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# Locus of control on mental health of college students in Guangxi, China: The chain mediating effect of grit and self-esteem

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**This study aims to explore the relationship between locus of control, grit, self-esteem and mental health among college students. A questionnaire survey was used to conduct a study on the mental health of 923 E-learning college students from 10 universities in Guangxi, China. In this study, Pearson correlation analysis was used to test the correlation between the study variables, and Bootstrap was used to test the mediating effect and effect ratio of grit and self-esteem. The results show that, locus of control, grit, and self-esteem can predict the mental health of college students. Grit plays a mediating role between locus of control and mental health; self-esteem plays a mediating role between locus of control and mental health; grit and self-esteem have a chain mediating effect between locus of control and mental health. Specifically, internal locus of control can effectively prevent college students from mental health problems through the chain mediation effect of grit and self-esteem. Powerful others and opportunity as the external locus of control will not only reduce the grit and self-esteem of college students, but also lead to more psychological problems. These research results provide suggestions to the university management on how to manage the mental health of E-learning students, especially those with psychological problems.**

**Key words:** E-learning, locus of control, grit, self-esteem, mental health.

## INTRODUCTION

Before the outbreak of Covid-19, the E-learning model was not a strategy that was externally imposed on universities (Abdelazim and Georgieva, 2020). Although many universities around the world have developed E-learning, they focus on a limited number of traditional courses, and traditional models. Until 2020, the Covid-19 pandemic has brought unprecedented changes and challenges to higher education; especially, the teaching process has been severely disrupted (Dwivedi et al., 2020; Sharin, 2021). To continue teaching/learning, universities quickly adopted the E-learning model and it has become an essential learning method for college

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students and a viable alternative to traditional teaching (Moy and Ng, 2021). It has become the best way of continuing education to some extent.

Although network technology has brought many conveniences to human beings, it has also adverse effects on human physical and mental health (Karakose and Ozdemir, 2022a). E-learning is a mode of interaction among participants in the educational process. It compensated, to a certain extent, for the teaching relationship between teachers and students during the Covid-19 period. But, sudden shifts in learning methods can have an impact on students' mental health (Baticulon et al., 2021). The transition to distance education presents both opportunities and challenges for students, teachers, and school administrators. With the further increase in the use of Internet learning platforms, the time for students to use online platforms for learning will inevitably increase. Improper use or excessive use of social media platforms will directly and indirectly have negative psychological effects on students, such as their happiness levels (Karakose et al., 2022c).

Studies have shown that most students claimed that using E-learning tools for a long time usually leads to boredom, tension, and anxiety (Haider and Al-Salman, 2020). A study found that 11.32% of Chinese college students experienced anxiety while studying via E-learning, and 55.42% of students experienced depression while studying via E-learning (Shao et al., 2021). It was found that 11.32% of Chinese college students had anxiety and 55.42% suffered depression. Students' level of negative psychology is much higher in China in recent years (Shao et al., 2021). In general, with the implementation of online teaching, students have felt more negative impacts than positive ones, resulting in a decline of their mental health (Chu and Li, 2022). Therefore, the mental health of college students involved in E-learning should be given great attention. In order to protect the mental health of students, they should be told the right time to use the network for learning. It is only when the mental health of students is maintained that is when they will be interested and willing to continue learning, thereby improving their learning satisfaction and learning outcomes (Tatiana et al., 2022; Karakose et al., 2022a, b).

There are many factors that affect an individual's mental health, including interest; self-control (girt), adaptability, self-efficacy, self-identity, and self-regulation. Locus of control is a psychological concept, divided into internal control and external control of behavior results (Rotter, 1990). Internal controllers attribute behavioral results to internal factors such as their own abilities and efforts. In contrast to internal controllers who attribute outcomes to their own actions, external controllers attribute behavioral results to external factors such as luck, opportunity, or other people (Cobb-Clark and Schurer, 2013). To strengthen the research on the locus of control of college students, it is critical to explore the psychological elements that affect students' learning process, accurately define the attribution of students' learning, and help students control their negative psychology in learning (Da and En, 2018).

