

# Understanding the quality factors that influence the continuance intention of students toward participation in MOOCs

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Published online: 22 February 2017

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**Abstract** The massive open online course (MOOC) is emerging as the new paradigm for modern education. The success of MOOCs depends on learners' continued usage. Drawing upon the information systems success model (IS success model) and technology acceptance model, a theoretical model for studying learners' continuance intentions toward participation in MOOCs was developed. Based on survey data from 294 respondents, structural equation modeling was employed to assess the model. The results of this analysis indicate that system quality, course quality, and service quality were significant antecedents of the continuance intention of individuals, and the effect of course quality and service quality were mediated by perceived usefulness. The results contribute to the extant literatures in the context of MOOCs learning by identifying the critical quality factors, and provide managerial guidelines for MOOCs utilization and generalization. The implications of the present findings for research and managerial practice are discussed.

**Keywords** MOOCs · E-learning · Continuance intention · IS success model · Quality factors

## Introduction

The rapid progress in development of both information and communication technologies has prompted the emergence of e-learning as the paradigm for modern education. Over the past few years, e-learning practices have undergone a number of changes, particularly with

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regard to the openness of the learning environment. One specific initiative that is quickly growing more popular among educational researchers, instructors, and learners is the massive open online course (MOOC) (Spector, 2014).

Massive open online course offered through platforms such as Coursera, edX, and Udacity allow users all over the world to participate in courses which are often supported by well-known universities. In addition to traditional course materials such as videos, readings, and problem sets, MOOCs provide interactive user forums that help build a community for students, professors, and teaching assistants. In most cases participants register for MOOCs free of charge, and in other cases for a small or minimal fee to obtain a completion certificate. In recent years there has been a tremendous increase in both the numbers of participants and the level of user contributions in the MOOC setting. For instance, the fast growing MOOC provider Coursera has more than 30 university partners, has registered more than 2.8 million students, and sees 1.4 million enrollments every month (Cusumano 2013).

Although many MOOC providers offer free certificates to the students who complete MOOC learning on the platform, the certificate is still not a useful inducement to finish the MOOC according to the research, and up to 90% stop in their pursuit of online learning after their initial MOOC experience (Hew and Cheung 2014). Previous studies have observed a variety of reasons for this low participation rate, such as a lack of incentive (Fini 2009), ambiguous assignments and course expectations (Sanchez-Gordon and Lujan-Mora 2013), minimal tutorial contact (de Freitas et al. 2015), and a lack of time due to other more important priorities and commitments (Yousef et al. 2014). However, little is known about the quality factors that motivate students to continue participating in a specific MOOCs platform. Given the quality differences of MOOCs platform, it is crucial to understand what are the specific quality factors that influence the continuance intention of students toward participation in MOOCs in order to support MOOC developers in the design of popular content that interests more students, and to help teachers and vendors design strategies that are more likely to increase the use of MOOCs.

This paper aims to investigate the quality factors that support the acceptance of MOOCs and foster improved continuance intention. We integrate the information systems (IS) success model and technology acceptance model (TAM) into a unified framework to explore the direct and indirect effects of quality factors on the continuance intention towards participation in MOOCs. Technology acceptance model explains why an individual accepts or rejects information technology by perceived usefulness and perceived ease of use (Davis et al. 1989). DeLone and McLean's IS success Model suggests that a system can be evaluated in terms of information, system and service quality; these characteristics affect the subsequent use or intention to use and user satisfaction (DeLone and McLean 2003). We combine these two theoretical models for the following three reasons. First, although previous research has combined the IS success model and TAM to explain users' intentions to reuse e-learning (Li et al. 2012), it does not inform us of which IS success dimensions would affect users' attitudinal beliefs, namely perceived ease of use and perceived usefulness. Second, while the IS success model has been found to be a robust model for explaining users' continuance intention toward e-learning (Wu and Zhang 2014), most of the extant literature focuses on system quality and information quality, yet ignores another significant dimension: service quality. Third, the integrated model helps fill in the research gap between design and implementation decisions regarding system characteristics and system success factors and their effects on continuous use intention toward MOOCs. The results presented in this research can help institutions reduce the risk of failure and overcome obstacles during MOOC implementation. Furthermore, those in academia can use the findings of this study as a basis to imitate related studies in the e-learning area.

The remainder of this paper is organized as follows. Section 2 provides the theoretical background of the study. Section 3 presents the research model and underlying hypotheses. The measurement method and the results of data analysis are discussed in Sects. 4 and 5, respectively. Section 6 concludes the discussion with a summary of the implications of this research.

## Theoretical background

Prior literature provides the rich foundation for the research model that was used to investigate the continuance intention of students toward participation in MOOCs. In this section the relevant literature on e-learning is reviewed from the perspective of the IS success model. Then the theoretical foundations of TAM are analyzed in the context of continuance intention toward participation in MOOCs.

### IS success model

MOOCs have attracted a great deal of interest in recent years as a new technology-enhanced learning model in higher education. MOOCs provide more educational opportunities by offering a massive number of learners the chance to attend free online courses around the world. However, low completion rates and other pedagogical problems concerning assessment and feedback have often been cited as evidence of a scale-efficacy tradeoff. The sustainability of the MOOC platform depends largely on whether learners are willing to continually participate; this is regarded as an effective measure for system success (Li et al. 2012).

