Relationship between College Students' Grit and Online Learning Satisfaction: Dual Mediating Role of Learning Motivation and Engagement

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Abstract: The shift towards online learning in higher education has created a need to explore the influence of individual traits such as grit and students' satisfaction with the online classroom experience. While previous research has highlighted the significance of grit in traditional classroom settings, its impact on online learning satisfaction remains relatively unexplored. This study aimed to explore whether the knowledge motivation and commitment of college learners have a dual mediating effect between grit and online learning satisfaction, and to provide basic data on improving college students' contentment with online education. This is a quantitative study, and among quantitative research methods, the survey method was applied. The survey method was utilized in the study, and the respondents of the study were 306 students from one of the universities in China. SPSS PROCESS macro 4.2 and SPSS PC+ Win. Ver. 26.0 were used for analysis. The statistical methods were descriptive statistics, correlation analysis and double mediation effect analysis, which was verified using the bootstrap method. The results are: First, a positive relationship among grit, online knowledge satisfaction, learning incentive, and commitment is definitely associated with each other. Second, learning incentive and engagement have dual mediating roles between grit and online education satisfaction. It confirmed that grit affects online class satisfaction via learning motivation and engagement. Based on these findings, this study suggested an approach to leverage learning motivation and engagement as a means to enhance online learning satisfaction.

Keywords: Double Mediating Role, Grit, Learning Engagement, Learning Motivation, Learning Satisfaction, Online Learning

1. Introduction

With the growth of the internet technology, several online courses was developed, especially after a new crown epidemic, online teaching has increased significantly. According to research, when using a smartphone in the classroom, its effectiveness and ease of use have an important influence on the willingness to use the smartphone and an important impact on learning contentment[1]. However, compared with group teaching in offline classes, the loneliness of online teaching and the lack of freedom of supervision have seriously affected students' sense of satisfaction in learning. The satisfaction of online learning is the key for college students to persist in completing online courses[2]

Therefore, how to improve the satisfaction of online learning has become an educational topic that cannot be ignored.

Online learning satisfaction is a feeling and attitude obtained with the satisfaction of learning needs, and it is an essential sign to know whether the actual effect of learners has reached their expected learning results[3]. Some scholars believe that learning satisfaction is reflected in a learner's psychological perception, a subjective evaluation of the learning process and results, covering the learner's evaluation of various aspects of the curriculum, teaching environment[4]. The students' online learning satisfaction is not only affected by these external factors, but it is also mainly affected by the internal factors of learners. Due to the lack of effective supervision methods in the current online learning environment, how to improve learners' internal factors is a practical and urgent way. According to research, students' performance in the classroom is also closely related to non-intellectual factors[5]. In other words, if educators want to improve learners' online learning satisfaction, they must pay attention to and improve learners' non-intellectual factors[6]. And grit is also a significant non-intellectual aspects.

Academic circles generally believe that grit is a state of continuous passion for long-term goals, and even if one encounter difficulties and setbacks, one can still persevere in self-motivation, self-discipline and self-adjustment personality qualities[3]. Grit also has wide-ranging applications in education. Research shows a significant link among grit and learning satisfaction[5]. Typically, learners with high levels of perseverance are more effective at overcoming difficulties and setbacks in the learning process, and sustainably invest time and energy in achieving learning goals. This kind of grit enables them to study persistently and not give up easily to achieve better learning results and improve learning satisfaction[7]. Therefore, it can infer that grit can effectively increase the level of online learning satisfaction.

At present, domestic and foreign research on grit and online learning satisfaction mostly focus on the relationship between it and mediator and moderator variables[7-9], but there are few studies on the correlation between mediator variables. Therefore, the aim of this research is to examine the dual mediating effect of these mediator variables between grit and online learning satisfaction by exploring the asoociation between mediator variables.

