Review of Gamified MOOC's Impact Toward Learner's Motivation in Learning Effectiveness Context

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Abstract. Massive Open Online Courses (MOOC) have become a strong support for building a ubiquitous learning environment typically during Covid19 pandemic. Although more and more Internet users are willing to try MOOC, the problems corresponding to users' free and autonomous learning are a poor learning experience, low long-term attractiveness to users, and low completion rate of courses. The fundamental reason is that online learning behaviour cannot be well motivated and maintained. A key design concept related to the MOOC is gamification design - the application of game design elements to non-gamification scenarios. Some MOOC has integrated different gamification method to attract users. However, the academic community's attitude towards gamification still inconsistent, and even some studies believe that the level of user motivation in the gamified design condition will decrease. From the perspective of user information behaviour, this paper follows the logical route of "motivation-behaviour" and analyse the perceptual challenge and perceptual attention, learning results and cognitive user participation. From the MOOC context, this paper discusses the technical application factors that affect user behaviour and enriches the research direction in the field of information behaviour. Lastly, this study puts forward some development suggestions to MOOC operators to comprehensively improve the perception challenge and attention of MOOC users and enhance their learning effect.

Keywords: MOOC · Competitive gamification design · Collaborative gamification design · Motivation factor · Learning effectiveness

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1 Introduction

Under the catalysis of Internet 3.0, education is continuously undergoing deep cross-border integration with the new generation of information technology. As a new and vital learning model, MOOC triggered a new wave of online learning and made researchers concerned about the latest development of education continue to think about promoting more effective teaching in MOOC.

1.1 Research Background

With the rise of online learning courses, the scale of Massive Open Online Courses (MOOC) has actively expanded while more learning applications have become more widely used especially during Covid 19 Pandemic [1]. However, the high dropout rate and low completion rate of courses hindered the sustainable development of the learning platform [2]. As a novice way to stimulate and maintain learning motivation, gamification design has won the favour of many learning platforms to attract potential users. So far, the research on the factors affecting the behaviour of MOOC participants has mostly focused on individual characteristic, motivation, cognition, emotion, society landscape only [3]. This research will focus on the influence of user motivation on learning effect under the conditions of MOOC gamification design. According to the concept of "motivation factor-behaviour result", clarify the influence of different gamification on motivation level and the effect of motivation factor on the final learning effect [4]. This paper synthesizes all relevant research results related to motivation and immersion theory, MOOC and gamification design.

2 Theoretical Basis

Different researchers have classified motivation according to various criteria. Thus there is no consistency about existing taxonomies and other categories. The following three are the most widely used in this paper.

2.1 Malone's Intrinsic Motivation Theory

Motivation is derived from the Latin word "Movere", which means to promote and cause activity. Motivation is the inner psychological power of individual activities guided by goals (a key driving factor to stimulate and maintain individual behaviour) [5]. Efficient learning activities cannot lack the support for learning motivation.

Through the research on computer games, Malone identified three types of motivational factors related to learning: challenge, curiosity, and fantasy, and proposed the "intrinsic motivation" theory, which directly reveals the motivational drive of gamification elements and mechanisms in learning activities [6]. First, a system must provide a sense of challenge can essentially motivate learners [7], and secondly, stimulating curiosity will attract learners [8]. Thus, it's emotionally attractive fantasies could engage the users to participate in learning activities [9]. Malone believes that people are immersed in games not because of external rewards, but because of the existence of intrinsic motivation.

1) **Challenge:** Compeau et al. believe that challenges provide individuals with opportunities to develop abilities and enhance self-efficacy, which is related to improving learning outcomes [10]. Applying gamified design elements can create challenges in online learning platforms. Recent research results in the field of education are consistent with Malone's research, players must work hard to overcome the challenges which lead to uncertain ending/result [4].
2) **Curiosity:** Second key motivation factor, including cognitive curiosity and perceptual curiosity. Loewenstein proposed that when users perceive their lack of knowledge, they will have cognitive curiosity, which will encourage users to participate in the learning process to improve their knowledge structure [11]. Clark and Paivio believed that in the learning process, sensory stimuli such as novel colours, sounds, images, etc. will trigger perceptual curiosity and make users focus to the learning task at hand [12]. In short, a proper gamified design could promote curiosity that enhances participation (engagement) and learning outcomes (fill up knowledge gaps).
3) **Fantasy:** Another motivation that workable in a learning environment. Fantasy occurs when people imagine something in their mind. Malone pointed out that fantasy could enable learners to meet their emotional needs and experience power, reputation and wealth that are not available in real life [13]. On the other hand, it allows learners to acquire knowledge and establish a connection with the real world. Research on online training shows that learning materials in a virtual context could improve learner's participation and learning effects [14].

Compared with ARCS Motivation and Flow theories, Malone's intrinsic motivation theory has two unique advantages in guiding the research on the influence of gamification design on motivation. First of all, Malone's theory was developed by observing children playing various computer games, so it is particularly suitable for guiding the selection of game elements. Park and Liu et al. integrated gamification elements based on Malone's intrinsic motivation theory in their learning platform. Research has shown that gamification systems can have a positive impact on learners' learning effects [4, 6, 15]. Therefore, this study includes Malone's intrinsic motivation theory.

2.2 ARCS Motivation Theory

Professor Keller proposed the ARCS motivation theory in 1983 through his research on motivation theories [16]. ARCS was summarised from Attention, Relevance, Confidence and Satisfaction [17].

a. **Attention:** It refers to attracting and maintaining the learners' interest in the learning process. It can arouse the learners' attention by arousing perception, stimulating inquiry, and using variability.
b. **Relevance:** It reflects that the teaching objectives and content should be related to the learner's own needs and knowledge background to make it feel personally relevant, such as establishing a virtual situation associated to the learner's current experience or interest.

c. **Confidence:** It refers to the establishment of self-confidence by various methods such as solving difficulties and achieving success, such as providing students with tasks and challenges within the scope of their ability to help them establish a correct view of attribution.
d. **Satisfaction:** It refers to allowing learners to experience the joy and value of learning by obtaining positive results and feeling fair, and to be satisfied in the learning process, such as learning new knowledge/skills and obtaining rewards.