However, E-learning is a process that requires long-term persistence, and the results can only be seen after a lot of time and energy are invested. It was found that students with high grit will put in more effort in learning; thus they achieve better grades and learning goals more easily in non-traditional educational settings (Aparicio et al., 2017; Weisskirch, 2018). Duckworth et al. (2007) believe that girt is an individual's perseverance and enthusiasm for the pursuit of long-term goals. It is a non-cognitive individual characteristic, which is reflected in the long-term pursuit of psychological ability. Individuals with high grit will use their strong will to reduce the psychological harm caused by the outside world, help improve their mental health, and thrive even in the face of adversity (Bono et al., 2020; Montano, 2021).

Similarly, self-esteem, as an individual's overall subjective feeling and evaluation of one's own value, is a relatively stable personality constitution that is closely related to mental health (Kannangara et al., 2018; Douglass et al., 2019; Yılmaz and Dundar, 2022). It is regarded as an effective indicator for measuring an individual's mental health. People with higher self-esteem report better mental health, and vice versa, their mental health are worse. Students with high self-esteem will increase the possibility of being accepted by others and buffer negative psychological emotions when interacting with others (Bi et al., 2016).

Therefore, this study focuses on the influence of college students' locus of control, grit and self-esteem on their mental health, hoping to provide targeted guidance for the prevention and intervention of E-learning college students' mental health problems.

## The effect of locus of control on mental health

Many studies have shown that the locus of control is significantly associated with mental health problems such as anxiety, and stress, and it has a predictive effect (Xia and Ma, 2020). The locus of control is an important structure for coping with mental health problems (Rashid, 2021).Regarding the performance of internal control and external control in coping with setbacks and pressure, internal control individuals have a stronger ability to resist stress than external control individuals; that is, in the face of the same huge pressure, internal control individuals will subjectively perceive less pressure. They will be more focused on the behavior of accomplishing the goal task, while the external control individual will be more focused on the behavior of venting emotions. Compared to internal control individuals, external control individuals feel more negative psychology during the learning process, and vice versa (Chisholm-Burns, 2021).

It can be seen that the existing research supports the effects of an individual's locus of control on his mental health. The negative psychological emotions perceived by internal control individuals are lower than those of external control individuals, and external control individuals will feel more negative psychological emotions in negative events, compared to internal control individuals. Therefore, students' ability to cope with stress can be improved by enhancing their internality, so as to form a good mental health state. This study attempts to propose the following research hypotheses:

H1: Locus of control significantly affects mental health

**The mediating role of grit between locus of control and mental health**

In previous studies, many literature shows that grit has an impact on individuals' psychological feelings, academic performance, academic performance (Datu et al., 2016; Ponikiewska et al., 2017; Jiang, 2019). Also, grit can affect the mental health of individuals (Vainio and Daukantait, 2016). Tang et al. (2020) investigated the influence of grit on students' mental health and confirmed that grit can affect students' mental health (loneliness, depression and anxiety).

Grit, as a positive personality characteristic, is influenced by an individual's internal psychological characteristics, such as locus of control. Grit levels of individuals with different types of locus of control are also different. The internal controller is positively correlated with grit, while the external controller is negatively correlated with Grit (Celik and Saricam, 2018). On the contrary, people with different grit levels have different attributions in the face of difficulties (Duckworth and Yeager, 2015). High grit will attribute the results to internal factors, while low grit will attribute the results to external factors. Therefore, the influence of locus of control on grit is significant. We can infer that the locus of control of college students will affect their mental health through grit. Therefore, this study attempts to put forward the following assumptions:

H2: Grit plays a mediating role between locus of control and mental health

**The mediating role of self-esteem between locus of control and mental health**

In previous studies, self-esteem is considered to be an important personality trait; it is not only directly affected by some external factors (Bai et al., 2021; Alvani et al., 2021), but also directly by an individual's Psychological feelings, such as happiness, life satisfaction, mental health, etc. (Jie et al., 2018; Bai et al., 2021; Yang et al., 2021). That is to say, self-esteem will be used as a dependent variable and it is influenced by external factors; individual internal factors will also be used as independent variables that affect individuals' mental health.