The primary interface for the MOOC is the web-based learning system. Therefore, in this section review of prior IS success model studies is used to establish the theoretical foundation for and means for conceptualization of the learning system success of MOOCs. The DeLone and McLean (1992) model (D&M model) is one of the most widely cited IS success models. It suggests that a systematic combination of individual measures from IS success categories creates a comprehensive measurement instrument. In this model, system quality and information quality both singly and jointly affect both system use and user satisfaction. Moreover, the amount of system use affects the degree of user satisfaction, and vice versa.

Seddon (1997) presented and justified a re-specified and slightly extended version of the D&M model. In this version, the process interpretation of the D&M model has been eliminated, and the remainder of the model has been split into two distinct variance models. The first model is the partial behavioral model of IS use, and the second is the IS success model. In Seddon's IS success model, user satisfaction is dependent upon six variables: system quality, information quality, perceived usefulness, net benefits to individuals, net benefits to organizations, and net benefits to society. Perceived usefulness is believed to depend upon the same six variables, excluding itself. Rai et al. (2002) empirically and theoretically assess DeLone and McLean's (1992) and Seddon's (1997) models of IS success in a quasi-voluntary IS use context; they found that both models exhibit reasonable fit with the collected data.

With the emergence and consequent explosive growth of Internet-based applications, DeLone and McLean (2003) proposed an updated IS success model and evaluated its usefulness in the e-commerce context. Based on previous studies, the updated IS success model DeLone and McLean (2003) presented included "service quality" measures as a

new dimension and grouped all the “impact” measures into a single impact or benefit category called “net benefit”. Thus, this updated model consists of six dimensions: (1) information quality, (2) system quality, (3) service quality, (4) use/intention to use, (5) user satisfaction, and (6) net benefits. Given that system usage continues to be used as a dependent variable in a number of empirical studies (Chiu et al. 2007; Li et al. 2012; Rai et al. 2002) and takes on new importance for success measurements of Internet applications where use is voluntary or quasi-voluntary, system usage or “intention to use” are still considered to be important measures of IS success in the updated D&M model.

Y. S. Wang et al. (2007) developed and validated a multi-dimensional model for assessing e-learning system success from the perspective of the e-learner; they emphasized in this model that quality is a vital aspect of e-learning systems. Prior studies of determinants of user continuance intention in the e-learning context also show that perceived quality is a significant factor behind the intention to use the e-learning system (Calisir et al. 2014; Chiu et al. 2007; Chiu et al. 2005; Li et al. 2012; K. M. Lin 2011; Wu and Zhang 2014). The DeLone and McLean (2003) updated IS success model can be adapted to the measurement challenges presented by a new e-learning context (Y. S. Wang et al. 2007). Accordingly, we adopted DeLone and McLean’s (2003) IS success model as a theoretical framework for assessing the success of MOOC systems in an organizational context. Thus, this study primarily focused on the perspective of the e-learner, and uses four of the updated IS success dimensions—information quality, system quality, service quality, and intention to use—to develop the research model in the context of MOOCs.

### Technology acceptance model

The technology acceptance model (TAM) was originally proposed in 1989 and has been widely applied in IS research to explain why an individual accepts or rejects information technology from a social psychological perspective (Davis et al. 1989). Drawing upon the theory of reasoned action, TAM focuses on the individual’s intention toward and actual use of a particular system and theorizes that an individual’s behavioral intention for system usage is determined by two major constructs: perceived usefulness and perceived ease of use. Perceived usefulness is defined as “the degree to which a person believes that using a particular system would enhance his or her job performance”, while perceived ease of use refers to “the degree to which a person believes that using a particular system would be free of effort” (Davis et al. 1989). Prior studies suggest that these two constructs are significant antecedents of an individual’s behavior intention towards system usage and can explain a large variance of the dependent variable (Venkatesh and Davis 2000).

In past decades, TAM in concert with other theories has integrated social, organizational, and individual factors to offer deep insights into the behavior intentions of individuals with regard to systems usage. Davis and Venkatesh (1996) extended TAM by adding a third construct: computer self-efficacy. The empirical studies suggest that self-efficacy is a significant antecedent of perceived ease of use. In a follow-up study, Venkatesh et al. (2003) integrated TAM with the theory of planned behavior, social cognitive theory, and motivation theory, and developed a unified theory of acceptance and use of technology. Some researchers argue that TAM needs to be further extended to adapt to new contexts and explain new phenomena with regard to IT usage (see for example Benbasat and Barki 2007).

A large amount of research has focused on the acceptance of e-learning systems due to the rapid growth of online learning systems applications. Several theoretical models have been developed to explain the behavioral intention of students toward e-learning systems (Bhuasiri et al. 2012; Liaw et al. 2007). However, most of the previous studies focus on the direct impact

of social, organizational, or individual factors on the behavior intention of students, and few studies have developed an integrated model to offer a comprehensive understanding of how these antecedents impact student intention toward system usage, especially in the context of developing countries such as China. In this study, TAM was extended with the IS success model to provide a better understanding of student acceptance and usage of MOOCs.

## Research model and hypotheses

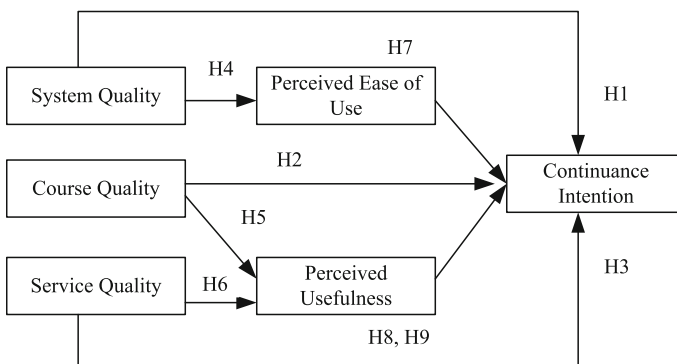
This study develops a theoretical model to examine the effect of system quality, course quality, and service quality on the intentions of students to continue using MOOCs on the basis of the updated IS success model. The basic assumption is that system quality, course quality, and service quality each have a positive impact on the continuance intentions of students to participate in MOOCs, mediated by perceived usefulness (PU) and perceived ease of use (PEU). The relationships between these constructs and corresponding hypotheses (H1–H9) are described in the research model, as illustrated in Fig. 1. We further explain the theoretical logic behind each hypothesis in Sect. 3.1–3.3.

