

# The Influence of Presence Types on Learning Engagement in a MOOC: The Role of Autonomous Motivation and Grit

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**Purpose:** We developed a research framework based on the community of inquiry theory to examine the relationship between three kinds of MOOC presence (teaching presence, social presence, and cognitive presence) and learning engagement. Further, we explored the mediating effect of autonomous motivation and the moderating role of grit in this relationship.

**Participants and Methods:** The online survey included a sample of  $N = 794$  college students (46.473% male) between the ages of 18 and 20. The COI survey instrument, short grit scale, the Utrecht work engagement scale-student scale and academic self-regulation questionnaire were used to test hypotheses.

**Results:** The study results showed that all three MOOC presences (teaching presence, social presence, and cognitive presence) had significant positive relationship with learning engagement. Autonomous motivation had a mediating role in them. Also, the positive relationship between social presence, cognitive presence, and autonomous motivation was stronger for students with a higher level of grit.

**Conclusion:** This study enriches the literature on whether and how the presence knowledge of MOOC courses affects college students' learning engagement, and the complexity of MOOC environments determines that grit plays an indispensable role in the learning process.

**Keywords:** MOOC, community of inquiry, presence, learning engagement, grit

## Introduction

Learning quality is a core research issue in higher education, and the degree of learners' active engagement in academic activities is the primary condition for improving their academic performance and cognitive development, as well as the quality of education. In recent years, with the rapid growth of informatization in higher education, Massive Open Online Courses (MOOC) have become an important practice in teaching and learning in higher education around the world to expand access to higher education and improve the quality of teaching and learning. MOOC is a kind of online learning environment that allows students to take courses in various disciplines without restriction.<sup>1</sup> With MOOC, everyone can listen to lectures by renowned professors for free and enjoy continuous learning support through diverse activities and rich learning materials.

For college students, as the direct stakeholders of MOOC, the Learning engagement of the course is a key indicator to test the effectiveness of teaching and learning and is crucial to their academic success.<sup>2</sup> Students must be active and positively engaged in the online learning process. However, in the MOOC learning stage, the temporal and spatial separation of teachers and students weakens the teaching-learning relationship, and learners' Learning engagement suffers from the low initiative and less deep engagement.<sup>3-5</sup> MOOC participation decreases significantly as the course progresses, and MOOC completion rates are typically low, perhaps as low as 3%-6%.<sup>6</sup> Similarly, the three presence types (Cognitive presence, Social presence, and Teaching presence) during online learning not only have a positive predictive effect on students' autonomous motivation but also indirectly influence students' Learning engagement through autonomous motivation affects students' Learning engagement.<sup>7</sup> In addition, students report mostly experiencing problems

such as low presence and feeling high levels of loneliness and failure during their MOOC studies.<sup>8</sup> Considering that the development and operation of MOOC requires more financial investment, such low learning persistence statistics are a barrier that undermines the sustainability and effectiveness of MOOC.<sup>9,10</sup> As research continues, researchers are beginning to recognize the important role of grit in online learning environments.<sup>11</sup> Grit not only motivates students to learn, but also helps them self-regulate their learning and adopt positive learning strategies, helping learners to function cognitively, emotionally, and behaviorally in order to exhibit higher levels of Learning engagement.<sup>12,13</sup> Individuals with high grit in the e-learning environment are more likely to overcome difficulties encountered in learning, act quickly and seize learning opportunities, show higher levels of autonomous motivation, and actively engage in learning.<sup>14</sup> Therefore, the research on the Learning engagement of learners' MOOCs has an important role and practical value for their academic achievement.<sup>15</sup>

Most previous studies on MOOC have focused on how learners' characteristics affect MOOC learning outcomes, and the relationship between Learning engagement and presence in MOOC remains under-researched.<sup>16,17</sup> Meanwhile, grit is particularly important in MOOC learning, which has been proven to be a strong individual factor for completion and sustained learning, and the impact on students' learning achievement in education has been abundantly confirmed.<sup>18–20</sup> Based on the community of inquiry (COI), this study explores the associations and potential mechanisms between three types of presences and learners' Learning engagement. The main objectives of this study are (1) whether the three presence categories (teaching presence, social presence, and Cognitive presence) in MOOC learning can influence college students' Learning engagement? (2) Whether Autonomous motivation mediates the above associations? (3) Does grit play a moderating role?