In the category of locus of control, the internal controller will attribute the success or failure to the inside, and vice versa, and then these attributions will affect an individual's self-esteem level (Duval and Silvia (2002)). People with higher self-internal control tend to show higher self-esteem than those with lower self-external control (Tangney et al., 2004; Timenes et al., 2021); that is, individuals with internal control are positively correlated with high self-esteem (Leung and Tan, 2018). Therefore, we can infer that the college students' locus of control will affect their mental health through self-esteem:

H3: Self-esteem plays a mediating role between locus of control and mental health

**The mediating role of grit and self-esteem between locus of control and mental health**

From the above discussion, it is seen that grit and self-esteem are important factors that influence students' mental health. They do not only have direct impact on students' mental health, but they can also affect students' mental health in conjunction with their locus of control (Vainio and Daukantait, 2016; Tang et al., 2020; Lee et al., 2014; Nguyen et al., 2019). Till date, although a few studies have explored the direct relationship between grit and self-esteem, they have not yet found the intermediary role between college students' locus of control and their mental health.

Grit is an individual's girt and enthusiasm for long-term goals. Although there is a risk of failure in the pursuit of goals, people with high grit will persist. Self-esteem refers to the feeling of positive or negative evaluation of oneself (Smith and Mackie, 2007). High self-esteem will stimulate self-potential and enhance the initiative and pleasure of pursuing one's goals (Weisskirch, 2018).In the face of failures and setbacks, strong self-esteem can make people persist for a longer time. When they persist in their long-term goals, they may be more satisfied with themselves because of their grit. From this, we can say there is a relationship between grit and self-esteem, which are closely related and complementary to each other (Campbell et al., 1996). Grit can significantly and positively predict one's self-esteem (Datu et al. 2016; Jie et al. 2018): the higher a student's self-esteem is, the more tenacious would be his academic performance (Coker, 2021; Oducado, 2021).

From the above discussion, we find that grit has a significant positive effect on self-esteem. Combining the relationship between locus of control, grit, self-esteem and mental health, we can conclude that the locus of