Research shows that the ARCS motivational design model is one of the most effective instructional design models to reduce the dropout rate of online education [18]. Therefore, this study draws on the ARCS motivation theory as the theoretical basis to study the background of user learning behaviour of online learning platforms.

2.3 Flow Theory

Flow Theory was proposed by Csikszentmihalyi [19]. In his research, he found that immersion is a state of full-heartedness. When people engaged by the activities they are participating in, they will be highly concentrated. Creativity and potential can be effectively stimulated, focusing only on specific goals and ignore irrelevant things and ideas. Jackson and Marsh summarised nine factors that produce immersive experience: challenge-skills balance, action-awareness merging, clear goals, instant feedback, concentration on the task at hand, sense of control, loss of self-consciousness, a transformation of time and autotelic experience [20].

As one of the primary research contents of positive psychology, immersion experience has attracted more and more attention in the fields of education, psychology and information technology. Current research related to immersive experience focuses on exploring the self-affirmation brought by immersion and the subsequent behaviour of users [21]. Immersive experience has a very positive impact on learning activities, helps to explore behaviours, and promotes the mastery of information technology [22]. Users have an immersive experience in gamification design will stay energetic and passionate. Therefore, the gamification design of online learning platforms should fully consider the elements of "immersion" experience [23]. This article summarises the motivation factors involved in the above three theories, as shown in Table 1.

Through the above research conclusions, it shows that challenges and attention as motivational factors could trigger the immersive experience. Csikszentmihalyi believes that the challenge is the key to maintaining the immersive experience between the individual and the task. When the individual's skill level and the challenge are balanced, immersive experience will exist. Rheinberg et al. proposed that users feel the immersion only when attention and challenge-skill level exist at the same time [24].

Table 1. Motivation factor.

Factor	Malone intrinsic motivation theory	ARCS motivation theory	Flow theory
Challenge	X		X
Curiosity	X		
Fantasy	X		
Attention		X	X
Relevance		X	
Confidence		X	
Satisfaction		X	

3 Massive Open Online Class (MOOC)

The continuous opening and sharing of educational resources have led to the emergence of Massive Open Online Courses (MOOCs), which have swept the world at an astonishing speed and become a new research hotspot in the field of open education. It is a new online course model that is free and open to society and a way of learning across time and space in the education field in recent years [25]. MOOC provides rich teaching resources (mostly in the form of multimedia), interactive forums, and learning communities. Based on the student-oriented and teacher-led teaching philosophy, MOOC organises large-scale distributed worlds in a network environment with similar goals, interests, and prior knowledge and complex types. Besides, students with different habits manage to stimulate their interest in learning in the MOOC platform which allows socialising individual learning and life-long learning experience [26].

3.1 Classification of MOOC

Since the development of MOOC in 2008, 2 main branches have evolved: Connectivist MOOCs (cMOOCs) and Expanded/Extension MOOCs (xMOOC) [27]. cMOOCs based on the relevance theory of learning, which is typically represented by the Connectivism and Connective Knowledge (CCK08) online courses offered by Canadian scholars Stephen Downes and George Siemens [28]. xMOOCs is based on behaviourist learning theory, represented by Coursera, Udacity and edX [29, 30, 31]. With the coexistence of cMOOCs and xMOOCs, if universities and social organisations do not distinguish between these two types of MOOC when building MOOC, it will have many unfavourable consequences.

3.2 cMOOCs

Learning theory is a systematic interpretation of the essence of learning and its formation mechanism, conditions and laws [32]. Its fundamental purpose is to provide people with a basic understanding of learning, to lay a more scientific foundation for forming their views on education and teaching. The theoretical basis of cMOOCs is the relevance

theory of learning. Connectivism is a new learning theory proposed by George Simmons for the digital age in 2004 [33]. It is an integration of principles explored through chaos, network, complexity and self-organisation theory. Connectivism regards learning as the process of network formation and believes that the essence of learning is the process of creating networks and forming connections. It has two meanings: one is to use the internet to support the learning process, and the other is how to learn on the internet. The existing cMOOCs emphasise creation, creativity, autonomy, social-networking learning. They focus on the generation of knowledge and encourage learners to find resources on the Internet to learn independently, aiming to let learners study by themselves [34]. Therefore, cMOOCs exhibit the primary characteristics of connective-based learning theory.

The cMOOCs is a single independent course, and each cMOOCs has its course content. Individual teachers assemble and implement on the Internet, use diversified platforms, and can use various social software. Learners can choose freely according to their conditions or preferences. The cMOOCs course model encourages learners to participate in multiple blogs, forums and other platforms. Besides, cMOOCs is a distributed learning environment that emphasis student autonomy [35]. Moreover, universities and institutions are not participating in the course planning while only the educators arrange the courses from the beginning until the end alone [36]. The organisers of these popular cMOOCs courses are mostly scholars who study cMOOCs.

For cMOOCs, new learners will be instructed to operate and participate in the platform. At the same time, the beginners have advised on learning skills, and learners are encouraged to tutor and support each other. In terms of resource connection, Stephen Downes developed the gRSShopper application, which is a tool used to aggregate key content in cMOOCs courses. In the cMOOCs course, gRSShopper not only aggregate the resources discovered and suggested by the learners, but also get the posts and Twitter messages in the discussion area, and finally combine these resources into a daily news release to send to the learners [37]. These can effectively help learners build their learning network and support their learning.