Learning motivation comes from motivation. Motivation is an internal psychological force guided by a goal or object to stimulate and maintain individual activities. Motivation can be categorized into two area: intrinsic motivation and extrinsic motivation. Intrinsic motivation discusses to individuals' inclination to see engage in accomplishment, challenges and enjoyment, whereas extrinsic motivation discusses to individuals' inclination to engage in activities for reasons other than the activities themselves. Motivation is the basis of most human behaviors. Through the observation of motivation, people can explain and predict the behavior of individuals[10]. The motivation that appears in the context of learning is called learning motivation[11]. In learning motivation, intrinsic motivation refers to the spontaneous interest and pleasure that students drive them to learn, while extrinsic motivation refers to the influence and motivation of external factors on learning[10]. The study revealed a robust link among learning motivation and educational performance, highlighting the significant associations between the depth of motivation and achievement motivation within the construct of learning motivation and educational performance[12]. Furthermore, the level of learning motivation is closely related to students' learning input. In past studies, it has demonstrated that learning motivation exerts a direct influence on students' learning satisfaction[7]. Therefore, this study uses learning motivation as an intermediary variable to verify the influence of learning incentive on grit and online learning contentment.

Learning engagement is a constructive and gratifying psychological state associated with the process of learning, encompassing three distinct dimensions: behavioral engagement, emotional engagement, and cognitive engagement[13]. Several literature discussed that there is an important positive correlation

among learning engagement and academic achievement. Learning motivation has an indirect impact on academic achievement through learning engagement[13][14]. In a research conducted among middle school learners in Shanghai, China, it was observed that learning engagement served as a partial mediator in the association among grit and mathematics performance, leading to a positive indirect effect[6]. At the same time, research findings indicate that, when considering gender and age as control variables, grit demonstrates a positive predictive ability for school engagement and academic achievements. Moreover, the connection among grit and academic achievements is completely mediated by school engagement[13]. In addition, Learning engagement acts as a mediator between teachers' caring behavior and online learning satisfaction, facilitating the relationship between these two variables[4]. Additionally, to investigate the mediating role of learning engagement in the association between grit and online learning satisfaction, this study incorporates learning engagement as a mediating variable.

Thus, this research is designed to explore whether the learning motivation and learning engagement of college learners have a double mediating influence between grit and online learning satisfaction, and to provide basic data for how to develop college learners' online learning satisfaction in . Second, do learning motivation and learning engagement dual mediate in the relationship between grit and online learning satisfaction?

2. Literature Review

2.1 Effect of Grit on Online Learning Satisfaction

Several courses have been transformed into online forms through the development of internet. Especially after the epidemic in 2020, this trend is particularly obvious. Much of the current research on online courses focuses primarily on academic achievement. However, using academic achievement as the sole criterion for measuring the quality of online learning is one-sided, it does not fully reflect the educational situation of students. Accordingly, the assessment of online course quality frequently employs online learning satisfaction as an evaluation criterion.

There are many descriptions of online learning satisfaction in the academic circle. From the perspective of customer satisfaction, some researchers regard online learning as an online learning service, and regard online learning satisfaction as an evaluation of this service, that is, The learner's appraisal of the caliber of online learning[5]. Starting from the emotional state of human beings, some researchers regard online learning satisfaction as the degree to which learners feel that they have achieved their main purpose and emotionally satisfied their personal needs during learning[15]. According to certain scholars, online learning satisfaction is regarded as an interdisciplinary concept rather than a straightforward amalgamation of "online learning" and "satisfaction." It encompasses not only the assessment of online educational services but also encompasses the learners' perception of the quality of online education. It represents an overarching sentiment and subjective evaluation formed by learners as they compare the actual perceived impact of online learning with their anticipated expectations[16]. In the present study, it contend that online learning satisfaction pertains to the learners' subjective assessment and comprehensive impression of the online course materials within the context of online courses[15]. The online learning satisfaction of college learners serves as a direct manifestation of the caliber and efficacy of their online learning endeavors[16]. Hence, the measurement of online learning satisfaction holds significant importance in assessing the quality of online learning.