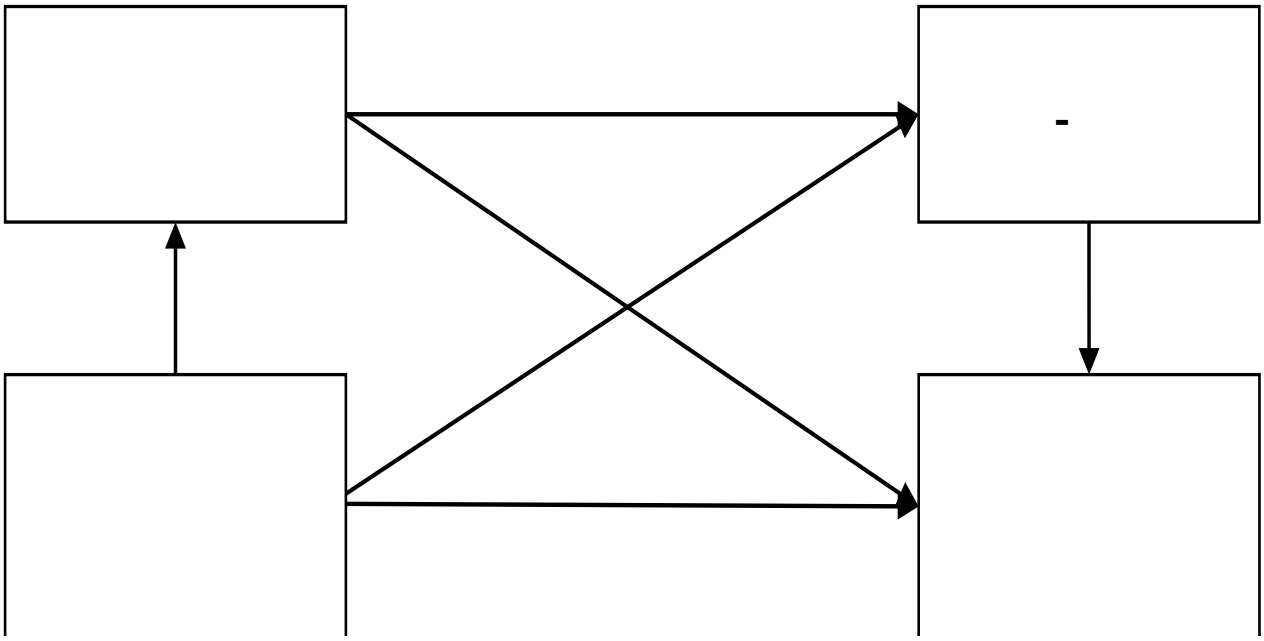


**Figure 1.** Research work.
Source: Author.

control of college students can jointly affect their mental health through grit and self-esteem. Therefore, this study attempts to put forward the following assumptions:

H4: Grit and self-esteem play mediating roles between locus of control and mental health.

While studies have explored the relationship among locus of control, grit, self-esteem, and mental health, the role of grit and self-esteem in the impact of locus of control on mental health has not been studied. This study aims to explore the chain mediation role of grit and self-esteem in the influence of locus of control on students' mental health.

## RESEARCH FRAMEWORK

According to the research purpose and literature review, a research framework was developed for this study (Figure 1).

### Research objects

In this study, 1000 questionnaires were actually collected: 77 invalid questionnaires were excluded, and 923 valid questionnaires were used. The basic data of the college students set in this study include their gender, grade and ethnic minorities. They are 142 males, accounting for 15.4%; 781 females, accounting for 84.60%; 308 freshmen, accounting for 33.4%; 335 sophomores, accounting for 36.3%; 236 juniors, accounting for 25.6%; 44 senior students, accounting for 4.8%; 260 ethnic minority students, accounting for 28.2%; 663 non-ethnic minority students, accounting for 71.8%.

### Tool locus of control

We used Levenson (1975)'s "Internality Powerful Others, Chance" scale (IPC); it contains three dimensions, Internality, with 24 items in total. A Likert scale of 6 points was used to score the items. In this study, the index values of the scale are $\chi^2/df(4.901)$, PGFI(0.786), PNFI(0.720), GFI(0.918), CFI(0.921), IFI(0.921), NFI(0.921), SRMR(0.044), RMSEA(0.065).

### Grit

We used Duckworth and Quinn (2009)'s Short Grit Scale (GRIT-S). The scale is divided into two dimensions: Consistency of Interest and Persistence of Efforts, with 8 items; they were scored by a Likert scale of 5 points. In this study, the fitting index values of the scale are $\chi^2/df$ (4.415), PGFI(0.515), PNFI(0.666), GFI(0.977), CFI(0.985), IFI(0.985), NFI(0.981), SRMR (0.981) and RMSEA(0.061).

### Self-esteem

We used Rosenberg (1965)'s Self-Esteem Scale (SES). The scale contains 10 items, which were scored on a Likert scale of 5 points. In this study, the index values of the scale are $\chi/df$ (4.415),

**Table 1.** Pearson correlation analysis.

| Path | M | SD | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| 1. Loc-Int | 5.174 | 0.623 | 1 | | | | | |
| 2. Loc-PO | 3.653 | 0.807 | -0.469** | 1 | | | | |
| 3. Loc-Ch | 3.930 | 0.712 | -0.520** | 0.638** | 1 | | | |
| 4. Grit | 3.701 | 0.713 | 0.753** | -0.498** | -0.538** | 1 | | |
| 5. SE | 3.716 | 0.529 | 0.779** | -0.456** | -0.509** | 0.650** | 1 | |
| 6. MH | 5.767 | 6.346 | -0.598** | 0.555** | 0.640** | -0.541** | -0.658** | 1 |

Loc-Int, Internality;Loc-PO, Powerful Others; Loc-Ch, Chance; SE, Self-Esteem; MH, Mental Health; **$p$<0.01.
Source: Author.