## Literature Review and Research Hypothesis

### Presence and Learning Engagement

Presence has long been recognized as one of the learning outcomes sought by education and teaching in online learning environments, which is critical to forming and developing online learning. COI has become an authoritative theoretical framework for describing the online learning process. The three core elements (Cognitive presence, Social presence, and Teaching presence) articulated in the framework are the core elements affecting learners' motivation and learning engagement online, which are highly explanatory and innovative for analyzing the success of teaching and learning in MOOC courses, and are the most critical components of a high-quality online learning experience in higher education settings.<sup>21–26</sup>

Teaching presence refers to teachers designing, facilitating, and guiding learners' cognitive and social processes to achieve personally meaningful and educationally rewarding learning outcomes for learners; Social presence refers to the learner's ability to communicate purposefully, express their individuality, and build interpersonal relationships in a reliable environment; Cognitive presence refers to the process by which learners construct knowledge and meaning through ongoing interactions in a learning community and reflect and dialog in making meaning.<sup>27–29</sup> Online participants must establish and maintain these three closely related and interdependent presences to achieve high-quality teaching and learning outcomes and educational experiences in online learning environments.<sup>25,30</sup>

Previous studies have shown that the three kinds of presence perceived by learners in online learning significantly affect Learning engagement. For example, the lower the level of teaching presence, the lower the level of online engagement, cognition, and interaction, and the lower the level of knowledge construction by absorbing peer information.<sup>31</sup> For MOOC learners, teaching presence has a significant direct effect on learning engagement and persistence of learning.<sup>32</sup> How teachers design teaching activities and maintain teacher-student relationships is crucial for students to perceive the meaning and value of learning activities and can directly affect students' learning efficiency and academic engagement levels.<sup>33</sup> Similarly, social presence has been shown to activate learners' ability to perceive their peers, emphasize the importance of learners' free expression and collaborative interactions in the cognitive process, support learners' collaborative learning, and motivate effective learning. Social presence reduces barriers created by physical distances in the virtual learning space. It lets learners know their peers' learning experiences or receive feedback from their peers about their learning experiences.<sup>33</sup> Social presence can reduce the barriers created by physical distance in the virtual learning space and let learners know the learning experience of their peers or get recognition from their

peers, which will increase their confidence and motivation to learn and motivate them to continue to participate in learning.<sup>34–36</sup> Finally, cognitive presence can help learners perceive the learning content at a higher level, grasp knowledge accurately, reflect on practical activities better, enhance learners' engagement, and thus improve learners' learning effectiveness, which is the main means for effective learning. In addition, Social presence helps students to engage in cooperative learning and critical thinking and helps students maintain behaviors such as concentration, self-discipline, and effort during the learning process.<sup>37</sup> Cognitive presence also promotes students' construction and understanding of knowledge and stimulates students' willingness to continue learning. Overall, according to the COI framework and empirical studies, it is known that different forms of presence lead to a more valuable learning experience and can encourage learners to engage in more and more sustained Learning engagement.<sup>24</sup>

## The Mediating Role of Autonomous Motivation

Autonomous motivation refers to an individual's motivation to engage in a behavior out of interest in a task, a hobby, or identification with its value.<sup>38</sup> According to the self-determined motivation theory, students' state of learning engagement may be moderated by a variety of reasons, such as their perception of the learning content as interesting, pleasurable, and fascinating (internal motivation), or students' internalization of external values and perceptions into their belief systems (integrative regulation), or students' recognize the importance and significance of learning activities for their long-term development and achievement of personal goals (identity regulation).<sup>39</sup> The latter two types of motivation are internalized external motivation, and these three types of motivation are collectively referred to as autonomous motivation. Numerous studies have shown that autonomous motivation is consistently associated with beneficial outcomes such as deeper learning, persistence, and higher academic achievement.<sup>40–42</sup>

Previous research found that demand-supportive learning environments contribute to students' autonomous motivation.<sup>43</sup> This standpoint was confirmed in the study of Learning engagement; that is, teaching presence can act as a positive social environment that has a positive predictive effect on students' autonomous motivation and indirectly influences students' Learning engagement through autonomous motivation.<sup>7</sup> The findings of Mouratidis showed that the provision of structural support by teachers significantly predicted students' learning efforts by influencing students' autonomous motivation.<sup>44</sup> Another meta-analysis of online learning found that teachers' effective knowledge of learners not only positively predicts students' Learning engagement directly but also indirectly affects students' learning outcomes through internal motivation.<sup>45</sup> For social presence, it has been shown to influence a variety of factors in the student learning experience. For example, Samuel et al emphasized that the creation of supportive online learning networks helps increase students' motivation for self-directed learning and their commitment to team goals and knowledge co-construction.<sup>46</sup> That is, a social presence in online learning not only positively affects students' motivation but also holds high levels of satisfaction with the course and instructor, which in turn ensures retention in the online course and longevity of learning engagement.<sup>47–49</sup> It can be seen that Teaching presence and social presence can enhance students' Learning engagement through the mediating role of autonomous motivation.

