The Relationship Between Physical Exercise and Self-Efficacy of College Students and The Mediating Role of Emotional Self-Regulation

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Abstract

Improving college students' health, contentment, and quality of life through physical exercise (PE) is a pressing issue that the government, society, education, and the academic community must urgently consider and resolve. This study aims to determine the relationship between physical education (PE) and students' mental health (MH). This investigation involves the administration of a survey questionnaire to 1,000 college and high school students. The results indicate that the anxiety and depression levels of college students were substantially higher than those of middle school students and that the anxiety and depression levels of boys were higher than those of girls. Moreover, the adjustment efficiency of melancholy and pain is greater among physical education majors than non-majors. PE affects MH by influencing emotion regulation self-efficacy (SE). Additionally, emotional regulation SE influences MH by affecting emotional regulation strategies. Emotional regulation SE and emotion regulation strategies (ERS) mediate the relationship between psychiatric symptoms (PE) and personality traits (MH).

Keywords. Physical exercise, Mental Health, emotion regulation, and emotion regulation strategies.

1. Introduction

Numerous studies have demonstrated that physical activity (PA) has a significant impact on mental health (MH), even though the research studies relating to PA and MH have distinct theoretical foundations and arrive at different conclusions and pathways (Zimmermann, Bledsoe, & Papa, 2021). Some studies initially emphasize the positive effects of physical education and PE on mental health (Aqeel et al., 2022). Self-efficacy (SE) refers to an individual's confidence in regulating their emotional state effectively. It can alleviate emotional tension, maintain emotional regulation, assist in regulating emotional impulses, and promote mental health. Regulatory feelings (Son et al., 2020). Self-efficacy comprises the ability to recognize one's emotional state, understand the emotional experience of others, and express positive and manage negative emotions.

The current study on the relationship between RMSE and adolescents' subjective well-being (SWB) and its mechanism is one of the leading domestic and international studies on this topic. SWB refers to evaluating life quality based on an individual's predetermined standard. It is an essential indicator for measuring an individual's quality of life and mental health. According to prior research, the SE of managing positive and negative emotions assists individuals in maintaining a positive self-concept, allowing them to experience more positive emotions and contentment. Significant negative correlations exist between anger, fury, and depression/pain management effectiveness and negative emotions, and significant positive correlations exist between anger management effectiveness and life satisfaction. RMSE has direct and indirect effects on subjective well-being, via factors such as interpersonal and empathic efficacy. RMSE significantly influences SWB (Giannopoulou et al., 2021).

Few studies in the literature have considered PE's mediating and moderating effects on the mental health of school students. According to Grubic, Badovinac, and Johri's (2020) study, the MH of students is the most important factor in improving their SE and learning performance. The study by Conrad et al. (2021) revealed that pupils lacking mental fitness perform poorly. The study by Meda et al. (2021) concluded that measuring students' behavior in various situations to enhance their understanding and learning performance is reliable. The study by Kaparounaki et al. (2020) also revealed that students who are less motivated to complete their assignments negatively perceive the classroom. According to Liu, Pinder-Amaker, Hahm, and Chen's (2022) study, the MH of the students is a crucial factor in their performance. In addition, Copeland et al. (2021) found that pupils with low MH do not perform well in their classroom activities. In addition, Harding et al. (2019) found that the MH of students facilitates their participation in class activities. However, Oswalt et al. (2020) found that a lack of attention to students' physical health can significantly impair their academic

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performance. Accordingly, Son et al. (2020) contributed to the literature by demonstrating that students' health significantly impacts their happiness and academic performance. According to the study conducted by Murad, Malik, and Ullah (2022), students' behavior significantly impacts their learning.

Thus, a significant lacuna in the literature surrounding these studies must be filled. This study sought to strengthen this literature gap by applying significant theoretical and practical implications. The availability of resources is necessary for students to enhance their mental health by working harder on their physical education. This research aims to determine the effect of PE on students' mental health. However, this study also introduced the mediating factors to advance the knowledge level. In this way, not only are the findings of this research significant on a theoretical level, but the practical implications of this research are also reliable for enhancing the students' understanding and behavior regarding their critical work. In addition, this research has some future directions that must be addressed significantly for the conclusions to be drawn.