PGFI(0.515), PNFI(0.666)，GFI(0.977), CFI(0.985), IFI(0.985), NFI(0.981), SRMR(0.022) and RMSEA(0.061).

#### Mental health

We used Lovibond and Lovibond (1995)'s Depression-Anxiety-Stress Scale (DASS-21). This scale has three dimensions, 21 items in total. A four-level scoring method of 0~3 was used for the items. The score of each dimension is the sum of seven items multiplied by 2, and the score ranges from 0 to 42. In this study, the index values of the scale are $\chi^2$/df (4.957), PGFI(0.711), PNFI(0.816), GFI(0.921), CFI(0.957), IFI(0.957), NFI(0.946), SRMR(0.015) and RMSEA(0.066).

#### Data collection and analysis

This study used convenience sampling to distribute electronic questionnaires to the subject group. The consent of each subject was obtained to anonymize their personal information. After getting the data, SPSS plug-in Process was used for the descriptive statistics. Pearson correlation analysis was used to test the correlation between the study variables. Bootstrap method was used to estimate the 95% confidence interval of 5000 repeated sampling for analyzing the mediation effect.

## RESULTS

### Correlation analysis

Correlation analysis results show that, the internality, powerful others, and opportunities are significantly related to grit, self-esteem, and mental health. Grit is significantly correlated with self-esteem, and mental health. Self-esteem is significantly correlated with mental health (Table 1).

### The mediating role of grit and self-esteem

In this study, Bootstrap was used to test the mediating effect and effect ratio of grit and self-esteem. 5000 Bootstrap samples were randomly selected from the original data. For example, the 95% confidence intervals of the deviation-adjusted non-parametric percentiles of the path do not contain 0, indicating that the mediation effect is established.

The mediation effect analysis results of model 1, the total indirect effect value of Bootstrap is -0.467 (p<0.001), and the 95% confidence interval does not contain 0 [Bootstrap95% CI: -0.541, -0.404], accounting for 78.60% of the total effect. The three mediating pathways also significantly affected the relationship between internality and mental health.

The mediating effect value of path 1 (internality → grit → mental health) is -0.115, and the 95% confidence interval does not include 0 [Bootstrap95% CI: -0.172, -0.059], accounting for 19.24% of the total effect. Path 2 (internality → grit → mental health) has a mediating effect value of -0.313 [Bootstrap95% CI: -0.382, -0.251], accounting for 52.34% of the total effect. Path 3 (internality → grit → self-esteem → mental health) has a mediating effect value of -0.042 [Bootstrap95% CI: -0.067, -0.021], accounting for 7.02% of the total indirect effect. The 95% confidence intervals of the three paths do not contain 0. From this we can know, that grit and self-esteem have a mediating effect between internality and mental health alone, and have also a chain mediating effect between internality and mental health (Table 2).

The mediation effect analysis results of model 2, the total indirect effect value of Bootstrap is 0.257 (p<0.001), and the 95% confidence interval does not include 0 [Bootstrap95% CI: 0.219, 0.299], accounting for 46.31% of the total effect. The three mediating influence pathways also significantly affected the relationship between powerful others and mental health. Path 1 (powerful others → grit → mental health) has a mediating effect value of 0.052 [Bootstrap95% CI: 0.023, 0.079], accounting for 9.36% of the total effect. Path 2 (powerful others → self-esteem → mental health) has a mediating effect value of 0.081 [Bootstrap95% CI: 0.051, 0.115], accounting for 14.59% of the total effect. Path 3(powerful others → grit → self-esteem → mental health) has a mediating effect value of 0.124[Bootstrap95% CI: 0.099, 0.149], accounting for 22.35% of the total indirect effect. The 95% confidence intervals of the three paths do not

