacts and organizational impacts. Consequently, gamification strengthens the positive effect of individual impact on organizational impacts. Table 9 synthesizes the structural hypotheses results and the findings of the study. The research model validated the one relationship of user satisfaction, namely information quality (Breslow et al., 2013; DeLone & McLean, 1992, 2003; Rai, Lang, & Welker, 2002). User satisfaction is considered as a positive influence on individual impacts and use. Similar results were found in Doll & Torkzadeh (1988).

Table 9- Research hypotheses results

	Independent Variable		**Dependent Variable**	**Moderator**	$\hat{\beta}$ **Model 1**	**Model 2**	**Findings**	**Conclusion**
H1a	Information Quality (IQ)	→	Use (U)	n.a.	0.017	-0.111	non-significant	not supported
H1b	Information Quality (IQ)	→	User Satisfaction (US)	n.a.	0.486	0.488	***/***	supported
H2a	System Quality (SysQ)	→	Use (U)	n.a.	0.050	0.005	non-significant	not supported
H2b	System Quality (SysQ)	→	User Satisfaction (US)	n.a.	0.168	0.174	non-significant	not supported
H3a	Service Quality (SerQ)	→	Use (U)	n.a.	0.111	0.085	non-significant	not supported
H3b	Service Quality (SerQ)	→	User Satisfaction (US)	n.a.	0.098	0.110	non-significant	not supported
H4a	Use (U)	→	User Satisfaction (US)	n.a.	0.113	n.a.	non-significant	not supported
H4b	User Satisfaction (US)	→	Use (U)	n.a.	n.a.	0.256	*	supported
H5	Use (U)	→	Individual Impacts (II)	n.a.	0.133	0.133	*/*	supported
H6	User Satisfaction (US)	→	Individual Impacts (II)	n.a.	0.280	0.280	*/*	supported
H7	Individual Impacts (II)	→	Organizational Impacts (OI)	n.a.	0.668	0.668	***/***	supported
H8	Gamification (GAM)	→	Enjoyment (E)	n.a	0.920	0.920	Gamification reflective-reflective second order construct	supported
		→	Challenge (CH)	n.a	0.903	0.903		
H9a	Gamification (GAM)	→	Use (U)	n.a.	0.375	0.341	***/***	supported
H9b	Gamification (GAM)	→	User Satisfaction (US)	n.a.	0.088	0.131	non-significant	not supported
H9c	Gamification (GAM)	→	Individual Impacts (II)	n.a.	0.486	0.487	***/***	supported
H9d	Individual Impacts (II) * Gamification (GAM)	→	Organizational Impacts (OI)	Gamification (GAM)	0.179	0.179	*/*	supported

Table 9- Research hypotheses results

	Independent Variable		Dependent Variable	Moderator	$\hat{\beta}$ Model 1	Model 2	Findings	Conclusion
H9e	Gamification (GAM)	→	Organizational Impacts (OI)	n.a.	0.098	0.098	non-significant	not supported

Notes: n.a- not applicable; * significant at p<0.05; ** significant at p<0.01; *** significant at p<0.001.

The research model does not support the positive relationships between use and user satisfaction. These findings suggest that information quality directly influences satisfaction, rather than the MOOC usage itself. However, user satisfaction directly influences usage. Furthermore, model results do not suggest a direct impact of service quality on user satisfaction, and similar results were obtained by Urbach et al. (2010). Although the positive relationships between use and user satisfaction on individual impacts have been studied by several authors (DeLone & McLean, 2003; Mohammadyari & Singh, 2015; Urbach et al., 2010; Wan, Wang, & Haggerty, 2008), we find no studies reporting the positive impact of gamification on individual impacts.

The research model validated the positive relationship between individual impacts on organizational impacts as verified by other studies (Etezadi-Amoli & Farhoomand, 1996; Jurison, 1996; Teo & Wong, 1998; Urbach et al., 2010). Our study also supports the empowerment of this relationship as a result derived from the moderation effect of gamification. Gamification positively moderates the positive relationship between individual impacts and organizational impacts. As gamification increases, the slope between individual impacts and organizational impacts also increases (Figure 5). The plot presented in Figure 5 suggests that, although individual impacts are positively associated with organizational impacts, individual impacts is likely to be even more effective in the positive effect on organizational impacts when the level of gamification is high. Gamification in this research model reflects the enjoyment and challenge perceived by learners.