### Perceived quality and continuance intention

In the context of MOOCs, the definitions of system quality, course quality, and service quality are different from those in the information system in general. Calisir et al. (2014) found that the system quality component of a course content management system includes reliability, flexibility, integration, accessibility, and timelines. However, this study assumes that the relative importance of each dimension of system quality is different.

Integration helps users to effectively learn. Reliability ensures the stable operation of the learning system. The main purpose of student participation in MOOCs is to study in online courses. As users cannot have face-to-face interactions with teachers in MOOCs, users pay most attention to two dimensions of system quality: integration and reliability.

Different from other complex forms of network information, online courses have a clear classification of subjects to help users easily find and access to courses what they are interested in. That is to say, the clear classification of online course information determines that it has high accessibility. Users spend more time learning materials in MOOCs while they spend less time operating the MOOC system compared with other information systems or sites. Therefore, users are less sensitive to the flexibility and timeliness of the system response.



**Fig. 1** Research model

In this paper, we define system quality as integration of system functions and reliability of system operation in the user-perceived MOOC platform. When users perceive that the MOOC platform provides a fully functioning system for learning, their continuance intentions toward participation in MOOCs will be positive influenced. Lin and Lu (2000) used the Internet as an example to verify the positive effect of system quality on learners' using intentions. They believed that despite the popularity of the Internet, a number of system quality factors still lead to the termination of the use of the Internet. Saeed et al. (2003) proposed that system quality is one of the main driving forces of consumer perception and subsequent online behavior. Therefore, we propose the following hypothesis:

**H1** System quality has a positive effect on the continuance intention toward participation in MOOCs.

Information quality can be jointly determined by the source of the information and the content of the information (Bhattacharjee and Sonford 2006). In the context of MOOCs, users' perception of course quality can be affected by the lecturers' knowledge, as well as the authority of the course content. In this study, we use course quality instead of information quality, which is defined as knowledgeable, authority of course content, and lecturers' teaching attitudes. When users perceive that online courses have high knowledgeable and authority, and find teachers are serious about teaching and fully prepared, the intrinsic motivation to continue to study is fully stimulated. Course quality has been proved to have a strong impact on the users' use of information systems, especially in the context of the e-learning systems (Molla and Licker 2001). Saeed et al. (2003) held that course quality positively affects the users' online behaviors. Li et al. (2012) found that course quality positively enhances the behavioral intention to reuse e-learning systems. Therefore, we propose the following hypothesis:

**H2** Course quality has a positive effect on the continuance intention toward participation in MOOCs.

Service quality can be defined as "a global judgment or attitude relating to the superiority of a service" (Parasuraman et al. 1985). In this study, service quality is considered to be the overall support delivered by the MOOC's service provider, or support rendered to the learners in a MOOC's platform, such as giving users professional guidance, helping users to carry out practical exercises, assigning homework, and organizing examinations. Zeithaml et al. (1996) proposed that service quality is one of the main predictors of repetitive behavior intentions. The better the user perceives service quality, the higher the possibility of that user continuing to use the information system in the future. Hu et al. (2009) verified a positive correlation between service quality and continuance intentions. In addition, many studies have proposed that when users perceive that an information system provides perfect service, they will have strong sense of satisfaction toward that information system, and intend to reuse it in the future (Chiu 2007; Chen 2007; Roca 2006; Zheng 2012; Zhou 2013; Chiu 2005). Therefore, we propose the following hypothesis:

**H3** Service quality has a positive effect on the continuance intention toward participation in MOOCs.

### **Perceived quality and perceived ease of use/perceived usefulness**

In the context of e-learning, perceived ease of use can be defined as the extent to which a person believes that using e-learning will be free of effort (K.-M. Lin et al. 2011). TAM proposes that perceived ease of use predicts both perceived usefulness and attitude towards

use (Davis et al. 1989). If potential users of MOOCs encounter security problems or system interruptions while using the system, they may abstain from making any mistakes. This withdrawal may cause a decrease in the perception of ease of use of the system. This in turn may affect behavioral intentions toward using the system and the satisfaction of system users (Chang and Tung 2008; J. K. Lee and Lee 2008). Several studies have also explored the significant effect system quality has on the perceived ease of use of e-learning systems. For instance, Calisir et al. (2014) found that higher perceived system quality has a positive effect on the perceived ease of use of a Web-based learning system. Li et al. (2012) found that system quality has a positive effect on perceived ease of use of e-learning systems in rural China. Therefore, we propose the following hypothesis:

**H4** System quality has a positive effect on perceived ease of use of MOOCs.

The perceived usefulness of e-learning can be described as the extent to which a person believes that e-learning can be a driving force toward achieving his or her goals (K.-M. Lin et al. 2011). It is expected that, as the perceived course quality increases, learners will perceive that the system is more useful, and thus continue to participate in MOOCs. Course quality has a significant effect on satisfaction (Sun et al. 2008), together with representational quality of information, service quality of interactions, perceived usefulness, and perceived ease of use (J. K. Lee and Lee 2008). Several studies also confirm the significant effect of course quality on the perceived usefulness of e-learning systems. For instance, Cheng (2011) and Calisir et al. (2014) found that content quality has a positive effect on perceived usefulness of e-learning systems. Therefore, we propose the following hypothesis:

**H5** Course quality has a positive effect on the perceived usefulness of MOOCs.

Moreover, when learners get high quality service from the MOOCs platform, such as professional guidance to fulfill their informational needs, their perceived usefulness of the MOOCs will be strengthened. Several studies also confirm the significant effect of service quality on the perceived usefulness of e-learning systems. For instance, Roca et al. (2006) found that service quality has a positive effect on confirmation, and thereby perceived usefulness of the e-learning system. Wang and Chiu (2011) showed that service quality significantly and positively affects perceived value and user satisfaction, and thereby loyalty intention toward using the next generation e-learning system. Therefore, we propose the following hypothesis:

**H6** Service quality has a positive effect on the perceived usefulness of MOOCs.

### **Mediation effect of perceived ease of use/perceived usefulness**

A large volume of studies have validated the use of TAM in the context of e-learning. Hence, in our research we came to the following conclusions: perceived ease of use has a positive effect on the perceived usefulness of MOOCs; perceived ease of use has a positive effect on the continuance intention toward participation in MOOCs; and perceived usefulness has a positive effect on the continuance intention toward participation in MOOCs.

According to H4 and the conclusions of TAM in the e-learning context, system quality and perceived ease of use are connected, as are perceived ease of use and continuance intentions. These connections suggest that system quality may affect users' continuance intentions to participate in MOOCs based on perceived ease of use. When users perceive that MOOCs are easy for them to participate in, the likelihood of continuing to use MOOCs will

increase. In contrast, users are not likely to continue participating in MOOCs when they perceive little convenience of the system. Therefore, we propose the following hypothesis:

**H7** Perceived ease of use mediates the relationship between system quality and continuance intention toward participation in MOOCs.

According to H5 and the conclusions of TAM in the e-learning context, course quality and perceived usefulness are connected, as are perceived usefulness and continuance intentions. These connections suggest that course quality may affect users' continuance intentions to participate in MOOCs based on perceived usefulness. The quality of online courses provided via a MOOC platform has a positive impact on users' perceived usefulness. When users find that MOOCs are very useful for them, they are more likely to continue to participate in the study of online courses in the future. However, low quality courses may weaken the users' perceived usefulness of MOOCs and leading to quitting. Therefore, we propose the following hypothesis:

**H8** Perceived usefulness mediates the relationship between course quality and continuance intention toward participation in MOOCs.

According to H6 and the conclusions of TAM in the e-learning context, service quality and perceived usefulness are connected, as are perceived usefulness and continuance intentions. These connections suggest that service quality may affect users' continuance intentions to participate in MOOCs based on perceived usefulness. When users get high quality services for completing learning tasks, their perceived usefulness as well as continuance intentions to participate in MOOCs are strengthened. On the contrary, low service quality hinders users from completing their learning tasks and weakens the users' sense of perceived usefulness towards MOOCs, resulting in a reduced possibility of continuing use of MOOCs. Therefore, we propose the following hypothesis:

**H9** Perceived usefulness mediates the relationship between service quality and continuance intention toward participation in MOOCs.

## Research methodology

### Research setting and data collection

The leading Chinese MOOC platform, icourse.com, was chosen as the research site for this study. There are around 200 courses released in icourse.com platform, and it has become one of the most successful MOOC platforms in China. To quantitatively test the data produced by this study, online surveys were sent via [www.Sojump.com](http://www.Sojump.com) to those in China with e-learning experience in icourse.com; data was collected from September to November 2016. A total of 294 usable surveys were collected and used. The 294 respondents all had some e-learning experience in icourse.com and had completed at least one course in the platform. The sample characteristics are summarized in Table 1.

### Instruments

We designed the measurement items drawing from previous studies, and several adjustments were made to the original items based on our research context. Specifically, the items for system quality, service quality, and course quality were adapted from DeLone



**Table 1** Sample characteristics

Items	Types	Numbers	Percentage (%)
Gender	Male	127	43.2
	Female	167	56.8
Age	<18	3	1.1
	18–30	273	92.8
	>30	18	6.1
Education	Senior high school and under	10	3.4
	Bachelor	254	86.4
	Master and above	30	10.2
Use time	<6 months	169	57.5
	6–12 months	81	27.6
	>1 year	44	14.9

and McLean (2003)'s and Chiu et al. (2007)'s research, and we added the words “MOOC platform” in the questionnaire to fit within our research context. The scale items for perceived usefulness and perceived ease of use were adapted from Lewis et al. (2003)'s and Li et al. (2012)'s study, and we replaced the words “information technology” in the original scale with the words “MOOCs system” based on our research context. While the items for continuance intention to use MOOCs were adapted from Bhattacharjee (2001) and Zhang et al. (2012), we used the words “MOOCs system” to replace the original words “e-learning system” to adapt to our research context. The measurements were all assessed using a seven-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree.

We conducted a pilot study to 60 college students before the final survey was administered. Following Chin et al. (2003)'s suggestion, we deleted the items with high loadings from the scale (<0.70) and kept 4 items for each construct in the final data collection and analysis. The constructs and the sources of the questionnaire items are given in Table 2, and the survey instrument is provided in Appendix A.