**Table 2.** Mediation effect analysis.

| Model | Path | Standardized $\beta$ | 95% CI | | The size of effects (%) |
|---|---|---|---|---|---|
| | | | Low | Up | |
| Model 1 | Total | -0.598 | -0.640 | -0.555 | |
| | Direct | -0.128 | -0.205 | -0.055 | |
| | Total Ind | -0.470 | -0.541 | -0.404 | 78.60 |
| | Ind1:Loc-Int→Grit→MH | -0.115 | -0.172 | -0.059 | 19.24 |
| | Ind2:Loc-Int→SE→MH | -0.313 | -0.382 | -0.251 | 52.34 |
| | Ind3:Loc-Int→Grit→SE→MH | -0.042 | -0.067 | -0.021 | 7.02 |
| Model 2 | Total | 0.555 | 0.505 | 0.600 | |
| | Direct | 0.298 | 0.245 | 0.349 | |
| | Total Ind | 0.257 | 0.219 | 0.299 | 46.31 |
| | Ind1:Loc-PO→Grit→MH | 0.052 | 0.023 | 0.079 | 9.36 |
| | Ind2:Loc-PO→SE→MH | 0.081 | 0.051 | 0.115 | 14.59 |
| | Ind3:Loc-PO→Grit→SE→MH | 0.124 | 0.099 | 0.149 | 22.35 |
| Model 3 | Total | 0.640 | 0.602 | 0.679 | |
| | Direct | 0.398 | 0.348 | 0.451 | |
| | Total Ind | 0.242 | 0.202 | 0.286 | 37.81 |
| | Ind1:Loc-Ch→Grit→MH | 0.033 | 0.002 | 0.062 | 5.15 |
| | Ind2:Loc-Ch→SE→MH | 0.094 | 0.062 | 0.128 | 14.69 |
| | Ind3:Loc-Ch→Grit→SE→MH | 0.115 | 0.093 | 0.140 | 17.97 |

Loc-Int, Internality;Loc-PO, Powerful Others; Loc-Ch, Chance; SE, Self-Esteem; MH, Mental Health.
Source: Author.

contain 0.From this we can know, that grit and self-esteem have a mediating effect between powerful others and mental health alone, and have also a chain mediating effect between powerful others and mental health (Table 2).

The mediation effect analysis results of model 3, the total indirect effect of Bootstrap is 0.242($p<0.001$), and the 95% confidence interval does not include 0 [Bootstrap95% CI: 0.219, 0.297], accounting for 37.81% of the total effect. The three intermediary influencing paths also significantly affect the relationship between chance and mental health. The mediating effect of Path 1 (chance → grit → mental health) is 0.033 [bootstrap 95% CI: 0.002, 0.062], accounting for 5.15% of the total effect. The mediating effect of path 2 (chance → grit → mental health) is 0.094 [bootstrap 95% CI: 0.02, 0.128], accounting for 14.69% of the total effect. Path 3 (chance → grit → self-esteem → mental health) has a mediating effect value of 0.093, and the 95% confidence interval does not include 0 [Bootstrap95% CI: 0.093, 0.140], accounting for 17.97% of the total receiving effect. The 95% confidence interval of the three paths does not include 0.From this we can know, that grit and self-esteem have a mediating effect between chance and mental health alone, and have also a chain mediating effect between chance and mental health (Table 2).

## DISCUSSION

Using a chain mediation model, this study explores the influence of locus of control, grit, self-esteem on the mental health of college students in Guangxi, China. The results support these hypotheses and test the mediating roles of grit and self-esteem between locus of control and mental health.

Regarding the relationship between locus of control, grit, self-esteem and mental health, the results of this study are in line with those of previous studies. The three factors of locus of control: internality, powerful others, and chance are all significantly related to mental health (Rashid, 2021). Among them, internality of college students will show lower symptoms of depression, anxiety and stress, while powerful others and chance will lead to higher symptoms of depression, anxiety and stress. This conclusion is consistent with previous studies (Khumalo and Plattner, 2019; Chisholm-Burns et al., 2021). Internally controlled students are stronger than externally (powerful others, opportunities) controlled students in terms of their ability to resist stress during E-learning. When faced with the same negative psychological emotions, internally controlled students will focus on how to overcome the problem.