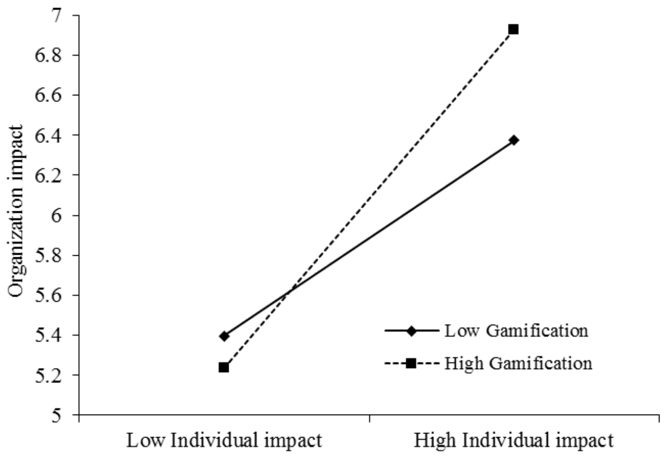


Figure 5- Gamification moderation effect

Furthermore, we find that the relationship between information quality, system quality, service quality, and MOOC use is not confirmed. This contradicts the findings of Piccoli et al. (2001), DeLone & McLean (2003) and Wang et al. (2007). Although service quality is not supporting a positive impact on use, it is consistent with the findings of Urbach et al. (2010). These findings are probably a result of the significant impact of gamification on MOOC use. Gamified learning environments influence the use of MOOCs in that learners tend to adopt an active role in course activities that in itself is a great influence on use. The research model results do not make a case for a significant relationship between gamification and user satisfaction. This may be because of people perceiving this as a consequence of MOOC usage, rather than the other way around. The non-significant impact of gamification on user satisfaction can also be the result of the positive influence information quality and system quality have on user satisfaction. Information quality influences user satisfaction, rather than system quality, service quality, use, and gamification. Our study does not support the positive impact of gamification on organizational impact as we did not find similar results; however, this can suggest that users perceive that gamification influences individual performance. Although gamification significantly influences use, which leads to the idea that it is significant for the adoption of MOOCs. Moreover, our model suggests that gamification is a major factor in the MOOC success model, explaining the use, individual impact, and gamification leverages the impact of individual impact on the organizational impact.

6.1. Theoretical implications

To our knowledge, no previous study has validated an IS success theory in a MOOC context. Our research indicates that D&M is an adequate model to explain success in a MOOC context. Moreover, when we combined the D&M model with gamification, our proposed model that we call as “MOOC success” emerges. The new model improves the D&M model in the context of MOOCs (i.e., based on adjusted R^2 values) and more adequately explains all the dependent variables. Consequently, the proposed model provides the theoretical and empirical support for a new model of MOOC success. Therefore, one implication of this study is that it provides an extension to the D&M model in a MOOC context. Another important implication is the theoretical operationalization of the gamification construct as a second order reflective-reflective type construct. The gamification construct is the most important driver of MOOC use and individual impact, and influences the impact of individual performance on organizational impact.

6.2. Practical implications

Our paper implies that the level of learner satisfaction and the presence of elements of gamification in the learning environment throughout the course influence MOOC usage. Our paper finds that if users think the course is useful, understandable, well-structured, easy to navigate, and consequently providing support for their field of study or work, this will influence their level of satisfaction with MOOCs.

From the perspective of MOOC providers, the main implications are that the designers should pay attention to features that affect the information quality and the usefulness and comprehensibility of the course. This suggests that industry also should consider the quality of the system in order to provide a good user experience, by customizing an easy to navigate user-friendly system. A significant implication of this paper is that the elements of the gamification of a course increase the interactivity of users, leading to a higher degree of enjoyment and challenge. Accordingly, MOOC providers benefit from the inclusion of gamified elements within the course. These elements can create an enjoyable environment with several challenges to overcome and provide auxiliary resources, which help them to overcome those challenges. A challenging environment, consisting of several tasks, which gradually increase the level of difficulty, gives the users a sense of engaging flow. However, in a MOOC context, providers have hundreds or even thousands of learners and this could be a barrier to the users’ perception of a lack of feedback provided by monitors or tutors. Furthermore, if the tasks are peer-reviewed, this is a challenge for users, but at the same time brings satisfaction. Another specific element of gamification, which may increase enjoyment, is a points system related to the completion of each level. Gamification may influence how the users percieve their progress and their perception of the usefulness of the course. Use, user satisfaction, and gamification are the principal drivers of success of MOOCs. Our paper implies that, if industry includes elements of gamification in the courses, it not only positively affects the level of usage, and the individual level of productivity, but also leverages, in terms of efficiency, the organizational benefits. The perception of individual benefits influences the perception of the overall organizational success. MOOC course designers might expect success if learners are satisfied by their experience of using MOOCs. We consider gamification as a significant contributing factor to the overall success of MOOCs. Not only can it reduce student dropout rates, it can improve learner satisfaction and user experience. The educational sector and industry now have the empirical evidence for the factors underlying viable MOOCs.