In addition, besides Teaching presence and social presence, we also focus on learners' cognitive presence. Previous studies have mainly investigated the relationship between Teaching presence, social presence, and learning engagement in MOOCs. There are fewer studies on the relationship between cognitive presence, autonomous motivation, and learning engagement. Research results suggest that cognitive presence may be located in the center of the learning network, and educators and learners need to make full use of other presences to facilitate cognitive presence.<sup>50</sup> The stronger the cognitive presence of learners, the higher the ability of learners to construct knowledge and the higher the autonomy of acquiring new knowledge, which is also more favorable to improving learners' online learning engagement.<sup>37</sup> Another study confirms that cognitive presence can promote students' construction and understanding of knowledge and stimulate students' willingness and motivation to continue learning, which is more conducive to enhancing the effectiveness of online learning.<sup>51</sup>

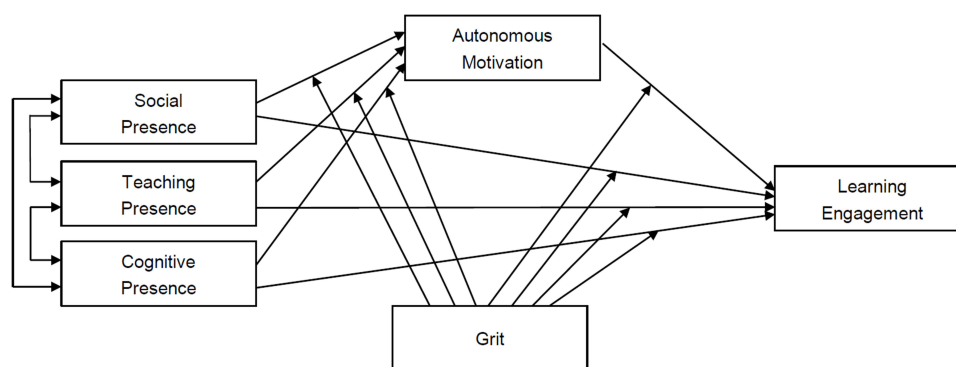
## The Moderating Effect of Grit

The impact of grit on the academic achievement of individuals in education has been well documented.<sup>20,52</sup> In recent years, educational policymakers have been calling for interventions to increase students' grit to improve their academic

achievement and persistence. Grit encompasses constant attempts at long-term goals, an enduring spirit, and a great deal of positive energy that pushes individuals to keep moving toward their dreams against all odds.<sup>19,53,54</sup> Grit, as a significant predictor variable of academic performance, not only predicts students' academic success and their lifelong development but also plays a role in cognitive, affective, and behavioral aspects to make students show a higher level of Learning engagement.<sup>13,55</sup> In particular, grit is essential in online learning environments. Carla noted that online courses are critical for motivating students and equipping them with methods and strategies that help them self-regulate their learning.<sup>12</sup> Students with high grit in their online learning engagement show higher levels of autonomous motivation, and they can act quickly and take advantage of learning opportunities, even when they face learning difficulties.<sup>56</sup> In addition, empirical studies have shown that grit, as an important personality trait, may have a positive effect on individuals' Learning engagement, motivation, academic performance, and psychological well-being.<sup>19,52,57</sup>

The study that has been conducted suggests that grit, as the foundation and deep force for learners to generate learning behaviors and advance learning activities, is one of the main components of college students' learning power in online learning courses.<sup>58</sup> Since blended learning courses include the independent learning stage in the early stage, students are usually in a passive learning state when participating in learning activities in this stage, only shallow learning involving less deep input.<sup>59</sup> Moreover, learners are disturbed by multiple factors online and offline, which puts higher requirements on learners' self-discipline and the concept of adversity. It may be easier for high-grit learners to overcome learning difficulties and gain positive emotional experiences such as confidence, surprise, and pleasure, which prompts them to be more willing to engage in learning activities actively.<sup>14</sup> Based on the above literature, we can think that grit is important in helping learners overcome online learning difficulties and obstacles and enhance MOOC learning engagement.