External controlled students (powerful others,

opportunities) think less about their own problems, attribute problems to external uncontrollable factors, and focus more on venting negative emotions (Khumalo and Plattner, 2019). University administrators or teachers can help students develop internally, when they encounter setbacks and difficulties in learning; they should teach students how to discover their problems themselves, and find solutions to them. This will help to improve their learning.

Internality, powerful others and chance are all significantly related to grit and self-esteem. Internality predicts high grit and high self-esteem, while people with powerful others and chance have lower grit and self-esteem than those with internality (Celik and Sariçam, 2018; Ng and Meena, 2021).Grit and self-esteem are important factors affecting students' mental health; if they are too low, college students will encounter more psychological problems in E-learning. When the self-esteem of college students in E-learning is weakened, they will doubt their ability and value, their learning satisfaction will decrease, symptoms of depression, anxiety and stress will also become prominent, which will easily lead to mental health problems (Nordstrom et al., 2014; Ron and Rovner, 2014).University administrators or teachers should improve the grit and self-esteem of college students for them to be able to resist and cope with depression, anxiety and stress. Even in the face of difficulties and setbacks, they can still show positive optimism and perseverance, and have learning satisfaction.

In addition, there are three findings in this study. First, grit plays a mediating role between locus of control and mental health of college students in Guangxi, China. Second, self-esteem has a mediating role between locus of control and mental health in college students in Guangxi, China. Combining the above analysis, it can be found that in the influence of locus of control on mental health; the mediating effect of self-esteem is greater than that of girt. There is also a path, that girt and self-esteem have a chain mediating effect between E-learning locus of control and mental health of college students in Guangxi, China, which is the main theoretical contribution of this study. Internality, powerful others, and opportunities can respectively predict mental health through grit and self-esteem. From the grit of path comparison, the chain mediation effect of grit and self-esteem is more obvious in the impact of powerful others and chance on mental health, accounting for 22.35 and 17.97% of the total utility, respectively.

Based on the background of E-learning, this study takes college students in Guangxi, China as the research object, and explores the influence of locus of control, grit, self-esteem on their mental health. It confirmed the important role of grit and self-esteem in this relationship. It further enriched the content of the locus of control theory, which has provided a meaningful reference for preventing and alleviating the mental health of college students in E-learning. School administrators and teachers should not only help students form correct self-cognition and well learning attributions in terms of psychological control sources, they should also pay attention to enhancing their girt in learning and build their self-esteem. It can more effectively reduce their feelings of depression, anxiety and stress, thereby forming a better mental health state and ultimately achieving better learning outcomes.

## Conclusion

This study examines the correlation among locus of control, grit, self-esteem, and mental health among college students in Guangxi, China, during the process of E-learning, and also confirms the chain mediation role of grit and self-esteem between locus of control and mental health. Specifically, the three factors of locus of control can directly or indirectly affect mental health through grit and self-esteem. We confirmed the chain mediation effect of grit and self-esteem between locus of control and mental health.

At present, college students have more and more mental health problems in E-learning. University administrators and teachers should strengthen the screening of students with serious mental health problems, and deeply understand the factors of mental health problems, especially internal symptoms, such as their locus of control, grit, or self-esteem, with due regard for their interrelationships. For example, focusing on improving E-learning grit and self-esteem, while focusing on their impact on mental health, may aid recovery or prevent further progression of symptoms.

## Research limitations and deficiencies

First of all, due to the impact of Covid-19, this study mainly distributed questionnaires online through convenient sampling. The selected samples are not targeted, and it is easy for the subjects to answer inaccurately or be biased. Secondly, the sample proportion of male students and fourth-grade students is too small, which could impact the representativeness of the research results. Third, this study found that other factors also have an impact on the mental health of college students, such as parents, teachers, and classmates (Zhang et al., 2012; Lei et al., 2022). In future studies, researchers can combine subjects' personal internal and external factors, and explore their mediating or regulating effects on the mental health of college students.

## CONFLICTS OF INTERESTS

The authors have not declared any conflicts of interests.

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