## Structural equation modeling analysis

The structural equation modeling (SEM) technique was used to examine the research model and test the hypotheses. The two-step structural equation modeling approach was followed to examine both the measurement and the structural model (Anderson and Gerbing 1988). SmartPLS was selected as the primary statistical tool for analysis since it is able to

**Table 2** Construct measurements

Measurement construct	Measurement items	Sources
System quality	SQ1–SQ4	DeLone and McLean, 2003; Chiu et al. 2007
Service quality	SeQ1–SeQ4	DeLone and McLean, 2003; Chiu et al. 2007
Course quality	CQ1–CQ4	DeLone and McLean, 2003; Chiu et al. 2007
Perceived ease of use	PEU1–PEU4	Lewis et al. 2003; Li et al. 2012
Perceived usefulness	PU1–PU4	Lewis et al. 2003; Li et al. 2012
Continuance intention to use	CIU1–CIU4	Bhattacharjee 2001; Zhang et al. 2012

accommodate smaller samples without the normality distribution requirement for the data (Chin et al. 2003). The requirements for sample size—either 10 times the larger measurement number within the same construct or 10 times the larger construct number affecting the same construct—the instant sample size satisfied these requirements (Chin et al. 2003).

## Measurement model analysis

The measurement model was first examined in SmartPLS to analyze the reliability, convergent validity, and discriminant validity of the constructs. Reliability addresses how well the items for one construct correlate with each other, and it is considered acceptable if each construct's composite reliability has exceeded 0.7 (Chin et al. 2003). Convergent validity refers to the degree to which the measurement items are related to the construct as theoretically predicted; this is measured by checking the item loadings and the average variance extracted (AVE) for each construct. To suggest adequate convergent validity the item loadings and AVE should be 0.5 or greater (Pavlou and Fygenson 2006). Table 3 lists the factor loadings, composite reliability, Cronbach's alpha, and AVE of the six constructs in the measurement model.

As illustrated in Table 3, the composite reliability of each construct exceeded 0.8, suggesting that the constructs are reliable. In addition, all of the factor loadings exceeded 0.7 with *t*-values far above 1.96, and the AVE of each construct exceeded 0.6, indicating a good convergent validity of the constructs.

Discriminant validity refers to the degree to which items differentiate between constructs, and it is examined using two criteria: (1) the square root of the AVE of each latent variable from its indicators should exceed that construct's correlation with other constructs; and (2) the items should load more highly on constructs they are intended to measure than on other constructs (Chin et al. 2003). The correlation and the cross-loadings of the six constructs are listed in Tables 4 and 5, respectively.

From Tables 4 and 5 it is clear that the square root of the AVE of each construct exceeds that construct's correlation with other constructs. In addition, the items for each construct load much higher for each assigned construct than on the other constructs, indicating a good discriminant validity of the constructs.

## Structural model analysis

The structural model was then examined in Smart PLS. The bootstrapping procedure with the re-sampling method was used to analyze the statistical significance of the parameter estimates to derive valid standard errors or *t*-values (Temme et al. 2006). The structural model analysis results are described in Figs. 2 and 3.

As showed in Fig. 2, system quality is positively associated with the continuance intention toward participation in MOOCs, and the path coefficient is significant at the 0.001 significance level ( $\beta = 0.170$ ,  $p < 0.001$ ). Thus, H1 is supported. Course quality is positively associated with the continuance intention toward participation in MOOCs, and the path coefficient is significant at the 0.001 significance level ( $\beta = 0.439$ ,  $p < 0.001$ ). Thus, H2 is supported. Service quality is positively associated with the continuance intention toward participation in MOOCs, and the path coefficient is significant at the 0.05 significance level ( $\beta = 0.076$ ,  $p < 0.05$ ). Thus, H3 is supported.

As illustrated in Fig. 3, system quality is positively associated with perceived ease of use, and the path coefficient is significant at the 0.001 significance level ( $\beta = 0.612$ ,  $p < 0.001$ ), suggesting that functionality and completeness of the MOOC platform is

**Table 3** Reliability and convergent validity analysis

Construct	Items	Factor loadings	T statistical test	Composite reliability	AVE
System quality (SQ)	SQ1	0.828	41.45	0.875	0.636
	SQ2	0.792	37.93		
	SQ3	0.822	53.25		
	SQ4	0.747	27.08		
Service quality (SeQ)	SeQ1	0.827	44.16	0.887	0.664
	SeQ2	0.834	48.85		
	SeQ3	0.759	28.75		
	SeQ4	0.837	68.17		
Course quality (CQ)	CQ1	0.763	30.82	0.866	0.619
	CQ2	0.807	34.11		
	CQ3	0.801	38.44		
	CQ4	0.774	35.82		
Perceived ease of use (PEU)	PEU1	0.710	20.31	0.867	0.621
	PEU2	0.806	42.01		
	PEU3	0.808	40.64		
	PEU4	0.825	50.58		
Perceived usefulness (PU)	PU1	0.853	51.86	0.909	0.714
	PU2	0.854	53.26		
	PU3	0.839	51.98		
	PU4	0.832	37.52		
Continuance intention to use (CIU)	CIU1	0.853	47.39	0.922	0.749
	CIU2	0.855	50.12		
	CIU3	0.879	71.43		
	CIU4	0.872	64.38		

beneficial to enhance individual's perceived ease of use of the online learning system. Thus, H4 is supported. Course quality is positively associated with perceived usefulness at the significance level of 0.001 ( $\beta = 0.235$ ,  $p < 0.001$ ), which is consistent with the argument that course content satisfying the needs of the individual is more likely to increase the perceived usefulness of the online learning system. Therefore, H5 is supported. Moreover, system service is also positively associated with perceived usefulness with a significance level of 0.001 ( $\beta = 0.193$ ,  $p < 0.001$ ). This indicates that service quality provided in the MOOC platform is a critical enhancer of individual's perceived usefulness of the online learning system. Thus, H6 is supported.