Most of the previous studies on MOOC have focused on how learners' characteristics affect MOOC learning outcomes, and there is still insufficient research on Learning engagement and persistence in MOOC.<sup>16,17,60</sup> Meanwhile, grit is essential in MOOC learning. It is a strong predictor of completion and persistence, and its impact on individual learning achievement in education has been heavily confirmed by many.<sup>18–20</sup> However, despite the large amount of research on autonomous motivation learning engagement in MOOC learning, there are still some research gaps in the literature. Most previous studies have focused on the role of grit in autonomous motivation and academic engagement. The research on the relationship between presence and grit in MOOC learning has not received enough attention, which needs further investigation in MOOC learning environments. Understanding the influence of learners' characteristics may lead to a better understanding of the determinants of academic success in MOOC. Therefore, based on CoI, this study explores the association between three types of presence and learners' Learning engagement. We incorporated grit into the CoI to examine the potential mechanisms of different presence types in MOOC learning on college students' learning engagement. We believe that presence may have a positive relationship with college students' learning engagement in MOOC learning, in which autonomous motivation may play a mediating role, and college students' grit plays a moderating role. Based on this, we constructed the research framework in Figure 1 and proposed the following research hypotheses.



**Figure 1** Theoretical model.

H1: Presence has a positive relationship with College students' learning engagement in MOOC, specifically:

H1a: Teaching presence has a positive relationship with learning engagement.

H1b: Social presence has a positive relationship with learning engagement.

H1c: Cognitive presence has a positive relationship with learning engagement.

H2: Autonomous motivation mediates the relationship between presence and learning engagement, specifically:

H2a: Autonomous motivation mediates the relationship between teaching presence and learning engagement.

H2b: Autonomous motivation mediates the relationship between social presence and learning engagement.

H2c: Autonomous motivation mediates the relationship between cognitive presence and learning engagement.

H3: Grit plays a moderating role in the direct and indirect path between presence and learning engagement.

## Data and Methods

### Data Source

The study subjects were selected as undergraduate students of a university in Shandong Province, China. By the end of 2022, the university has implemented nearly 60 online MOOC courses for all students, and all the courses are on the China MOOC platform. The course selected for this study is "College English", one of the courses that Chinese college students generally need to take. The instructor has many years of MOOC teaching experience. The course is from February 20, 2023, to June 30, 2023. Students' MOOC learning includes watching videos, participating in forum discussions, taking online tests, and completing assessments. In this MOOC, weekly online quizzes are required to help students with self-assessment. The instructor poses 1 question per week in the content discussion forum for students to discuss. Students can only comment or respond to other students' posts. Students can ask course-related questions in the Q&A Forum sessions, where the instructor or other students can help them answer their questions. Open communication builds Personal relationships with others, ultimately forming a unique learning community. Students who complete the course content study and assessment and whose grades meet the course assessment standards are awarded a certificate of certification.

The data for this study were collected in the last class before the end of the course. Ethical approval for this study was obtained from the Academic Committee of Qingdao University. All participating students were informed of the purpose, procedure, and content of the survey and that the study was voluntary and anonymous. A total of 794 university students (369 males and 425 females) eventually completed the questionnaire, ranging in age from 18 to 20 years ( $18.474 \pm 0.550$ ). Of these participants, 442 (55.668%) had MOOC learning experience, 352 (44.332%) did not have MOOC learning experience, and 691 of them eventually received certification.

### Method

#### COI Survey Instrument

This study utilized the COI survey instrument developed by Arbaugh.<sup>61</sup> The survey had 34 items, including 13 items of teaching presence (eg, instructor clearly communicated important course topics; instructor provided timely feedback), 9 items of social presence (eg, meeting other course participants gave me a sense of belonging to the course; online discussions helped me develop a sense of collaboration), and 12 items of cognitive presence (eg, the questions asked increased my interest in the course issues; I can apply what I learned in this course to my job or other non-classroom related activities) based on a 5-point scale from strongly disagree to strongly agree. Earlier studies have validated the questionnaire.<sup>8,22,25,30,49,61</sup>

### Autonomous Motivation

The Identified (7-items) and Internal (7-items) subscales of the Academic Self-Regulation Questionnaire developed by Ryan and Connell (1989) were used to measure students' autonomous motivation. The questionnaire was scored on a 4-point scale, with 1 being not at all consistent and 4 being very consistent.<sup>62</sup>

### Short Grit Scale

The Short Grit Scale (Grit-S) developed by Duckworth was used. The questionnaire consists of eight items and measures the dimensions of persistence of interest and consistency of effort.<sup>19</sup> Items include "I am a hard worker", "Whatever I start, I finish", and "I often set one goal, but then choose to pursue a different one", et al. A 5-point scale was used (1=not at all compliant, 5=fully compliant), and the 8-item scores were summed to obtain the scale's total score; the higher the score, the higher the degree of grit.