2. Literature Review

Harrer et al.'s (2019) self-control energy model concluded that individual self-control depends on psychological resources. However, the capacity of psychological resources is limited, and they are being depleted by behaviors such as information processing and social interaction, resulting in a lack of self-control (Faisal et al., 2022). Sujarwoto, Saputri, and Yumarni (2023) postulated that mobile phone addiction could decrease an individual's self-control ability and influence their RMSE. In addition, those with a low RMSE are prone to negative emotions, resulting in a cascade of negative outcomes (LaBelle & Johnson, 2021). Savage et al. (2020) found a significant negative correlation between the RMSE and the degree of depression tendency. According to the expansion-construction theory of positive emotions, positive emotions can expand an individual's quick thinking and sequence of activities and help promote the construction of physical and psychological resources.

In contrast, negative emotions inhibit the construction of physical and psychological resources. Depression is easily induced when an individual focuses on negative emotions and cannot effectively resolve or release them (Thompson, Wood, & MacNevin, 2019). The research of Lee, Jeong, and Kim (2021) indicates a close relationship between sports participation and sports confidence, which can effectively enhance students' perception of SE. PE can substantially improve emotional regulation SE (Capone et al., 2020). Shanahan et al. (2022) demonstrate that participation in high school sports activities can help enhance SE and consequently have a positive effect on physical activity levels (Pollard et al., 2021). In addition, recent research has focused on the relationship between physical activity and emotion regulation strategies (ERS) selection. Some people study the effects of Taijiquan PE on emotional regulation strategies in middle-aged and elderly individuals, and the results indicate that Taijiquan PE can effectively adjust the use of emotional regulation strategies in middle-aged and elderly individuals; however, further evidence is required to determine whether this conclusion can be generalized. In conclusion, even though the existing studies from their respective perspectives and methods reveal PE and MH, PE and emotional regulation SE, emotional regulation, emotional regulation strategies, and MH better, it is difficult to explain the relationship between the factors, the role, the role of the factors, and the overall effect under the separation research environment system.

Varying situations elicit varying types of student behavior, and the dependability of their relationships is essential for their work (Wang et al., 2020). When students are motivated to work for better health development, their awareness of the working world can be raised. The health indicators are required for students to achieve advanced levels of performance (Fu et al., 2021). The reasoning skills of healthy pupils are robust, and they never experience anxiety during the learning process. However, many students must be self-motivated to improve their performance. The student's health is the most important factor influencing their classroom performance.

Nonetheless, PE also improves MH (Patsali et al., 2020). Physical activity routine is necessary for students to study at a higher level. Physical education improves the health of students who engage in regular exercise. Parents' encouragement is necessary for pupils to improve their learning positively (Schwartz et al., 2021). The method that enables students to improve their learning performance is the sustainability of the work for establishing dependable relationships.

When a student is instructed to enhance his health to perform better, his performance will improve. Students' performance improves over time due to participation in sports (Bolatov et al., 2021). Additionally, students are required to be positively motivated to acquire a deeper understanding of their health. It is appropriate to improve students' academic performance by ensuring their safety. The available resources are essential for students to enhance their positive health behaviors.

AlJhani et al. (2022) state that students' health can significantly impact their academic performance, but they can take steps to enhance their health. If students are not self-motivated to improve their health, providing them with improved health facilities would be ineffective. Practically, the dependability of health-related resources can enhance students' comprehension. Reducing students' apprehension is facilitated by the availability of training to improve their health. When dependable employment opportunities are created to better students' academic performance, mental health is enhanced, and anxiety is diminished.

The academic performance of students who must overcome obstacles to enhance their health is hindered. When students have access to enhanced learning, their reasoning can be enhanced over time. Students' anxiety is viewed as a challenge to their health, and they are required to enhance their health condition critically (Schwartz et al., 2021). Students' critical thinking assists them in achieving their essential objectives for a higher standard of living. However, students with a less productive attitude are not reasonable in their learning, and their performance also suffers.

Based on current research, this paper proposes an emotional theory based on PE that incorporates the two emotional variables of RMSE and emotional regulation strategies into the study framework. Figure 1 depicts constructing a structural model between PE, RMSE, model fit test, ERS, and MH to determine whether PE can influence the selection of ERS.