Perceived ease of use is positively related to perceived usefulness ( $\beta = 0.249$ ,  $p < 0.001$ ). Perceived usefulness and perceived ease of use have positive impacts on the continuance intention toward use of MOOCs ( $\beta_1 = 0.326$ ,  $p < 0.001$   $\beta_2 = 0.293$ ,  $p < 0.001$ ). This is consistent with both the hypotheses presented in this paper and previous studies. Furthermore, the R<sup>2</sup> of continuance intention expressed by the exogenous variables is 33.6%, showing that the explanatory power of this research model is good.

The control variables were sex, age, educational background, and experience with using MOOCs. These specific variables were selected because of their potential impact on the behavioral intention of users as suggested within the extant literature. From Fig. 3 it is

**Table 4** Discriminant validity analysis

	SQ	SeQ	CQ	PEU	PU	CIU
SQ	<b>0.797</b>					
SeQ	0.573	<b>0.815</b>				
CQ	0.562	0.594	<b>0.787</b>			
PEU	0.611	0.579	0.560	<b>0.788</b>		
PU	0.468	0.512	0.512	0.494	<b>0.845</b>	
CIU	0.550	0.542	0.604	0.502	0.483	<b>0.865</b>

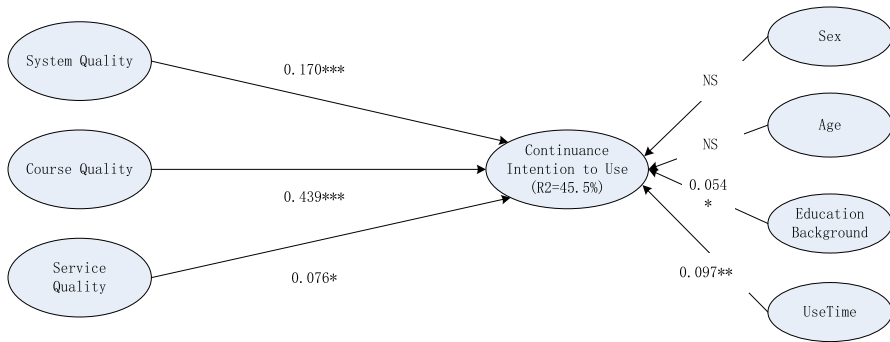
**Table 5** Cross loadings of the items

	SQ	SeQ	CQ	PEU	PU	CIU
SQ1	<b>0.828</b>	0.576	0.553	0.440	0.341	0.368
SQ2	<b>0.792</b>	0.493	0.518	0.459	0.393	0.471
SQ3	<b>0.822</b>	0.608	0.551	0.570	0.388	0.403
SQ4	<b>0.747</b>	0.625	0.643	0.463	0.367	0.520
SeQ1	0.617	<b>0.827</b>	0.606	0.477	0.382	0.398
SeQ2	0.561	<b>0.834</b>	0.597	0.456	0.418	0.423
SeQ1	0.510	<b>0.759</b>	0.567	0.419	0.377	0.443
SeQ2	0.657	<b>0.837</b>	0.638	0.527	0.481	0.494
CQ1	0.554	0.617	<b>0.763</b>	0.438	0.366	0.481
CQ2	0.606	0.577	<b>0.808</b>	0.514	0.442	0.407
CQ3	0.566	0.622	<b>0.801</b>	0.373	0.387	0.458
CQ4	0.503	0.521	<b>0.774</b>	0.430	0.413	0.562
PEU1	0.411	0.347	0.380	<b>0.708</b>	0.303	0.319
PEU2	0.457	0.419	0.396	<b>0.806</b>	0.398	0.371
PEU3	0.499	0.491	0.510	<b>0.808</b>	0.445	0.400
PEU4	0.546	0.544	0.466	<b>0.825</b>	0.399	0.477
PU1	0.393	0.421	0.426	0.375	<b>0.853</b>	0.375
PU2	0.399	0.489	0.465	0.424	<b>0.854</b>	0.400
PU3	0.365	0.398	0.447	0.405	<b>0.839</b>	0.411
PU4	0.422	0.421	0.395	0.461	<b>0.832</b>	0.444
CIU1	0.432	0.389	0.461	0.410	0.397	<b>0.854</b>
CIU2	0.461	0.462	0.509	0.411	0.392	<b>0.856</b>
CIU3	0.453	0.461	0.518	0.423	0.421	<b>0.880</b>
CIU4	0.549	0.552	0.594	0.489	0.457	<b>0.873</b>

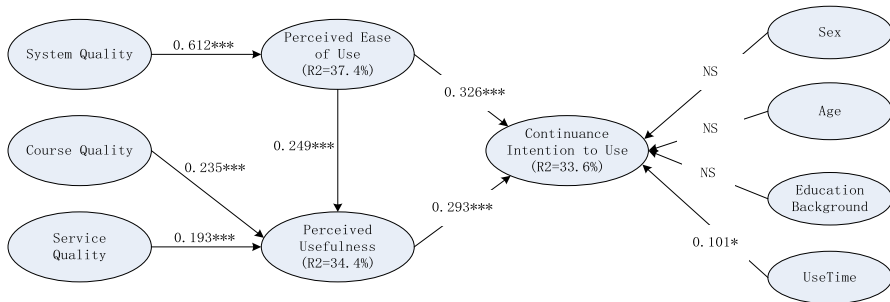
clear that user experience with MOOCs is also positively associated with the continuance intention toward use of MOOCs, suggesting that experienced users are more likely to keep using MOOCs as part of their online learning strategy.