### Learning Engagement

The Utrecht Work Engagement Scale-Student (UWES-S) scale was developed by Schaufeli, and the Chinese version was revised by Fang.<sup>63,64</sup> The 17-item scale is divided into three dimensions: vigor, dedication, and concentration.<sup>64</sup> The scale adopts a 7-point scale, with 1 representing "never" and 7 representing "always", the higher the score, the higher the individual's learning engagement.

## Analytic Strategies

We first analyzed the sample data using SPSS and AMOS software. Preliminary analyses were first performed, including Harman's single-factor Test, multicollinearity tests, and reliability and validity tests of the scales. Then, we developed structural equation modeling and tested the path relationships and mediating effects among variables using the Bootstrap method. Finally, we divided the sample into two groups based on the grit means, and using cluster analysis and coefficient difference tests in AMOS, we compared the differences in the path coefficients of the structural equation models under different grit level groups.

## Results

### Preliminary Analysis

Harman's one-way test showed six factors with eigenvalues of the questionnaire greater than 1. The variance extracted from the first factor was 27.225%, which was below the 40% critical value criterion, and there was no severe method bias. The multicollinearity test showed that each variable VIF was between 1.019 and 2.600, lower than 10, so there is no severe multicollinearity between the variables. Finally, Table 1 demonstrates the basic descriptive statistics and reliability tests of the scales used in this study. As shown in Table 1, each scale used in this study has good reliability and validity.<sup>65</sup>

**Table 1** Basic Analysis of Scales

	Mean	SD	$\chi^2/df$	CFI	GFI	AGFI	TLI	RMSEA	Cronbach's $\alpha$
Teaching Presence	39.224	11.863	1.828	0.989	0.978	0.969	0.987	0.032	0.928
Cognitive Presence	36.086	10.798	1.910	0.989	0.979	0.970	0.987	0.034	0.921
Social Presence	27.521	8.523	2.748	0.988	0.979	0.965	0.984	0.047	0.921
Autonomous Motivation	29.895	8.503	2.203	0.975	0.975	0.966	0.970	0.039	0.898
Learning Engagement	55.363	13.047	1.491	0.991	0.976	0.968	0.990	0.025	0.938
Grit	23.674	7.703	1.546	0.996	0.991	0.983	0.994	0.026	0.890

## Structural Equation Model Analysis

The structural equations were modeled using AMOS software. The overall fit indices of the structural model for this study were as follows:  $\chi^2/df= 1.095$ , CFI=1.000, GFI=0.997, AGFI=0.989, TLI=0.999, and RMSEA=0.011, with each of the indices being within a reasonable range, and with the model having an overall good fit.<sup>65</sup> The results of the structural equation model fit are shown in Table 2, teaching presence ( $\beta=0.228$ ,  $p<0.001$ ), cognitive presence ( $\beta=0.115$ ,  $p<0.01$ ), and social presence ( $\beta=0.135$ ,  $p<0.001$ ) all had significant positive correlations with learning engagement, thus supporting H1 a~c. In addition, teaching presence ( $\beta=0.240$ ,  $p<0.001$ ), cognitive presence ( $\beta=0.115$ ,  $p<0.05$ ), and social presence ( $\beta=0.145$ ,  $p<0.001$ ) also had a significant positive correlation with autonomous motivation. Finally, autonomous motivation ( $\beta=0.232$ ,  $p<0.001$ ) also correlates significantly positively with learning engagement.

## Mediation Effect Analysis

The Bootstrap method was used to examine the mediating effects of Autonomous Motivation, and Table 3 reports the results of the bias-corrected percentile bootstrap method.<sup>66</sup> As shown in Table 3, the 95% BootCIs for all three mediation paths of autonomous motivation did not contain 0, indicating that autonomous motivation significantly mediated the relationship between teaching presence (Effect=0.061, 95%BootCI=[0.032, 0.103]), cognitive presence (Effect=0.032, 95%BootCI=[0.005, 0.063]), and social presence (Effect=0.051, 95%BootCI=[0.021, 0.093]), and learning engagement. Therefore, H2 a~c are confirmed.