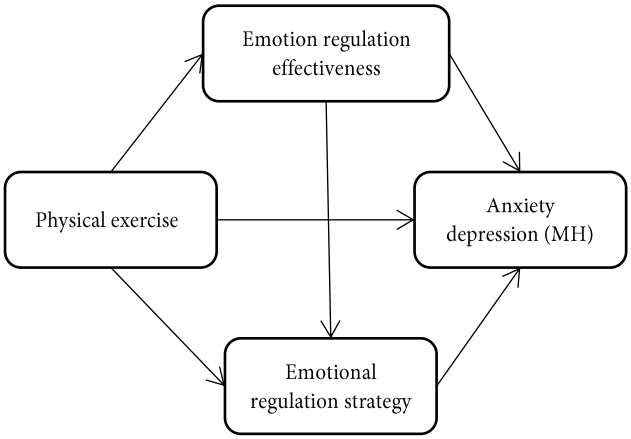

Figure 1. Research Model

3. Methodology

3.1 Participants

In the paper, the "cluster random sampling method" is employed. 600 college students, including 263 males and 337 females, were chosen. In addition, 400 secondary school students were chosen, including 179 boys and 221 girls. There are 1,000 individuals in total, with 442 males and 546 females. They are between 17 and 23, with an average age of 18.21.67 (SD = 2.40). In order to prevent "common method deviations," the questionnaire survey is administered four times, with each participant completing one questionnaire per week. During the data collection procedure, classes are coded uniformly. Results are strictly confidential and restricted to academic research only.

3.2 Measuring tools

The college student PE questionnaire is used as a scale of PE commitment intentions. The scale consists of 8 questions. There are 4 PE commitment questions and 4 PE persistence questions. The answers are all based on the Likert 5-point method, ranging from "strongly disagree," "disagree," "neither agree nor objection," "agree," and "strongly agree," which correspond to 1–5 points. Furthermore, the total score indicates the level of PE of the participant. The absolute value of the item skewness is within 0.241–0.504, the absolute value of kurtosis is within 0.099–0.694, and the minimum standard deviation is 1.018. The scale Cronbach's α=0.881, split-half reliability=0.845, and the total correlation of questions is in the range of 0.870–0.917 ($p<0.01$).

An RMSE scale is used. The revised test-retest reliability is 0.823, $p<0.01$, the scale Cronbach's α=0.839, and the subscale coefficient α is between 0.804-0.831. Where the coefficient of POS is 0.831, the coefficient of DES is 0.827, and the coefficient of ANG is 0.804. A load of each factor is between 0.562-0.849, and the structural indicators are: GFI=0.937, AGF=0.904, IFI=0.936, TLI=0.917, CFI=0.936, RMSEA=0.080, and all indicators are in line with psychometric indicators. The scale mainly includes three dimensions: SE (POS) in expressing positive emotions, SE (DES) in regulating depression/painful emotions, and SE (ANG) in regulating anger/rage emotions. The scale consists of 12 items, using the Likert 5-point method, with 1 point representing strongly disagree and 5 points representing strongly agree. An emotion regulation questionnaire (ERQ) is used. The questionnaire mainly assesses the differences between cognitive reassessment and expression inhibition in individuals' daily lives. The revised test-retest reliability is 0.88, $p<0.01$, the coefficient of all items is 0.737, the coefficient of cognitive reassessment is 0.763, and the coefficient of expression suppression is 0.616. A factor analysis of all items is carried out to investigate the structure of factors 1 and 2. The total explanatory rate is 52.71%, the factor load of each item is between 0.542-0.782, and all

indicators align with psychometric indicators. The D SCL-90 scale is used. The scale includes 90 items, covering various psychiatric symptoms, such as thinking, emotion, behavior, interpersonal relationships, and living habits. The evaluation time can evaluate a specific time, usually one week. The evaluation method is divided into five grades (0-4), 0 means never, 1 means mild, 2 means moderate, 3 means very severe, and 4 means severe. Given that the general MH problems of college and high school students are mainly reflected in anxiety and depression, the study mainly chooses anxiety and depression as MH indicators.

3.3 Statistical analysis

We utilized SPSS 18.0 and Amos 18.0 for statistical processing and data analysis. First, the "Harman single factor method and single method latent factor method" are utilized to examine the common method deviation of sample data. Second, "descriptive statistics and correlation analysis" are applied to each variable.