In cMOOCs, learners allowed open discussions, and there is no strict right or wrong in evaluating learners [38]. Therefore, in the course of cMOOCs course operation, there is not too much timely feedback on the learning process of learners, and there is no too much learning. The evaluation of the learner's learning effect. Learners can decide how much material they read, how much time they spend studying, and what form of study they use. Learners can also interact with teachers in real-time. As for the effect of learning, teachers use RRS aggregated resources for comprehensive evaluation. Learners could conduct mutual evaluation among themselves. The evaluation standard of cMOOCs is whether learners can successfully carry out autonomous learning without the support and help of educators.

3.3 xMOOCs

Unlike cMOOCs, the theoretical basis of xMOOCs is behaviourist learning theory [39]. Behaviourism's explanation of learning emphasises the acquisition of observable behaviours. What an individual learns are determined by environmental stimuli. When the connection between environmental stimuli and individual behavioural reflections has

reinforced, the corresponding behavioural habits form "learning" [40]. The theory has four fundamental viewpoints: a) learning is a process of stimulus-response connection; b) learning is a process of trial and error; c) learning is a process of student observation and imitation; d) learning is a process of operational reinforcement. xMOOCs pays attention to augmentation process, knowledge repetition, and traditional learning methods such as video demonstrations, short quizzes and tests [41]. Therefore, xMOOCs show the characteristics of behaviourist learning theory.

xMOOCs has a strong organisation and operation team. The team is composed of project managers, lecturers, teaching assistants, course volunteers, producers, filming teams, technical support teams together with a large amount of capital investment. To implement xMOOCs, learners only need to complete all the course learning, discussion and testing processes of their elective courses on a single platform. The platform generally cooperates with many world-renowned universities. Universities could publish and share their courses on the MOOC platform with learners around the world for their elective courses [42]. For example, Coursera and edX have gathered courses from famous schools and educators from all over the world.

Compared with cMOOCs, the learning support services of xMOOCs are more technical. The number of xMOOCs courses continues to increase, and the number of learners participating is also enormous. The large-scale and open characteristics of xMOOCs determine the demand for learning support services and attract learning support service providers on the market [43]. Example, Class-Central provides indexing functions, CourseBuffet, Knollop, and CourseTalk that provide evaluation and recommendation functions, CourseMiner provides community functions and Pearson and ProctorU that provide examination functions. The xMOOCs platform cooperates with these learning support service websites to provide a better environment for learners to learn.

Different from cMOOCs, learners can obtain instant learning feedback in the process of learning xMOOCs [27]. A quiz will be embedded in the lecture video to test the learner's mastery of the knowledge base on the section of the content. Else, a final exam will be prepared to obtain the learning effect of the learner's entire unit or the entire course. The evaluations are all carried out on the platform. After completion, the intuitive evaluation results will be displayed. Learners could check their learning condition in time. Teachers can analyse the test results of learners to understand their mastery of knowledge and recommend personalised learning resources. The evaluation standard of xMOOCs is whether learners have the same or similar knowledge as educators [44]. Table 2 will analyse the difference between cMOOCs and xMOOCs.

4 MOOC Gamification Design

Professor Richard Batle, a pioneer of multiplayer online games [45]. The original intention was to "turn things (or work) that are not games into games". In 2003, Nick Pelling adopted the concept of "gamification" when designing the game interface of electronic devices [46]. Until 2010, the term "gamification" began to be widely used [47].

Table 2. Comparison of cMOOCs and xMOOCs.

Subject	CMOOCs	XMOOCs
Learning Theory	Connectivist learning theory, focusing on knowledge creation	Behavioural learning theory, focusing on knowledge repetition
Course Organization	Educator-oriented	A strong teaching team supports the courses
Course Implementation	Distributed on various platforms	Centralized, on a unified platform
Course Content	Unstructured, through various resources created when learners participate in topic discussions	Structured, mainly through videos and lectures for teaching
Course Range	Narrow, mainly in the particular module / subjects	A wide range of subject areas
Learning Support	Conduct tutorials, use tools to aggregate resources and send daily emails / notification	The platform cooperates with learning support service providers to provide learners with learning support services
Feedback	Limited instant feedback	Instant pre-set feedback
Learning Evaluation	Teachers conduct comprehensive evaluations through aggregated resources; learners evaluate each other	Quiz and peer assessment
Evaluation Standard	Could learners successfully carry out autonomous learning without the support and assistance of teachers	Does the learner acquire the same or similar knowledge as the teacher

4.1 Gamification

The concept of "gamification" can be traced back to 1978. It was introduced by The definition of gamification proposed by Deterding in 2011 has been widely recognised [48]. Generally speaking, gamification is the application of game design elements to non-game situations. Early Game-Based Learning (GBL) explored the integration of learning activities into mature and complete games [49]. Glover believes that gamification design requires the addition of a game layer to a well-established online learning system to provide more design flexibility [50]. Besides, he believed gamification is only an auxiliary design - a game element that exists in the learning activity, rather than direct learning in the game. Based on studies, individual performance and satisfaction are expanded by implementing appropriate gamified elements [51]. At present, gamification has become part of the core structure in the online learning platforms.

In the context of the information system, the positive influence of motivation on user information behaviour has been supported by a considerable number of scholars. Gorbunovs et al. researched computer-supported collaborative learning through investigation methods and found that in the learning process, there is a correlation between

learners' motivation and knowledge acquisition and learning activities [52]. Kormos and Csizer put forward the factors that affect the learning effect of learners in the network environment and believes that learning motivation is an important personal factor that affects the ability of autonomous learning [53]. Prasetya research shows that learning motivation can effectively improve learning effects and attractiveness [54]. Reinhold et al. found that learners' motivation has a significant and positive impact on learning effects through random sampling methods [55]. Although there have been a lot of proofs for the internal logical relationship of "motivation factor-behaviour result", there are still few studies to analyse in-depth whether online learning platform gamification design can affect the relationship between motivation and learning effect. Secondly, which motivational factors are more conducive to improve learning effects still need to be discussed in depth.