**Table 2** Results of the Structural Equation Model Analysis

Path	STD.Est	Unstd.Est	S.E.	t
Teaching Presence → Learning Engagement	0.228	0.250	0.052	4.803***
Cognitive Presence → Learning Engagement	0.115	0.139	0.052	2.670**
Social Presence → Learning Engagement	0.135	0.207	0.059	3.530***
Teaching Presence → Autonomous Motivation	0.240	0.172	0.036	4.729***
Cognitive Presence → Autonomous Motivation	0.115	0.091	0.037	2.468*
Social Presence → Autonomous Motivation	0.145	0.145	0.041	3.504***
Autonomous Motivation → Learning Engagement	0.232	0.355	0.05	7.093***
Cognitive Presence ↔ Teaching Presence	0.724	92.607	5.608	16.512***
Social Presence ↔ Cognitive Presence	0.532	48.852	3.696	13.217***
Social Presence ↔ Teaching Presence	0.624	63.042	4.227	14.913***

Notes: \*\*\* $p<0.001$ , \*\* $p<0.01$ , \* $p<0.05$ .

**Table 3** Mediating Effect Test

Path	Effect	SE	95% BootCI	
			Lower	Upper
Teaching Presence → Autonomous Motivation → Learning Engagement	0.061	0.018	0.032	0.103
Cognitive Presence → Autonomous Motivation → Learning Engagement	0.032	0.015	0.005	0.063
Social Presence → Autonomous Motivation → Learning Engagement	0.051	0.018	0.021	0.093

## Moderation Effect Analysis

Based on the students' grit scale scores, samples with grit greater than the mean of the grit scale were defined as the "high grit" group, and samples with grit less than the mean were defined as the "low grit" group. A multi-group analysis was then conducted using Amos. The results show a significant difference between the unconstrained and constrained models ( $\Delta\chi^2 = 23.252, p < 0.01$ ), suggesting that the level of grit does play a moderating role. Table 4 reports the two groups' path coefficients and the significance of differences. The results show that while the path coefficients for all paths differed between the two groups, only the path coefficients between cognitive presence and autonomous motivation and between social presence and autonomous motivation were statistically significantly different ( $|Z\text{-score}| > 1.98$ ). Specifically, there was a positive correlation between cognitive presence and autonomous motivation, and the path coefficients were greater in the high-grit group ( $\beta = 0.203, p < 0.01$ ) than in the low-grit group ( $\beta = 0.015, p > 0.05$ ); the path coefficients between social presence and autonomous motivation were also positively correlated, with the path coefficient for the high grit group ( $\beta = 0.232, p < 0.01$ ) similarly greater than that for the low grit group ( $\beta = 0.032, p > 0.05$ ). Thus, grit moderates part of the path between presence and learning engagement, H3 has partially supported.

## Discussion

This study examined the link between three types of presence in MOOC learning and college students' Learning engagement. In addition, we examined the roles of autonomous motivation and grit in a community of inquiry theoretical framework. In this study, we found that different types of presence (teaching presence, social presence, and cognitive presence) were significantly and positively associated with college students' learning engagement. Teaching, social, and cognitive presence were positively associated with college students learning engagement through the community of inquiry theoretical framework. The study also examined the role of grit in moderating the relationship between presences and learning engagement. It is essential because it can indirectly affect students' learning engagement through autonomous motivation. This study expands the literature on the effects of MOOC learning on learning engagement. Further, it examines the positive role of grit in the MOOC learning environment for college students, providing empirical evidence for MOOC course design and implementation.

First, Teaching presence, Social presence, and Cognitive presence have all been shown to be positively related to college students' Learning engagement, and H1a-c is supported. Among them, teaching presence has a greater impact on Learning engagement, social presence is the next highest, and cognitive presence is the lowest. Specifically, instructional presence positively influenced learners' constructive and interactive engagement behaviors. These results