4. Findings and Discussion

The "average, standard deviation, and variance analysis" results of PE, RMSE, ERS, and MH in gender, school period, and major are shown in Table 1, Table 2, and Table 3.

Table 1

Results of statistical analysis and analysis of variance on gender

	Gender				
	Male		Female		F（1,812）
	M	SD	M	SD	
POS	5.09	0.71	5.10	0.72	0.58
DES	3.50	0.75	3.23	0.98	29.15
ANG	3.38	0.93	3.29	0.83	3.85
Cognitive reassessment	3.95	0.97	3.57	0.93	2.30
Expression suppression	3.00	0.77	2.88	0.77	5.79
PE commitment	3.85	0.91	3.12	1.09	99.20
PE persistence	3.97	0.95	2.92	0.84	127.21
Anxiety factor	5.91	5.89	9.20	5.59	2.19
Depressive factor	8.57	9.13	9.51	7.75	1.79

The results of Table 1, Table 2, and Table 3 show that in terms of gender, levels of boys' DES [F (1,812) = 29.15, p<0.01], expression suppression [F (1, 812) = 5.79, p< 0.05], PE commitment [F (1, 812) = 99.20, p<0.01] and PE persistence [F (1, 812) = 127.21, p<0.01] are significantly higher than those of girls. In the school period, the level of PE persistence of college students is significantly higher than that of high school students [F (1, 812) = 5.05, p<0.05].

Table 2

Results of statistical analysis and analysis of variance on school period

	School period				
	College		High school		F（1,812）
	M	SD	M	SD	
POS	5.09	0.70	5.12	0.79	1.35
DES	3.35	0.71	3.39	0.77	0.07
ANG	3.30	0.79	3.39	0.92	0.91
Cognitive reassessment	3.57	0.95	3.95	0.95	199
Expression suppression	2.95	0.75	2.90	0.71	0.59
PE commitment	3.55	1.10	3.52	1.09	0.09
PE persistence	3.30	1..05	3.15	0.93	5.05
Anxiety factor	9.39	5.97	5.97	5.00	10.23
Depressive factor	9.99	9.21	7.57	7.03	9.72

The levels of anxiety and depression of college students are significantly higher than those of high school students [F (1, 812) 10.23, p<0.01, F (1, 812) = 9.72, p<0.01]. In major, PE major students are significantly higher than non-PE major students in terms of DES, PE commitment, and PE persistence [F (1, 812) = 7.75, p<0.01, F (1,812) =55.39, p <0.01, F (1, 812) = 133.92, p<0.001]. At the same time, non-PE major students have significantly higher POS than PE major students [F (1, 812) = 7.70, p<0.01].

Table 3

Results of statistical analysis and analysis of variance on major

	Major				
	PE		Non-PE		F（1,812）
	M	SD	M	SD	
POS	3.95	0.79	5.11	0.70	7.70
DES	3.50	0.71	3.31	0.73	7.75
ANG	3.35	0.77	3.91	0.77	0.15
Cognitive reassessment	3.57	0.95	3.31	0.95	0.21
Expression suppression	3.05	0.75	2.91	0.77	3.39
PE commitment	5.00	0.95	3.30	1.09	55.39
PE persistence	5.05	0.75	3.07	0.99	133.92
Anxiety factor	9.09	9.07	5.90	5.95	0.13
Depressive factor	7.57	9.13	9.51	7.75	1.79

Figure 2 depicts the results of the structural equation test model. According to the model test standard, if the GFI, GFI, AGFI, IFI, TLI, and CFI values are greater than 0.90, then the model adequately suits the data. Specifically, the RMSEA of the research model exceeds its test index of 0.05RMSEA0.08, indicating that the research model is appropriate for the data. Generally, the model developed in this analysis corresponds well with the scale data.