An important variable that affects online learning satisfaction is grit. Grit is characterized as a non-cognitive personality trait exemplifying the enduring dedication and fervent enthusiasm towards long-term objectives through the manifestation of persistent efforts[17]. Grit consists of two fundamental latent issues: perseverance of effort (PE) and consistency of interest (CI). PE encompasses the

determination to overcome obstacles and actively pursue demanding objectives, while CI emphasizes the sustained passionate dedication to goals over an extended period[18]. Since it is a good predictor of individual achievement, grit is frequently employed as an explanatory framework to elucidate individuals' motivation in striving to optimize their full potential[17]. Therefore, in learning activities, grit is often used to explain learners' persistence in learning, that is, the extent to which learners persist in their efforts when encountering learning difficulties or external influences. Through a survey of primary school seniors, the research findings indicated a positive link among online learning satisfaction and the initial dimension of grit, specifically persistence, but there was no statistical relationship with the second dimension of git—interest of consistency[19]. The research results show that, as a non-cognitive feature of learners, grit can affect learners' online learning satisfaction, and learners with higher levels of grit have higher online learning satisfaction[6]. Therefore, it can speculate that grit is positively related to online course satisfaction.

2.2 Mediating Roles of Learning Motivation and Learning Engagement

Motivation can be described as an internal driving force that propels individuals to engage in activities with the aim of accomplishing specific objectives[20]. It drives people to do everything[21]. Learning motivation is also a kind of motivation, which includes three basic components of motivation, goals, needs and encouragement[22]. Learning motivation is an internal motivating factor that motivates learners to produce learning behavior. It is produced through the learning activities of students[23]. The more effort is put into learning[24].

Research has revealed a strong association between learning motivation and grit. By conducting a survey among junior high school students, the researchers identified an important positive connection among the initial dimension of grit and learning motivation. These findings suggest that the level of grit exhibited by junior high school students exerts a discernible influence on their learning motivation[25]. The research found that with the increase of learning motivation, the impact on grit is also greater[26]. In the environment of lack of supervision in online teaching, students' learning motivation is reduced, and improving students' self-control ability can effectively improve students' learning motivation[27]. Therefore, it can infer that learning motivation has a positive effect on grit.

Also, several research have proved a noteworthy positive correlation between students' sustained learning efforts and academic achievement[28]. A study that investigated students' participation in different online learning activities showed that the higher the weekly online completion rate of students, the greater the online learning investment, and the better the expected performance of the final exam [29]. Thus, it can be inferred that students' learning input is associated with their online learning achievement, and learning achievement positively predicts learning satisfaction[27]. Hence, it can be inferred that a strong relationship exists between learning investment and learning satisfaction. Among the various factors influencing learners, learning engagement emerges as a pivotal element that significantly impacts learning outcomes, including learning satisfaction. When comparing learners with low learning engagement to those with high learning engagement, it is evident that higher levels of learning engagement correlate with enhanced comprehension and application of knowledge, as well as increased levels of learning satisfaction [30]. Based on the aforementioned research findings, it becomes apparent that learning input is a significant correlated variable of learning satisfaction. Consequently, it can be predicted that learning input exerts a positive effect on online learning satisfaction.

Research has demonstrated that in e-learning instruction, both pre- and post-motivation factors of ARCS (Attention, Relevance, Confidence, and Satisfaction) significantly influence learning engagement and learning satisfaction, and the differences between students' pre- and post-motivation have an impact on learning satisfaction[31]. Therefore, it is reasonable to speculate that learning motivation will likewise exert an influence on learning engagement and online learning satisfaction.