4.2 MOOC Gamification

Low effective participation and high dropout rate are the two major problems that currently exist in MOOC learning. Although MOOC is a comprehensive learning resource, a large number of studies have shown that more MOOC learners are more willing to skip other course links and only spend time watching the course videos. However, the problem of high dropout rate makes the viewing of course videos in MOOC learning also worrying. Relevant studies show that among all users who register for courses, no more than 50% of users persist until the end of the course [56, 57]. In other words, a large number of MOOC learners did not even insist on watching the course videos.

In response to the above problems, researchers in many countries have begun to try to integrate gamification and MOOC. They believe the addition of gamification elements can stimulate the learning motivation of MOOC learners, thereby solving the two major problems in current MOOC learning. For example, ESADE Business School (Spain) integrates two online games MetaVals and Hot-ShotBusiness in MOOC courses to help learners learn financial concepts and investment [58]. Saudi Arabia's mainstream MOOC platform RWAQ, through the integration of gamification, makes the courses more effective. The completion rate has increased to 20%–25%, far exceeding the global average of the completion rate of MOOC courses of no more than 10% [59]. German researchers have integrated gamified competition elements with peer evaluation, which improves the enthusiasm of MOOC learners to participate in peer evaluation [60]. Based on this, it is recommended that the current MOOC platform should integrate with gamification [61, 62]. In addition to related research, many mainstream MOOC platforms, such as Coursera, edX and Udacity have begun to increase support for gamification elements.

Although the enthusiasm for gamification design in the practical world is high, and each MOOC has launched its own gamification design to attract users, the research results of the academic world have shown inconsistencies. Hew's research shows that the introduction of gamification design in curriculum learning has no significant impact on learners' learning effects [63]. Hanus believes that adding gamification design will harm learners' learning effects [64]. De-Marcos et al. confirmed that gamified online learning experience could fully improve teaching effects [65].

Table 3 and 4 summarise the gamification elements and motivation mechanism used by cMOOCs and xMOOCs.

Table 3. cMOOCs gamification.

Gamified MOOC platform		Moodle	Google classroom	Blackboard	Gami press
Gamification elements	Point	✓	✓	✓	✓
	Progress bar	✓		✓	✓
	Badges	✓	✓	✓	✓
	Level	✓	✓		✓
	Leader board	✓	✓	✓	✓
	Achievement	✓		✓	✓
	Mutual assistant	*	*		*
	Challenge (ad-hoc)	✓	✓	✓	✓
Motivation mechanism	Emotion		*		*
	Relevance of content	*	*	*	*
	Narrative	*	*	*	*
	Progress	✓	*	✓	✓
	Relationships	✓	✓	✓	✓

✓ - Yes, * - Depends on user setting/plugins

Table 4. xMOOCs gamification.

Gamified MOOC Platform		Coursera	edX	Udacity	Udemy	Edmodo
Gamification elements	Point	✓	✓	✓	✓	✓
	Progress bar		✓	✓	✓	
	Badges	✓	✓	✓	✓	✓
	Level			✓	✓	✓
	Leader board	✓	✓	✓		
	Achievement					
	Mutual assistant		*			✓
	Challenge (ad-hoc)	✓				✓
Motivation mechanism	Emotion					*
	Relevance of content	*	*	*	*	*
	Narrative	*	*	*	*	*
	Progress	✓	✓	✓	✓	✓
	Relationships	✓	✓	✓	✓	✓

✓ - Yes, * - Depends on user setting/plugins

In general, the gamification components used in these cases are focusing on points, badges, and rankings. On the other hand, gamification motivation mechanisms mainly involved emotions, progress, and relationships. The current integration of gamification and MOOC has two main characteristics. First, the gamification element embeds on existing MOOC platform via plugins. Secondly, learning materials (knowledge-based videos) embedded in a game platform. Currently, the main research gamification elements include leaderboards, badges, competitions, teams, etc. Gamification systems have a high degree of user communication and interaction [66]. According to the way of communication between users, those gamification design could be classified into two categories: competitive and cooperative [67]. This paper will explore the role of cooperative and competitive gamification design in MOOC platform. It mainly explores the influence of differences in motivation factors under different conditions and different gamification design conditions of competition and collaboration on the relationship between user motivation factors and learning effects.

4.3 Overview of Competition and Collaboration

Competition and collaboration are two common social phenomena, which can be seen everywhere in all aspects of life and study, from individuals to groups.

Competition is also the psychological and behavioural needs of individuals or groups trying to overcome the opponent, aiming to pursue attractive goals. Competition is the most epidemic gamification design in MOOC platforms, including leaderboards, championship and other elements. Competition could be adopted to stimulate learning motivation. Maller has done a comparative experiment and divided students into a control group and a competition group. The results show that the learning motivation of the competition group is significantly higher than that of the control group [68]. On the contrary, individuals with improper competitive psychology may have negative emotions such as tension, anxiety and low self-esteem due to irrational motivations and attitudes, which are not conducive to mental health and interpersonal relationship development [69].

Collaboration refers to the behaviour of multiple individuals working together for a common goal, resulting in beneficial results for all parties. Many studies have shown that cooperative behaviour has a positive impact on learners' interpersonal attraction and motivational motivation [70, 71]. The collaboration gamification design includes team formation, mutual help Q&A, check-in reminder, etc. Miquel and Duran propose in research that cooperative learning experience encourages learners to correctly recognise their abilities, reflect on themselves in the process of collaboration with others, and feel the learning content is directly related [73].

Competition and collaboration are of great significance to life, study, and work. They can enrich our interpersonal relationships and give us more opportunities for conversation in an online environment that lacks communication. This paper summarises the definition of collaboration and competition as shown in Table 5. Through the research on the characteristics of competition and collaboration, we could justify the possible impact of competition and collaborative gamification design.

Table 5. Competition v.s. collaboration.