**Table 4** Multigroup Analysis

Path	High Grit (n=419)				Low Grit (n=375)				Z-Score
	STD.Est	Unstd.Est	S.E	t	STD.Est	Unstd.Est	S.E	t	
Teaching Presence → Learning Engagement	0.141	0.162	0.074	2.197*	0.327	0.344	0.074	4.627***	-1.739
Cognitive Presence → Learning Engagement	0.175	0.215	0.075	2.872**	0.044	0.052	0.073	0.718	1.557
Social Presence → Learning Engagement	0.141	0.222	0.080	2.771**	0.114	0.169	0.088	1.933	0.446
Teaching Presence → Autonomous Motivation	0.187	0.138	0.049	2.808**	0.315	0.220	0.053	4.113***	-1.136
Cognitive Presence → Autonomous Motivation	0.203	0.161	0.050	3.220**	0.015	0.012	0.054	0.228	2.025
Social Presence → Autonomous Motivation	0.232	0.237	0.053	4.472***	0.032	0.032	0.064	0.493	2.467
Autonomous Motivation → Learning Engagement	0.275	0.425	0.072	5.873***	0.177	0.268	0.070	3.802***	1.563
Cognitive Presence ↔ Teaching Presence	0.745	95.332	7.805	12.214***	0.695	86.981	7.884	11.033***	0.753
Social Presence ↔ Cognitive Presence	0.527	48.955	5.138	9.528***	0.528	46.931	5.200	9.026***	0.277
Social Presence ↔ Teaching Presence	0.588	58.553	5.652	10.360***	0.658	66.105	6.221	10.626***	-0.899

Notes: \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ .



demonstrate the value and importance of the online tutor's role in designing, organizing, facilitating, and directly instructing (ie, Teaching presence), which is consistent with the findings of previous studies.<sup>67-69</sup> COI framework provides a reasonable explanation for this result, ie, the environment and experience in the MOOC learning community will have an impact on students' subjective beliefs (eg, satisfaction, motivation, etc.), which will then strongly guide and dictate their learning engagement behaviors.<sup>22</sup> In this process, the teacher, as the main body of reconstructing and designing the hybrid course, arranges the teaching activities that directly affect the student's learning activities and learning experiences. Students form subjective perceptions of the course during the learning activities organized by the teacher and compare them with their expectations, resulting in overall satisfaction with the blended course. The higher the student's satisfaction, the stronger their motivational beliefs, and the easier it is for them to maintain a high level of engagement in the learning process, thus maximizing their learning outcomes. Social presence can also help students alleviate negative emotions during the learning process, increase a good learning experience, form a willingness to continue learning and promote behaviors such as vitality, concentration, and dedication in Learning engagement.<sup>70,71</sup> In addition, cognitive presence represents students' higher-order thinking level, reflecting students' critical thinking and profound learning ability. In exploring and solving the problems related to MOOC courses, students broaden the depth and breadth of learning engagement by making the necessary efforts to understand complex knowledge and acquire difficult skills. The depth and breadth of learning engagement can be broadened, and the level of learning engagement can be significantly improved.<sup>37</sup>

Second, autonomous motivation mediates the relationship between MOOC presence and learning engagement among college students. Specifically, students' perceived presence during MOOC learning can affect their learning engagement by influencing their autonomous motivation, which H2a-c supports. In other words, the lower the college students' perceived presence, the more their learning engagement will be affected. In other words, the higher the perceived presence of college students, the stronger their autonomous motivation for MOOC learning and their willingness to learn learning behaviors.<sup>72,73</sup> Students' perceptions and evaluations of the course environment can regulate students' motivation and influence knowledge construction, behavioral performance, and learning engagement.<sup>22</sup> Individuals in the online learning process experience greater psychological well-being by satisfying the psychological needs of learners; conversely, when their demands are not met, they feel highly fragmented, isolated, and reactive. Compared with traditional teaching, MOOC teaching emphasizes "student-centeredness", the combination of teaching presence, social presence, and cognitive presence affects students' psychological needs. When the teaching design of MOOC fully meets the psychological needs, students will actively participate in the learning tasks, leading to more sustainable learning engagement.<sup>43,74</sup> Among them, compared with other presence types, teaching presence has the greatest effect on college students' autonomous motivation, while the mediating effect of autonomous motivation between teaching presence and learning engagement was also the largest. This result may be attributed to instructors' efforts in constructing course content and course design, appropriately challenging tasks, and testing to enhance students' autonomous motivation in MOOC learning environments, which is critical for maintaining students' motivation and engagement in MOOC learning.