**Mediation effect in the research model**

We followed Sobel’s procedure to test the mediation effect (Baron and Kenny 1986). This procedure allowed us to examine whether the relationship between independent variables and dependent variables were considerably reduced (partial mediation) or completely



**Fig. 2** Structural model analysis I. Note: path coefficient and T test are significant at: \*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001, NS represents Not Significant



**Fig. 3** Structural model analysis II. Note: path coefficient and T test are significant at: \*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001, NS represents Not Significant

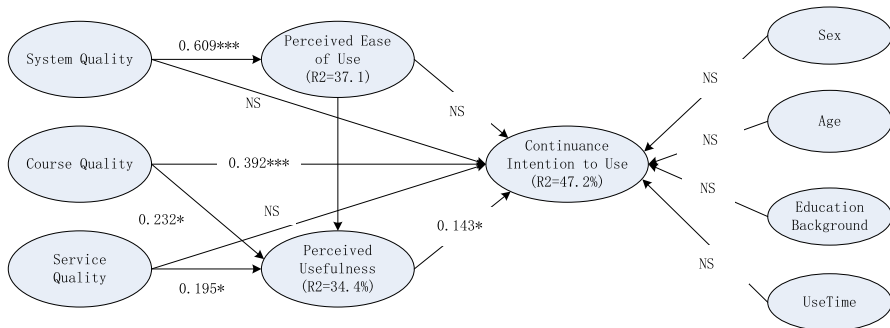
diminished (full mediation) when we incorporated mediation variables into the model. The structural model analysis results are described in Fig. 4 and Table 6.

We first investigated the mediating role of perceived ease of use, which mediates the relationship between system quality and continuance intention toward MOOCs. As shown in Fig. 4 and Table 6, the mediation effect is not supported; thus, H7 is not supported. Then we investigated the mediating role of perceived usefulness, which mediates the relationship between course quality and continuance intention to use MOOCs, as well as the relationship between service quality and continuance intention to use MOOCs. As shown in in Fig. 4 and Table 6, these two mediation effects are supported. Thus, H8 and H9 are supported.

## Discussions and implications

### Discussion

This study aims to investigate the quality factors that support the acceptance of MOOCs and foster improved continuance intention. The present study shows that system quality, course quality, and service quality all positively affect users' continuance intentions to use MOOCs. System quality is positively related to the user's perceived ease of use of system.



**Fig. 4** Structural model analysis III. Note: path coefficient and T test are significant at: \* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ , NS represents Not Significant

Course quality and service quality are both positively correlated with the user's perceived system usefulness. Moreover, course quality and service quality both influence the users' continuance intentions to use MOOCs by influencing perceived usefulness. The mediation effect of perceived ease of use on the relationship between system quality and continuance intentions to participate in MOOCs has not been verified.

However, although the mediation effect of perceived ease of use is not significant, system quality does directly affect users' continuance intentions. In other words, the direct effect of system quality on continuance intentions is significant, but the indirect effect is not significant. As shown in Table 6, although the results of Sobel test ( $t = 2.077$ ) failed to pass significance test, after adding perceived ease of use, the effect of system quality on continuance intention changes from significance ( $\beta = 0.170$ ,  $P < 0.001$ ) to no significance ( $\beta = 0.108$ ,  $P > 0.05$ ).

### Theoretical implications

This study provides at least two theoretical contributions to the literature in this area. First, this study examines the critical quality factors of user continuance intention to use MOOCs from an IS success theoretical perspective. It was found that system quality, course quality, and service quality are significant antecedents of higher levels of continuance intention towards the use of MOOCs, thus providing support for Hypotheses H1, H2, and H3. Previous studies mostly focused on the system or course quality of the e-learning system while ignoring the dimension of service quality. Our study proposes a comprehensive model that integrates the dimension of system quality as a significant antecedent, and explores the impact mechanism of the three quality factors on user's attitudinal beliefs and intention to reuse a MOOC system. The empirical findings contribute to the extant literature by identifying the critical system quality success factors and their effects on user's continuous learning intention in the context of MOOC platforms.

Second, our study explores the mediation mechanisms of system quality, course quality, and service quality on the continuance intention of learners toward MOOCs. It was found that perceived usefulness is a significant mediator between quality factors (course quality and service quality) and user's continuance intention. Specifically, course quality is a critical driver of perceived usefulness, indicating that the knowledgeability and authority of course content can increase users' perceptions of the benefits of MOOCs to some extent. Furthermore, service quality is significantly associated with perceived usefulness, which in

**Table 6** Mediation effect test

Path	A	B	C	C'	Sobel test	Mediation effect
System quality → perceived ease of use → continuance intention to use MOOCs	0.609 (0.0249)	0.109 (0.0523)	0.170***	0.108	2.077	Not supported
Course quality → perceived usefulness → continuance intention to use MOOCs	0.232 (0.0666)	0.143 (0.0391)	0.439***	0.392***	2.522*	Partial mediation
Service quality → perceived usefulness → continuance intention to use MOOCs	0.195 (0.0507)	0.143 (0.0391)	0.076*	0.024	2.650**	Full mediation

Note: Path coefficient and T test are significant at: \*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001

<sup>a</sup> Beta of X → M b: Beta of M → Y c: Beta of X → Y c': Beta of X and M → Y

The numbers in parentheses are the standard errors

turn has a positive effect on the users' continuance intention. This empirical finding suggests that high quality service delivered by MOOC platforms can also greatly increase user perceptions of benefits towards participation in MOOCs. The mediation mechanism can provide theoretical guidance with regard to the design and implementation of MOOC system characteristics.