6.3. Limitations and Future Work

The data for this paper were collected in one survey, and we accept that a longitudinal study could contribute to a more efficient model. We did not conduct a study of behavioral MOOC platform back-end data of learners. An in-depth study of learners would give us a better understanding of the real causes of these results. Such a study could contribute to reducing eventual subjective bias, typical of questionnaire-based surveys. It could give a greater insight into the success of MOOCs and could establish a direct correlation between the perceived users' level of performance, and their actual performance registered during the course. Further study on a second-order formative construct MOOC success is proposed to clarify dependent variables of success for a MOOC context.

7. Conclusions

This study outlines the driving factors behind MOOCs. Based on IS success theory and gamification, we propose a theoretical model and present an empirical study in the context of a MOOC. Besides the

IS theory success factors, this study demonstrates the decisive role of gamification in explaining the success of MOOCs. We show that the MOOCs success model explains 62% of the variation of individual impacts and 45% of the variation of organizational impacts. MOOC use is explained in (26% / 28%, model 1 and model 2, correspondingly) by user satisfaction and gamification. User satisfaction variation is explained in 68% by information quality, system quality, and use. This study confirms that gamification is a second-order reflective-reflective construct of enjoyment and challenge. Gamification plays a central role in the success of MOOCs, as it positively influences use, individual impacts, and organizational impacts, and moderates the positive relation between individual and organizational impacts. As a consequence, gamification not only has a direct positive effect, but also an indirect effect, by leveraging the effect of individual impact on organizational impact. This study contributes to the theoretical and practical insights invaluable for providers and designers of MOOCs, either in higher education or industry. Furthermore, gamification is the most important driver in explaining the individual impact of MOOCs. In conclusion, we found that a gamified learning environment is a decisive factor in the success of MOOCs.

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Appendix A: Measurement items

Constructs	Code	Indicators	Theoretical support
Using a seven-point rating scale (1- strongly disagree, 7- strongly agree on the scale), the variables are measured by asking students to rate their perception regarding their perceptions on MOOC. (1 Strongly disagree … 7 Strongly agree)			
Information Quality	IQ1	Please assess the quality of the information provided by your MOOC. Examples are retrievable documents, courses news, process descriptions, and course-specific information. The information provided by MOOC is useful.	Urbach et al., 2010
	IQ2	The information provided by MOOC is understandable.	
	IQ3	The information provided by MOOC is interesting.	
	IQ4	The information provided by MOOC is reliable.	
System Quality	SysQ1	Please assess the system quality of the e-learning platform. The MOOC is easy to navigate.	Urbach et al., 2010
	SysQ2	The MOOC allows me to find easily the information I am looking for.	
	SysQ3	The MOOC system is well structured.	
	SysQ4	The MOOC is easy to use.	
Service Quality	SerQ1	Please assess the service quality of the personnel responsible for the support of the MOOC. The responsible service personnel is always highly willing to help whenever I need support with the MOOC.	Urbach et al., 2010
	SerQ2	The responsible service personnel provides personal attention when I experience problems with the MOOC.	
	SerQ3	The responsible service personnel provides services related to the MOOC at the promised time.	
	SerQ4	The responsible service personnel has sufficient knowledge to answer my questions in respect of the MOOC.	
Use	Use1	Please indicate the extent to which you use the MOOC to perform the following tasks: Retrieve information.	Urbach et al., 2010
	Use2	Publish information.	
	Use3	Communicate with colleagues and teachers.	
	Use4	Store and share documents.	
	Use5	Execute courses work.	
User Satisfaction	US1	Please indicate your satisfaction with the MOOC that you use. How adequately does the MOOC support your area of study?	Urbach et al., 2010
	US2	How efficient is the MOOC?	
	US3	How effective is the MOOC?	
	US4	Are you satisfied with the MOOC overall?	
Individual Impact	II1	Please assess the individual benefits derived from using your organization's MOOC. The MOOC enables me to accomplish tasks more quickly.	Urbach et al., 2010
	II2	The MOOC increases my productivity.	
	II3	The MOOC makes it easier to accomplish tasks.	
	II4	The MOOC is useful for my job.	
Organizational Impact	OI1	Please assess the university benefits of utilizing your university/organization MOOC. The MOOC has helped my university improve the efficiency of internal operations.	Urbach et al., 2010
	OI2	The MOOC has helped my university improve the quality of working results.	
	OI3	The MOOC has helped my university enhance and improve coordination within the University.	
	OI4	The MOOC has helped my university make itself an overall success.	
Enjoyment	E1	I find using MOOC to be enjoyable.	Davis et al., 1992
	E2	The actual process of using MOOC is pleasant.	
	E3	I have fun using MOOC.	
Challenge	CH1	The MOOC provides "hints" in text that helps me overcome the challenges	Fu, Su & Yu, 2009
	CH2	The MOOC provides "online support" that helps me overcome the challenges.	
	CH3	The MOOC provides video or audio auxiliaries that help me overcome the challenges	