	Competition	Collaboration
Positive meaning	Arouse achievement motivation and stimulate potential	Learn from others and improve efficiency
	Know your own strengths and weaknesses	Establish good interpersonal relationships
	Reflect self-worth and promote innovation	Get encouragement and help
Negative meaning	Too eager for quick success	Dependence, sit back and enjoy
	Produce unhealthy emotions such as tension and anxiety	Reduce the sense of responsibility and shirk each other's accountability
	Harm the interests of others	Laziness, loss of self-motivation

4.4 Perceive Challenge and Attention

Challenge is one of the essential motivation factors suggested in Malone's intrinsic motivation theory. Learners should receive appropriate challenges with a relevant degree of difficulty and complexity. At the same time, the challenge has a positive inherent motivational effect, which provides learners with an opportunity to develop their abilities thus enhance their sense of self-efficacy, which is related to strengthen the learning outcomes [74]. The ARCS motivation theory also proposes that all the tasks/mission must be sufficiently challenging as the difficulty should within the scope of the learner's ability. Those learners shall feel the opportunity to succeed, achieve results, and build self-confidence. Martelli 's research defines the perceptual challenge as the difficulty and complexity experienced by users in the process of acquiring knowledge [75].

ARCS Motivation Theory proposes that attention is another key motivation factor. It is necessary to attract and maintain the learner's attention during the learning process to arouse interest. First, the system inspires learners' interest via new, engaging, uncertain or conflicting content. Second, inspiring inquiry aims to construct problem situations to stimulate learners' desire to participate in exploration, analysis and problem-solving. In short, a system that promotes curiosity and increase attention could enhance learners' sense of participation and learning outcomes.

4.5 Gamification Design Conditions

Gamification systems have a high degree of user interaction. According to the way of interaction between users, the gamification design of MOOC platforms can be divided into two categories: competitive and cooperative [68].

A fundamental design element of a gamified information system is competition. Reeves considers one of the ten main characteristics of successful game design is competition [76]. However, competition creates the risk of losing motivation. The mass still believes that competition failure will lead to negative emotions and reduce the fun. Previous research has shown that losing in the game can negatively affect happiness and

intrinsic motivation [77]. Although losing in the game may have a negative impact, a large amount of literature has also confirmed the positive impact of competition. In this paper, we will study the influence of motivational factors on learning effects under the conditions of competitive gamification design.

Regarding collaboration gamification design, some scholars believe that cooperation can put learners in a situation of equal respect, solidarity and mutual assistance. Collaboration gamification design elements (such as teaming, reminders, and likes) may have a certain effect on the formation and development of learning motivation. Cooperative gamification design conditions will not produce the anxiety or depression that may occur under competitive conditions. At the same time, it will not make learners have the idea of giving up after the competition fails.

4.6 The Moderating Role of Gamification Design

At present, there are few studies on the question of what motivational factors are more helpful to improve the learning effect under which gamification design conditions. By increasing the mission difficulty and creating competitive situations are effective ways to increase the challenge. In games, competition is regarded as a source of challenge, which gives the game an inherent motivational effect. Research has confirmed the role of competition as a source of player motivation and participation, although there may be individual differences [77]. Reeves et al. found that competition can increase the desire to do a good job and the sense of challenge, both of which can promote intrinsic motivation [78]. In a competitive external environment, users often face a series of major challenges such as ranking declines and slow progress. The pressure that users can feel increases, which stimulates them to learn more, which can strengthen the perception of challenge and the effect of learning impact. Competition could make individuals pay more attention to their abilities. When they value abilities or perceive challenges, individuals might become more engaged and perform better.

Collaboration can cultivate positive interpersonal relationships and connections between teammates, and guide individuals to value teamwork and personal contributions in it. Huang et al. believes that collaboration will affect intrinsic motivation in many ways so that each individual can experience the benefits of being a team member, work for a common goal, and develop a sense of belonging with their teammates [79]. The research of Wong and Yang showed that when players get instant feedback and can communicate smoothly with other participants, they will have more sense of composure, which may be a reason why people are addicted to the Internet. Under the condition of collaboration gamification design, team reminders, supervision, communication with teammates and peers, personal responsibility and sense of mission could prompt users to focus and strive to perform better and be more engaged.

In summary, this research believes that under the conditions of competitive gamification design, the perceptual challenge is one of the important motivational factors, which will have a significant impact on the learning effect of MOOC platform users. Table 6 summarise the gamification elements required when designing gamified MOOC based on competitive and collaborative context.

Table 6. Gamification elements for competitive and collaborative condition.

Category	Gamification elements
Competitive gamification design	Points
	Levels
	Leaderboard
	Scoring board
Collaborative gamification design	Points
	Levels
	Group scoring board
	Member reminder
	Mutual assistant (from group members)

5 Conclusion

The spectrum of online learning platform perceptual challenge is based on the following rules (Competition condition - Collaboration condition - Non-gamified condition). Participating in leaderboard score competition and group collaboration to complete tasks in the online learning process could improve users' perception of challenge. The pressure and tension in the competition process have a greater impact on users' perceptual challenge performance. Gamified MOOC users' perceptual attention is higher under collaborative condition compared with competition condition. Excessive attention to the leaderboard during the competition may distract users to a certain extent.

Regarding the moderating effect of gamification design conditions on the relationship between motivational factors and learning effects, the tense atmosphere under competitive conditions or the result of competition failure will make users lose confidence and motivation to continue working hard. Perceptual attention has a stronger positive impact on online learning platform users' learning outcomes and cognitive participation under the conditions of collaborative gamification design. Under collaborative conditions, the increased attention from teammates' reminders and self-responsibility supervision can further enhance users' learning results and cognitive participation. Regarding user perception and attention under competitive conditions are higher than non-gamification design conditions. One is that competitive conditions might cause users to pay too much attention to elements such as leaderboards, leading to competition for competition. The situation of competition may distract users' concentration to some extent. Second, some users find it difficult to accept the result of competition failure, and they will have a misleading mentality and give up their attention to follow-up learning.