3. Research Methods

3.1 Research Model

The research model was set up as shown in [Fig. 1] according to the serial dual mediation effect analysis procedure proposed by Hayes[32]. Based on earlier research, a research model was recognized to confirm whether grit affects online class satisfaction via learning motivation and learning engagement.
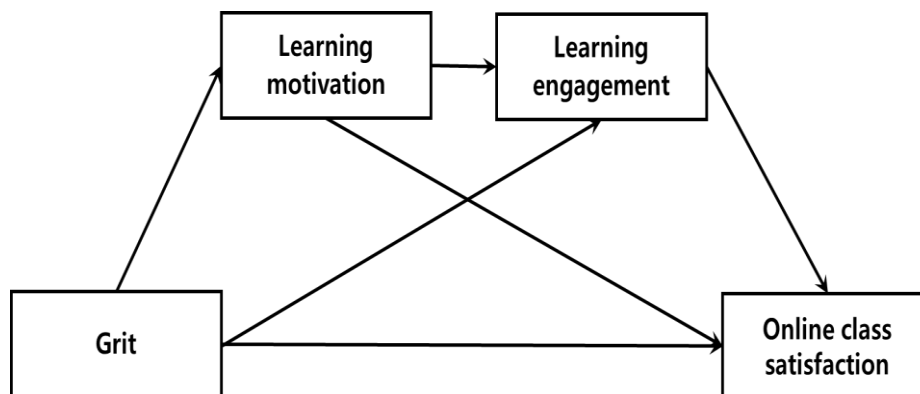
[Fig. 1] Research Model

3.2 Participants of the Study and Data Collection Method

The students of a public vocational college in Guangdong were purposively selected as the subjects, and 306 valid samples were obtained by using the "Questionnaire Star" platform to distribute and collect questionnaires, excluding invalid questionnaires. Students were required to assent before answering the inquiry by signing a consent document., and it was stated in the consent form that they could stop at any time during the survey. Respondents who responded after the survey was completed were provided with a gift worth 5,000 won online.

There were 21 males, 285 females, 175 freshmen, 106 sophomores and 25 juniors. There were 28 people living in Guangzhou, 84 people living outside Guangzhou in Guangdong Province, and 21 people outside Guangdong Province. There were 72 in the upper reaches, 172 in the middle reaches and 62 at the lower reaches.

3.3 Research Instruments

3.3.1 Grit

In this study, grit was evaluated utilizing the grit scale developed by Duckworth and Quinn[18], consisting of eight items such as " I have a hard time focusing on tasks that take more than 2-3 months". The scale employs a 5-point Likert scale for scoring. A greater score on the scale designates a greater level of grit. The Cronbach α of the scale was 0.774.

3.3.2 Learning Motivation

The learning motivation scale in this study developed by Zhao Pei Hong[33] was used. The scale consists of four dimensions, namely, attention focus, relevance, self-confidence, and satisfaction. The acale has seventeen questions and rated on the 5-point Likert scale, and a higher score on the scale indicates a greater level of learning engagement among the subjects. The Cronbach coefficient of the

scale was .945.

3.3.3 Learning Engagement

The learning engagement scale developed by Zhao Pei Hong[33] was utilized. The scale contains of three dimensions: motivational involvement, cognitive involvement and emotional involvement. It contains nine questions. The scale was rated on the 5-point Likert scale, indicating that greater scores were associated with greater levels of learning engagement. The Cronbach's α of reliability was 0.945.

3.3.4 Online Learning Satisfaction

Online learning satisfaction scale developed by Wei[34] was used. The scale comprises three dimensions, namely, learning experience satisfaction, learning effect satisfaction and learner satisfaction. It contains ten questions and was measured on the five-point Likert scale, indicating that higher scores indicates greater levels of online learning satisfaction. The consistency Cronbach's α was .887.

3.4 Data Analysis

PROCESS macro ver. 4.2 and SPSS PC+ Win. ver. 26.0 were utilized to evaluate the data, and reliability analysis, frequency analysis, correlation analysis, and dual mediating effect analysis were conducted as part of the study methodology. To examine the significance of the dual mediating effect, statistical tests were employed, bootstrap method was utilized. Meanwhile the sampling quantity is 5000, and the confidence interval was set at 95%.

4. Results

4.1 Correlation between Main Variables

Pearson correlation study was directed to observe the associations among the primary variables. The findings indicate an important positive relationship among grit, learning motivation, learning engagement, and online learning satisfaction. Among the variables examined, the correlation between online learning satisfaction and learning engagement displayed the highest magnitude (r=.902, p<.01), then by the relationship among learning engagement and learning motivation (r=.771, p<.01). Conversely, the link among learning motivation and grit was found to be the lowest.