Appendix B: Outer Loading and Cross-Loading

Items		IQ	SysQ	SerQ	U	US	II	OI	GAM
IQ1		**0.965**	0.823	0.563	0.373	0.790	0.692	0.426	0.710
IQ2		**0.943**	0.821	0.549	0.405	0.752	0.662	0.417	0.707
IQ3		**0.952**	0.830	0.571	0.414	0.760	0.719	0.412	0.714
IQ4		**0.898**	0.699	0.519	0.310	0.688	0.607	0.422	0.645
SysQ1		0.792	**0.947**	0.536	0.387	0.710	0.703	0.366	0.699
SysQ2		0.809	**0.952**	0.619	0.419	0.722	0.687	0.395	0.731
SysQ3		0.854	**0.962**	0.605	0.390	0.751	0.704	0.395	0.727
SysQ4		0.725	**0.904**	0.539	0.331	0.636	0.629	0.331	0.595
SerQ1		0.599	0.623	**0.960**	0.394	0.585	0.623	0.396	0.657
SerQ2		0.446	0.494	**0.918**	0.391	0.496	0.506	0.412	0.521
SerQ3		0.548	0.566	**0.969**	0.350	0.570	0.560	0.424	0.601
SerQ4		0.613	0.622	**0.932**	0.362	0.566	0.618	0.431	0.678
U1		0.437	0.406	0.303	**0.795**	0.469	0.442	0.340	0.473
U2		0.239	0.234	0.293	**0.837**	0.309	0.362	0.434	0.315
U3		0.235	0.262	0.320	**0.836**	0.303	0.342	0.414	0.359
U4		0.284	0.297	0.382	**0.891**	0.377	0.401	0.431	0.413
U5		0.395	0.419	0.318	**0.743**	0.381	0.478	0.415	0.434
US1		0.757	0.716	0.520	0.419	**0.900**	0.635	0.417	0.633
US2		0.757	0.708	0.565	0.456	**0.972**	0.642	0.442	0.666
US3		0.746	0.698	0.560	0.430	**0.969**	0.637	0.420	0.656
US4		0.760	0.722	0.583	0.434	**0.951**	0.652	0.417	0.665
II1		0.711	0.721	0.617	0.484	0.675	**0.967**	0.578	0.746
II2		0.673	0.701	0.600	0.466	0.639	**0.961**	0.591	0.719
II3		0.679	0.701	0.608	0.464	0.649	**0.961**	0.576	0.747
II4		0.632	0.608	0.485	0.485	0.591	**0.884**	0.718	0.603
OI1		0.456	0.398	0.449	0.488	0.436	0.652	**0.968**	0.503
OI2		0.443	0.397	0.405	0.471	0.451	0.651	**0.977**	0.468
OI3		0.399	0.356	0.413	0.479	0.417	0.602	**0.958**	0.448
OI4		0.415	0.372	0.425	0.465	0.416	0.608	**0.949**	0.476
Gamification	E1	0.590	0.609	0.610	0.480	0.602	0.661	0.466	**0.807**
	E2	0.700	0.711	0.604	0.456	0.642	0.713	0.426	**0.906**
	E3	0.731	0.730	0.648	0.435	0.670	0.703	0.442	**0.878**
	CH1	0.620	0.590	0.455	0.380	0.552	0.592	0.390	**0.873**
	CH2	0.540	0.549	0.572	0.443	0.525	0.583	0.404	**0.860**
	CH3	0.598	0.556	0.439	0.345	0.542	0.558	0.394	**0.801**

Note: Information Quality (IQ); System Quality (SysQ); Service Quality (SerQ); Use (U); User Satisfaction (US); Individual Impacts (II); Organizational Impacts (OI); Enjoyment (E); Challenge (CH); and Gamification (GAM)