Regarding the perceptual challenge under the conditions of competitive gamification design, the positive impact on the learning results and cognitive participation of online game platform users is higher. Although the competitive gamification design can fully enhance the perceptual challenge and make users feel pressure and tension, it has not produced the expected adjustment effect. Users only fight for the first place and ignore other things as they disgusted with the elements of competition or use deceptive means to

participate in the competition. Under the condition of collaborative gamification design, the user's perceptual attention could be enhanced, whether it is due to the supervision and reminder of the collaborator or the promotion of self-fulfilment and responsibility. In this process, it positively regulates the relationship between perceptual attention and learning effect. The gamified system will prompt users to participate in the learning process and bringing higher progress to themselves and their peers.

In summary, intense competition did not bring about the desired effect. For one of the currently widely used gamification design elements in the leaderboard, nearly half of the research subjects denied its role. For precise mapping and gamification design, user/player type should be considered in future development. The gamified MOOC should be design using game elements based on user types as particular game element might not be suitable and some might negatively affect some user types. The influence of the skill level of peers and competitors on the learning effect of users is worthy of attention in future research.

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References

1. Yang, R.: China's higher education during the COVID-19 pandemic: some preliminary observations, pp. 1–5. Higher Education Research & Development (2020)
2. Goopio, J., Cheung, C.: The MOOC dropout phenomenon and retention strategies. J. Teach. Travel Tour. 1–21 (2020)
3. Zhang, M., Yin, S., Luo, M., Yan, W.: Learner control, user characteristics, platform difference, and their role in adoption intention for MOOC learning in China. Australas. J. Educ. Technol. **33**(1) (2017)
4. Van Roy, R., Zaman, B.: Need-supporting gamification in education: an assessment of motivational effects over time. Comput. Educ. **127**, 283–297 (2018)
5. Kulkarni, T.D., Narasimhan, K., Saeedi, A., Tenenbaum, J.: Hierarchical deep reinforcement learning: integrating temporal abstraction and intrinsic motivation. In: Advances in Neural Information Processing Systems, pp. 3675–3683 (2016)
6. Corona Martínez, D., Real García, J.J.: Using Malone's theoretical model on gamification for designing educational rubrics. In: Informatics, vol. 6, no. 1, p. 9. Multidisciplinary Digital Publishing Institute (2019)
7. Alsawaier, R.S.: The effect of gamification on motivation and engagement. Int. J. Inf. Learn. Technol. **35**(1), 56–79 (2018)
8. Svendsen, B., Burner, T., Røkenes, F.M.: Intrinsically motivating instruction—Thomas Malone. In: Akpan, B., Kennedy, T.J. (eds.) Science Education in Theory and Practice. Springer Texts in Education, pp. 45–53. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-43620-9_4
9. Malone, T.W.: What makes things fun to learn? A study of intrinsically motivating computer games (1981)
10. Compeau, D., Gravill, J., Haggerty, N., Kelley, H.: Computer self-efficacy. In: Human-Computer Interaction and Management Information Systems: Foundations, pp. 225–261 (2006)

11. Golman, R., Loewenstein, G.: Curiosity, information gaps, and the utility of knowledge. Inf. Gaps Utility Knowl., 96–135 (2015)
12. Paivio, A., Clark, J.M.: Dual coding theory and education. Pathways to literacy achievement for high poverty children, pp. 1–20 (2006)
13. Gachkova, M., Somova, E.: Plug-in for creation of gamified courses in the e-learning environment moodle. In: IOP Conference Series: Materials Science and Engineering, vol. 618, no. 1, p. 012079. IOP Publishing (2019)
14. Cordova, D.I., Lepper, M.R.: Intrinsic motivation and the process of learning: beneficial effects of contextualization, personalization, and choice. J. Educ. Psychol. **88**(4), 715 (1996)
15. Park, J., Liu, D., Mun, Y.Y., Santhanam, R.: GAMESIT: a gamified system for information technology training. Comput. Educ. **142**, 103643 (2019)
16. Simsek, A.: Interview with John M. Keller on motivational design of instruction. Contemp. Educ. Technol. **5**(1), 90–95 (2014)
17. Li, K., Moore, D.R.: Motivating students in massive open online courses (MOOCs) using the attention, relevance, confidence, satisfaction (ARCS) model. J. Formative Des. Learn. **2**(2), 102–113 (2018)
18. Li, K., Keller, J.M.: Use of the ARCS model in education: a literature review. Comput. Educ. **122**, 54–62 (2018)
19. Nakamura, J., Csikszentmihalyi, M.: The concept of flow. In: Nakamura, J., Csikszentmihalyi, M. (eds.) Flow and the Foundations of Positive Psychology, pp. 239–263. Springer, Dordrecht (2014). https://doi.org/10.1007/978-94-017-9088-8_16
20. Jackson, S.A., Marsh, H.W.: Development and validation of a scale to measure optimal experience: the flow state scale. J. Sport Exerc. Psychol. **18**(1), 17–35 (1996)
21. Tsao, Y.C., Shu, C.C., Lan, T.S.: Development of a reminiscence therapy system for the elderly using the integration of virtual reality and augmented reality. Sustainability **11**(17), 4792 (2019)
22. Van Schaik, P., Martin, S., Vallance, M.: Measuring flow experience in an immersive virtual environment for collaborative learning. J. Comput. Assist. Learn. **28**(4), 350–365 (2012)
23. Zhang, Y., Chen, J., Miao, D.: Zhang, C (2018) Design and analysis of an interactive MOOC teaching system based on virtual reality. Int. J. Emerg. Technol. Learn. (iJET) **13**(07), 111–123 (2012)
24. Rheinberg, F., Vollmeyer, R.: Flow experience in a computer game under experimentally controlled conditions. Zeitschrift fur Psychologie **211**(4), 161–170 (2003)
25. Reich, J., Ruipérez-Valiente, J.A.: The MOOC pivot. Science **363**(6423), 130–131 (2019)
26. Steffens, K.: Competences, learning theories and MOOC s: recent developments in lifelong learning. Eur. J. Educ. **50**(1), 41–59 (2015)
27. Ping, W.: The latest development and application of massive open online course: from cMOOC to xMOOC. Mod. Distance Educ. Res. **3**(005) (2013)
28. Siemens, G., Downes, S.: Connectivism & connective knowledge. Universidad de Manitoba (2008)
29. O'Brien, K., Forte, M., Mackey, T., Jacobson, T.: Metaliteracy as pedagogical framework for learner-centered design in three MOOC platforms: Connectivist. Open Praxis **9**(3), 267–286 (2017)
30. Anyatasia, F.N., Santoso, H.B., Junus, K.: An evaluation of the Udacity MOOC based on instructional and interface design principles. In: Journal of Physics: Conference Series, vol. 1566, no. 1, p. 012053. IOP Publishing (2020)
31. Gimeno-Sanz, A., Navarro-Laboulais, C., Despujol-Zabala, I.: Additional functionalities to convert an xMOOC into an xLMOOC. In: Delgado Kloos, C., Jermann, P., Pérez-Sanagustín, M., Seaton, D., White, S. (eds.) EMOOCs 2017. LNCS, vol. 10254, pp. 48–57. Springer, Cham (2017). https://doi.org/10.1007/978-3-319-59044-8_6