### **Practical implications**

This research also highlights several important practical implications, especially for the developers and business operators of MOOC platforms in higher education. First, system designers need to develop appropriate system functions capable of facilitating the teaching and learning process and outcomes. For example, besides the regular Q&A module, they can add some other modules that provide some embedded tools to facilitate user learning in the community. Both teacher and learner involvement in MOOC platform design would help to identify the most suitable functionalities.

Second, since service quality has been demonstrated to be a significant driver of continuance intention toward ongoing participation in MOOCs, human interaction as an important part of services cannot be underestimated or eliminated. Developers should try their best to cater to the varied learning needs of users. More specifically, they should maintain and reinforce their characterization of the online course community as a positive learning space. For instance, MOOC platforms should provide reliable service to meet the specific needs of each learner on time.

Third, since course quality significantly affects the continuance intention of learners toward ongoing participation in MOOCs, the course information should be clear, understandable, complete, and relevant. For instance, teachers should offer course outlines that contain objectives, lists of subjects, course materials, time schedules, and visual progress timelines in graphic form. What's more, the course materials provided by the MOOCs platform should be complete, easy to comprehend, timely, and presented with text and multimedia.

### **Conclusions and limitations**

MOOCs have attracted a great deal of interest in recent years as a new technology-enhanced learning model in higher education settings. The importance of learner participation in this context as well as the significant gap in previous literature regarding the continuance intention of learners participating in MOOCs motivated the research team undertaking this study. As a result, the findings identify a comprehensive set of quality factors most relevant to this context and explain their influence on the continuance intention of learners toward using MOOCs.

The results show that five exogenous constructs have direct or indirect influence on the continuance decision of learners: system quality, course quality, service quality, perceived ease of use, and perceived usefulness. The findings also reveal that perceived usefulness and perceived ease of use mediate the relationship between system quality, course quality, service quality, and the continuance intention of users toward ongoing use of MOOCs. These findings not only enrich academic understanding of MOOCs and the nuanced differential influence of the quality factors but also deliver an important message to the platform developers for MOOCs. They can leverage these results to better attract their



users; more importantly, with a better understanding of the relative strength of each type of quality factor, developers can design and implement more effective MOOCs based on their ability to enhance a specific aspect of operation management in their MOOC platform.

The present study has several limitations which should be addressed in future studies. First, the present study only focused on data from subjects in China, so the research findings are context-specific and cannot be generalized to other countries. Future studies should collect data from other countries and compare their results with this study to see if there are any differences. Second, the present study was conducted using a short-term snapshot of users' behaviors; thus, longitudinal studies are required to determine the validity of the proposed model and to better measure the continuance intention of users after using MOOCs for a period of time. Third, this study used 2 items to measure the constructs of system quality, course quality, service quality, and continuous intention, and future studies need to add 1–2 items for each construct to improve the measurement validity.

**Acknowledgements** This work was supported in part by grants from the National Natural Science Foundation of China (Nos. 71301172, 71301035) and the Beijing Higher Education Young Elite Teacher Project (No. YETP1001).

#### Appendix A Questionnaire items used in this study

Constructs	Questionnaire items
System quality	<ol style="list-style-type: none"> <li>1. The user interface of the icourse platform is well designed</li> <li>2. The icourse platform can quickly load all the text and graphics</li> <li>3. It is easy to navigate the icourse platform</li> <li>4. The icourse platform functions well all the time</li> </ol>
Service quality	<ol style="list-style-type: none"> <li>1. Icourse platform provides prompt responses to my request</li> <li>2. Icourse platform provides right solution to my request</li> <li>3. The service provided in icourse platform attends to individual's personalized needs</li> <li>4. The service provided in icourse platform is reliable</li> </ol>
Course quality	<ol style="list-style-type: none"> <li>1. The content of the course materials provided by the icourse platform is complete</li> <li>2. The content of the course materials provided by the icourse platform is easy to comprehend</li> <li>3. The course materials provided by the icourse platform learning site are well represented with text and graphics</li> <li>4. The content of the course materials provided by the icourse platform is relevant to the topic</li> </ol>
Perceived usefulness	<ol style="list-style-type: none"> <li>1. Using icourse platform improves my performance in learning</li> <li>2. Using icourse platform increases my productivity in learning</li> <li>3. Using icourse platform enhances my effectiveness in learning</li> <li>4. Overall, icourse platform is useful in learning</li> </ol>
Perceived ease of use	<ol style="list-style-type: none"> <li>1. It's easy to become skillful at using icourse platform</li> <li>2. Using the icourse platform does not require a lot of my mental effort</li> <li>3. I find the icourse platform easy to use</li> <li>4. I find it easy to get the icourse platform to do what I want it to do</li> </ol>
Continuance intention	<ol style="list-style-type: none"> <li>1. I think using icourse platform to study is a great idea.</li> <li>2. I intend to continue using icourse platform rather than discontinue its use</li> <li>3. My intentions are to continue using icourse platform than use any alternative means</li> <li>4. I plan to continue using icourse platform to learn about new knowledge</li> </ol>

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