[Table 1] Correlation and Descriptive Statistics of Variables

	Grit	Learning motivation	Learning engagement	Online learning satisfaction
Grit	1			
Learning Motivation	.243**	1		
Learning engagement	.269**	.771**	1	
Online learning satisfaction	.246**	.706**	.902**	1
M	2.88	3.50	3.37	3.40
SD	.58	.63	.91	.90

**p<.01

Meanwhile, the correlation coefficients between main variables were than .7, suggesting multicollinearity. Therefore, after performing a regression analysis with online learning satisfaction as the dependent variable, grit, learning motivation and learning engagement as independent variables, VIF

and tolerance for diagnosing multicollinearity were calculated. The tolerance was less than 1 for all independent variables and the value of VIF was less than 5, so it was judged that there was no problem of multicollinearity[35].

The mean of learning motivation (M = 3.5), learning engagement (M = 3.37) and online learning satisfaction (M = 3.4) all exceed the median, but grit (M = 2.88) does not exceed the median of 3, as presented in [Table 1].
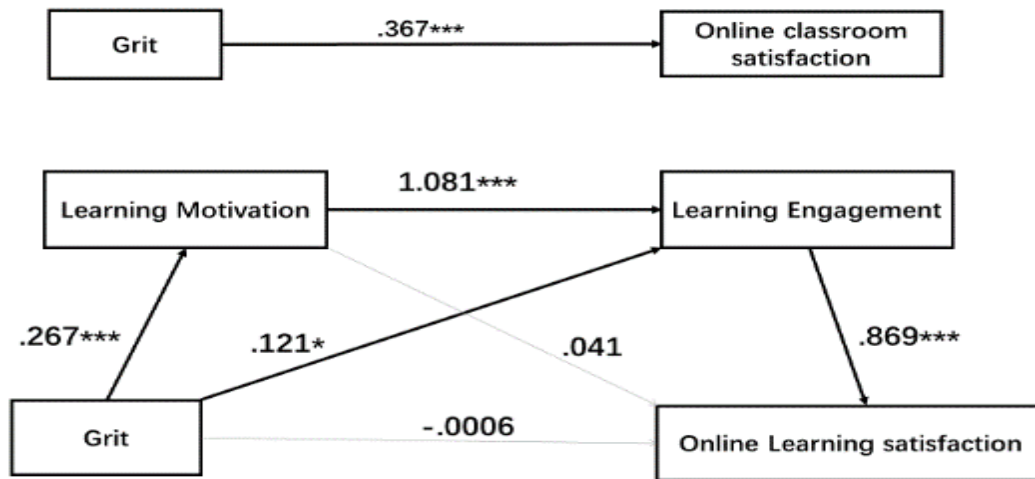
4.2 Dual Mediating Effects of Learning Motivation and Learning Engagement

To investigate the dual mediation result of learning motivation and learning engagement in association with grit and online learning satisfaction, a mediation analysis was conducted., this study uses the PROCESS macro 4.2. To prove the dual mediation effect in this study, the bootstrap method was employed in which 5000 samples were set and the confidence interval was set to 95%. The results of the analysis are presented in [Table 2].

[Table 2] The Results of Dual Mediating Dffects

Contents	Variables	Coeffect	Se	t value	p	LLCI*	ULCI**
Mediating variable model (DV: Learning motivation)	Constant	2.6979	.6089	4.4304	.000	1.4995	3.8962
	Grit	.2667	.0616	4.326	.000	.1454	.388
Mediating variable model (DV: Learning engagement)	Grit	-.9537	.58	-1.6443	.1012	-2.0951	.1877
	Learning motivation	.1215	.0586	2.0721	.0391	.0061	.2369
Dependent variable model (DV: Online Learning Satisfaction)	Constant	-.0823	.3949	-.2083	.8351	-.8594	.6949
	Grit	-.0006	.04	-.0142	.9887	-.0793	.0782
	Learning motivation	.0418	.0558	.7506	.4535	-.0679	.1516
	Learning engagement	.8692	.0393	22.1366	0	.7919	.9465