32. Lopatiev, A., Ivashchenko, O., Khudoliy, O., Pjanylo, Y., Chernenko., Yermakova, T.: Systemic approach and mathematical modeling in physical education and sports (2017)
33. Zou, M., Chen, R., Su, M.: How to make traditional advanced mathematics classrooms walks out of MOOC storm. In: 2018 International Conference on Social Science and Education Reform (ICSSER 2018). Atlantis Press (2018)
34. Wang, Z., Anderson, T., Chen, L.: How learners participate in connectivist learning: an analysis of the interaction traces from a cMOOC. Int. Rev. Res. Open Distrib. Learn. **19**(1) (2018)
35. Bozkurt, A., Honeychurch, S., Caines, A., Bali, M., Koutropoulos, A., Cormier, D.: Community tracking in a cMOOC and nomadic learner behaviour identification on a connectivist rhizomatic learning network. Turkish Online J. Distance Educ. **17**(4), 4–30 (2016)
36. Foroughi, A.: MOOCs: the enduring importance of "teacher presence." J. High. Educ. Theory Pract. **16**(6), 76 (2016)
37. Downes, S.: Applications, algorithms and data: open educational resources and the next generation of virtual learning (2017)
38. Joksimović, S., et al.: Exploring development of social capital in a CMOOC through language and discourse. Internet High. Educ. **36**, 54–64 (2018)
39. Mahmod, M.A., Ali, A.M., Shah, A.: Massive open online courses as an augmentation of e-learning: a review. Int. J. Perceptive Cognit. Comput. **4**(2), 1–4 (2018)
40. Dai, H.M., Teo, T., Rappa, N.: A understanding continuance intention among MOOC participants: the role of habit and MOOC performance. Comput. Hum. Behav. **112**, 106455 (2020)
41. Newfield, C.: Aftermath of the MOOC wars: can commercial vendors support creative higher education? Learn. Teach. **9**(2), 12–41 (2016)
42. Kaplan, A.M., Haenlein, M.: Higher education and the digital revolution: about MOOCs, SPOCs, social media, and the Cookie Monster. Bus. Horiz. **59**(4), 441–450 (2016)
43. Renz, J., Schwerer, F., Meinel, C.: openSAP: Evaluating xMOOC usage and challenges for scalable and open enterprise education. Int. J. Adv. Corpo. Learn. (iJAC) **9**(2), 34–39 (2016)
44. Ramírez-Montoya, M.S., Mena, J., Rodríguez-Arroyo, J.A.: In-service teachers' self-perceptions of digital competence and OER use as determined by a xMOOC training course. Comput. Hum. Behav. **77**, 356–364 (2017)
45. Chou, Y.K.: Actionable Gamification: Beyond Points, Badges, and Leaderboards. Packt Publishing Ltd., Birmingham (2019)
46. Rigóczki, C., Damsa, A., Györgyi-Ambró, K.: Gamification on the edge of educational sciences and pedagogical methodologies. J. Appl. Techn. Educ. Sci. **7**(4), 79–88 (2017)
47. Morschheuser, B., Hassan, L., Werder, K., Hamari, J.: How to design gamification? A method for engineering gamified software. Inf. Softw. Technol. **95**, 219–237 (2018)
48. Deterding, S., Dixon, D., Khaled, R., Nacke, L.: From game design elements to gamefulness: defining "gamification". In: Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments, pp. 9–15 (2011)
49. Mavromihales, M., Holmes, V., Racasan, R.: Game-based learning in mechanical engineering education: case study of games-based learning application in computer aided design assembly. Int. J. Mech. Eng. Educ. **47**(2), 156–179 (2019)
50. Glover, I.: Play as you learn: gamification as a technique for motivating learners. In: Edmedia+ innovate learning, pp. 1999–2008. Association for the Advancement of Computing in Education (AACE) (2013)
51. Nor, N.N., Sunar, M.S., Kapi, A.Y.: User experience of gamified virtual reality (VR) in sport: a review. In: Santos, H., Pereira, G., Budde, M., Lopes, S., Nikolic, P. (eds.) SmartCity 360 2019. LNICST, vol. 323, pp. 440–449. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-51005-3_36