In addition, this study emphasizes the importance of grit, a personality trait, in students' MOOC learning. It was found that grit could modulate the relationship between cognitive presence, social presence, and autonomous motivation in MOOC learning. In other words, the positive correlation between social and cognitive presence and autonomous motivation in college students' learning increased with the higher students' grit levels. Grit helps learners to self-regulate their learning methods and strategies in case of learning barriers and failures and to put in more effort until they achieve their goals.<sup>19,52</sup> From this point of view, on the one hand, those students with high grit tend to show more patience and enthusiasm in the face of adversity, harboring great positive energy to study hard and persevere in learning, which in turn promotes their autonomous motivation.<sup>53,54</sup> On the other hand, passion is included in grit, and higher education students with high grit traits may work long hours to accomplish a learning task because they are passionate about it. Although they have many negative attitudes (stress, failure) in pursuing their goals, a more grit person can persevere in their work/education.<sup>75</sup> This shows that grit is essential in MOOC learning environments because individuals with this trait persist in their learning tasks. Even though learners may be filled with loneliness, boredom, or negative attitudes due to low Social presence and Cognitive presence, grit may move them toward achieving their goals (completing their learning).<sup>58</sup>

## Conclusion, Limitation and Future Research

This study examined the relationship between three presence categories (teaching presence, social presence, and cognitive presence) and college students learning engagement in MOOC learning and investigated the mediating role of autonomous motivation and the moderating role of grit. We also examined the mediating role of autonomous motivation and the moderating role of grit. The results of the study showed that the presence (including the three kinds of presence) in MOOC learning was significantly and positively related to college students' learning engagement. Meanwhile, autonomous motivation mediated the relationship between the three types of presences and learning engagement. In addition, grit moderated some path relationships between different types of presence and students' learning engagement in MOOC learning environments. Overall, this study enriches the literature on whether and how the presence of MOOC courses affects college students' learning engagement, and the complexity of MOOC environments determines that grit plays an indispensable role in the learning process. The results of this study can be helpful for the design and implementation of MOOC courses and the effectiveness of MOOC learning for college students.

Based on the above results, it can be seen that the three types of presence perceptions in MOOC learning, especially teacher presence, are still important factors influencing learners' autonomous motivation and academic engagement. First, MOOC learning needs to strengthen the instructional design and guidance for virtual scenarios and enhance the instructional interaction and personalized learning experience to adapt to academic engagement in constructed, blended, and complex virtual learning environments. Second, social presence is also essential in the relatively "loose" virtual environment of teaching and learning, where learners must enhance interaction and transform the type of online learning from passive to active and from active to constructive to promote the ultimate learning engagement of learners. At the same time, online learning lacks the familiarity of traditional classroom instruction and may create additional uncertainty for learners. As an important link between instructional behavior and learning engagement, autonomous motivation will play an important role. Enhancing autonomous motivation can encourage learners to use more learning strategies, reduce learning isolation, improve learning persistence, and realize the shift from learning under external regulation to high immersion and reflective learning under self-regulation. Finally, the moderating effect of grit in MOOC learning suggests that learners' grit is necessary to overcome low presence, maintain autonomous motivation, and ensure learning engagement. Therefore, it is recommended that learners be provided with a favorable autonomy-supportive environment to promote the development of their grit qualities. For example, students who are satisfied through perceived teacher autonomy support can exert high effort and persistence to achieve learning goals and are willing to take on challenging tasks that may motivate them to show stronger grit in learning.<sup>38,76</sup> Similarly, positive interdependence among peers may also play an important role in developing student grit.<sup>77</sup> Therefore, schools and pedagogues also need to foster the development of relationships between peers or classmates.

This study also has some limitations. First, we explored the effects of different presences of knowledge on college students' Learning engagement in MOOC learning environments based on the Community of Inquiry framework and verified the validity of the results of previous studies. However, each MOOC learning program may vary greatly in terms of platform functionality, number of learners, and instructional design, which may affect the applicability of the findings. Future research could be extended to other MOOC environments. Second, the participants in this study were from a university in Shandong province, China, and the sample may not be representative of all university students in terms of MOOC learning and affect the generalizability of this study. Further research is needed to test the validity of the findings with more empirical studies from a wider range of regions, cultural backgrounds, institutions, and disciplines. Finally, previous studies have suggested a causal relationship between teaching presence, social presence, and cognitive presence. In this study, only the effects of different types of presence on college students' commitment to MOOC learning were explored separately, without considering the links among the three types of presence. Future research needs to explore the intrinsic relationship between different presences more comprehensively.

## Data Sharing Statement

The data that support the findings of this study are available on request from the corresponding author.

## Ethical Approval

This study was approved by the Qingdao University Academic Ethics Committee.

## Informed Consent

Informed consent was obtained from all the participants.

## Disclosure

The author reports no conflicts of interest in this work.

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