Verification of indirect effects of Learning motivation and Learning engagement				
	Effect	se	LLCI	ULCI
Total effect	.3667	.087	.1955	.5379
Direct effect	-.0006	.04	-.0793	.0782
Ind1: Grit → Learning motivation → Online Learning satisfaction	.0072	.0114	-.014	.0322
Ind2: Grit → Learning engagement → Online Learning satisfaction	.0684	.0389	-.0075	.1442
Ind3: Grit → Learning motivation → Learning Engagement → Online Learning satisfaction	.1622	.0458	.0695	.2500

*LLCI = lower limit within 95% confidence interval of boot indirect effect
** ULCI = upper limit within 95% confidence interval of boot indirect effect

*p<.01, ***p<.001

[Fig. 2] Dual Mediating Effects of Learning Motivation and Learning Engagement

The dual mediation result of school motivation and learning engagement in grit and online learning satisfaction was tested. According to [Table 3], the results showed that grit did not significantly predict online learning satisfaction (B=-.0006, p>0.5), but positively expected learning motivation (B=.267, p<.001); When learning engagement was the dependent variable, grit positively anticipated learning engagement (B=.121, p<.05), and learning motivation positively anticipated learning engagement (B=1.081, p<.001); When online class satisfaction was the dependent variable, learning motivation (B=.041, p > 0.5) did not significantly predict online class satisfaction, while learning engagement (B=.869, p<.001) positively predicted online class satisfaction. The results revealed that grit was not a significant predictor of online learning satisfaction. However, learning motivation and learning engagement were found to play a mediating part in the association with grit and online learning satisfaction.

5. Discussion and Conclusion

This study focused on college students as the participants and aimed to investigate whether learning motivation and learning engagement act as dual mediators in the association of grit and online learning satisfaction. Findings shows extensive discussions were conducted, and conclusions were drawn.

This study revealed a significant positive predictive result of grit on learning motivation. The study results align with the research findings of Wan Jiu xin et al[25], demonstrating a significant positive predictive effect of learning motivation on learning engagement, as well as a significant positive predictive effect of learning engagement on online course satisfaction[36]. However, grit, which itself has a significant positive predictive effect on online course satisfaction, is not related to online course satisfaction in the double mediation model. Therefore, the double mediation model of this study is a full mediation model, learning motivation and learning input act as a complete mediator. The effect of grit on learning satisfaction were not important. This is because when learning motivation and engagement are high, the direct effect of grit is canceled out. Therefore, it was suggested that when grit is low, learning satisfaction can be increased by increasing learning motivation and engagement.

Despite its contributions, this study has limitations and thus suggests future practical research for enhancing online course satisfaction. Notably, the findings emphasize that students' grit influences learning motivation, subsequently affecting the level of engagement. These interconnected factors collectively shape the ultimate learning satisfaction. Therefore, educators should focus on the cultivation

of students' perseverance in the education and learning development, by explaining a role of perseverance and the importance of the change of life, to arouse students' awareness of the cultivation of perseverance, so as to consciously improve their grit. At the same time, teachers should also understand the knowledge of grit and help students improve their personal grit through scientific methods, to develop students' learning motivation and learning input, and prepare for further improving class satisfaction.

Second, it is found that grit or learning motivation does not directly affect online course satisfaction, which indicates that there is a logical relationship between the research factors in this research model. Therefore, in the teaching process, teachers should focus on the internal logical relationship of the problem. In order to develop the contentment of online classroom, simply improving learning input cannot improve the satisfaction of online courses well. Instead, educators should trace the source and find out the core of the problem. While improving students' grit, it is necessary to communicate with students carefully, understand students' learning demands and problems, provide students with accurate teaching content, so as to improve students' classroom enthusiasm and ultimately achieve the purpose of improving online classroom satisfaction.

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