52. Gorbunovs, A., Kapenieks, A., Cakula, S.: Self-discipline as a key indicator to improve learning outcomes in e-learning environment. Procedia Soc. Behav. Sci. **231**, 256–262 (2016)
53. Kormos, J., Csizer, K.: The interaction of motivation, self-regulatory strategies, and autonomous learning behavior in different learner groups. TESOL Q. **48**(2), 275–299 (2014)
54. Prasetya, D.D., Wibawa, A.P., Ahmar, A.S.: Design of web-based lightweight interactive multimedia for distance learning. In: Journal of Physics: Conference Series, vol. 1028, no. 1 (2018)
55. Reinhold, S., Gegenfurtner, A., Lewalter, D.: Social support and motivation to transfer as predictors of training transfer: testing full and partial mediation using meta-analytic structural equation modelling. Int. J. Train. Dev. **22**(1), 1–14 (2018)
56. Rivard, R.: Measuring the MOOC dropout rate. Inside High. Educ. **8** (2013)
57. Ricart, S., Villar-Navascués, R.A., Gil-Guirado, S., Hernández, M., Rico-Amorós, A.M., Olcina-Cantos, J.: Could MOOC-takers' behaviour discuss the meaning of success-dropout rate? Players, auditors, and spectators in a geographical analysis course about natural risks. Sustainability **12**(12), 4878 (2020)
58. Cheek, D.W.: A panoramic view of the future of learning and the role of design(ers) in such experiences. In: Hokanson, B., Clinton, G., Tracey, M. (eds.) The Design of Learning Experience. ECTII, pp. 5–37. Springer, Cham (2015). https://doi.org/10.1007/978-3-319-16504-2_2
59. Adham, R., Parslow, P., Dimitriadi, Y., Lundqvist, K.Ø.: The use of avatars in gender segregated online learning within MOOCs in Saudi Arabia-A Rwaq case study. Int. Rev. Res. Open Distrib. Learn. **19**(1) (2018)
60. Staubitz, T., Petrick, D., Bauer, M., Renz, J., Meinel, C.: Improving the peer assessment experience on MOOC platforms. In: Proceedings of the Third ACM Conference on Learning@Scale, pp. 389–398 (2016)
61. Martínez-Núñez, M., Fidalgo-Blanco, Á., Borrás-Gené, O.: New challenges for the motivation and learning in engineering education using gamification in MOOC (2015)
62. Gené, O.B., Núñez, M.M., Blanco, Á.F.: Gamification in MOOC: challenges, opportunities and proposals for advancing MOOC model. In: Proceedings of the Second International Conference on Technological Ecosystems for Enhancing Multiculturality (2014)
63. Klemke, R., Antonaci, A., Limbu, B.: Gamifire - a scalable, platform-independent infrastructure for meaningful gamification of MOOCs. In: Liapis, A., Yannakakis, G., Gentile, M., Ninaus, M. (eds.) GALA 2019. LNCS, vol. 11899, pp. 256–265. Springer, Cham (2019). https://doi.org/10.1007/978-3-030-34350-7_25
64. Hew, K.F., Huang, B., Chu, K.W.S., Chiu, D.K.: Engaging Asian students through game mechanics: findings from two experiment studies. Comput. Educ. **92**, 221–236 (2016)
65. Hanus, M.D., Fox, J.: Assessing the effects of gamification in the classroom: a longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. Comput. Educ. **80**, 152–161 (2015)
66. De-Marcos, L., Garcia-Lopez, E., Garcia-Cabot, A.: On the effectiveness of game-like and social approaches in learning: comparing educational gaming, gamification & social networking. Comput. Educ. **95**, 99–113 (2016)
67. Fan, J., Wang, Z.: The impact of gamified interaction on mobile learning APP users' learning performance: the moderating effect of users' learning style. Behav. Inf. Technol., 1–14 (2020)
68. Liu, D., Santhanam, R., Webster, J.: Toward meaningful engagement: A framework for design and research of gamified information systems. MIS Q. **41**(4) (2017)
69. Maller, J.B.: Cooperation and competition: an experimental study in motivation. Teach. Coll. Contrib. Educ. (1929)
70. Tauer, J.M., Harackiewicz, J.M.: The effects of cooperation and competition on intrinsic motivation and performance. J. Pers. Soc. Psychol. **86**(6), 849 (2004)

71. Tran, V.D.: Does cooperative learning increase students' motivation in learning? Int. J. High. Educ. **8**(5), 12–20 (2019)
72. Liao, C.W., Chen, C.H., Shih, S.J.: The interactivity of video and collaboration for learning achievement, intrinsic motivation, cognitive load, and behaviour patterns in a digital game-based learning environment. Comput. Educ. **133**, 43–55 (2019)
73. Miquel, E., Duran, D.: Peer learning network: implementing and sustaining cooperative learning by teacher collaboration. J. Educ. Teach. **43**(3), 349–360 (2017)
74. Panadero, E., Jonsson, A., Botella, J.: Effects of self-assessment on self-regulated learning and self-efficacy: four meta-analyses. Educ. Res. Rev. **22**, 74–98 (2017)
75. Martelli, E.: International student perceptual challenges and coping within higher education (2020)
76. Bharathi, A.K.B.G., Singh, A., Tucker, C.S., Nembhard, H.B.: Knowledge discovery of game design features by mining user-generated feedback. Comput. Hum. Behav. **60**, 361–371 (2016)
77. Vansteenkiste, M., Deci, E.L.: Competitively contingent rewards and intrinsic motivation: can losers remain motivated? Motiv. Emot. **27**(4), 273–299 (2003)
78. Reeves, N., West, P., Simperl, E.: A game without competition is hardly a game: the impact of competitions on player activity in a human computation game. In: AAAI (2018)
79. Huang, S.C., Etkin, J., Jin, L.: How winning changes motivation in multiphase competitions. J. Pers. Soc. Psychol. **112**(6), 813 (2017)