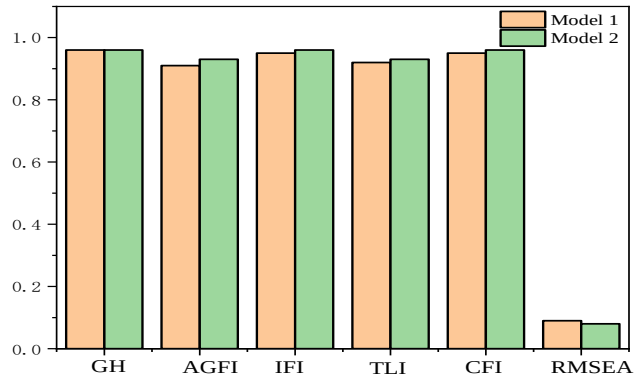

Figure 2. Model fit test

Following the findings of previous studies conducted by Western researchers (Elmer, Mepham, & Stadtfeld, 2020), boys have substantially higher levels of SE in regulating depression/painful emotions than girls. Males can achieve adulthood with a more developed SE for regulating negative emotions than females. In contrast, women's SE in regulating negative emotions has gradually increased. The level of expression suppression in boys is also considerably greater than in girls. Men are an emotionally "non-expressing" population, whereas women are more expressive emotionally. This gender advancement may result from societal expectations regarding men's and women's roles. Often, the environment has distinct gender role expectations for men and women, requiring men to be more responsible and courageous and less likely to express their emotions. There is a substantial difference between boys and girls in commitment and persistence to physical education. Boys pay more attention to health motivation and are generally more motivated to exercise than girls. This is because boys and girls have distinct innate propensities to pursue motivation. Exercise also benefits psychological health. The exercise program is essential for individuals to attain a higher level of learning. When students engage in regular physical activity, their health is enhanced. For students to enhance their academic performance, parental motivation is necessary. The strategy that aids students in enhancing their learning capacity is a persistent pursuit of establishing trustworthy relationships.

College students are substantially more committed to physical education during the school year than high school students. For this reason, college students have a strong motivation for physical education, a strong ability to manage time, and a relatively flexible learning schedule, and they have the energy and time to participate in PE. High school pupils have limited free time and require more energy to study for the college entrance exam. Moreover, secondary school students lack the necessary understanding of physical education. However, anxiety and depression are substantially more prevalent among college students than high school students. This relates to the primary challenges encountered by students at various grade levels. High school pupils' primary sources of psychological stress are "learning, interpersonal relationships and communication, and RM efficiency." "Employment, learning, interpersonal relationship and communication, and RM effectiveness" are the primary psychological pressures on college students.

Students exhibit different behaviors in different contexts, and the dependability of their interactions is essential to their productivity. When students are motivated to strive towards optimal health development, their awareness of the function can increase. The specific area is necessary for pupils to improve their performance to the following level. Students in excellent health have superior critical thinking skills and never experience anxiety related to learning. However, a sizeable proportion of students must be ego to obtain improved performance. According to experts, a teen's health is the most influential factor in their academic performance.

Compared to high school students, college students experience an additional problem with employment, so their anxiety and depression levels are higher. PE majors have substantially higher levels of SE in regulating depression/painful emotions, PE commitment, and PE persistence than non-PE majors, primarily because the goal orientation and motivation levels of PE majors differ from those of non-PE majors. This may be related to the goal-oriented nature of competitive sports and the monitoring of one's own emotions. Athletes view competition performance as their primary objective, an essential motivator. To enhance their athletic performance, they set unrealistic objectives and frequently monitor their emotions, but it is simple for them to conceal their true emotions. When the amount of training or intensity of exercise exceeds the individual's maximum tolerable level without reaching the self-set level, the individual will experience irritability, boredom, and a relatively low SE in expressing positive emotions due to fatigue. When a student is instructed on enhancing his health to perform better, his performance will increase. Sports are considered important for students because they have a lasting impact on their academic performance. In addition, the pupils must be positively motivated to increase their health consciousness. The best way to improve students' academic performance is to ensure their health. The resources offered are crucial for assisting students in making positive changes to their health-related behaviors.

Existing studies have predominantly investigated the relationship between PE and MH from a single angle, for example, the relationships between PE and SE, RMSE and MH, ERS use and MH, and RMSE and ERS. However, there is never a precise comprehension of the overall relationship between PE and MH, nor an accurate understanding of the complex relationship between various factors. This study's findings serve as a benchmark for elucidating these issues and enhancing existing theories. From the model's test results, it can be concluded that structural verification demonstrates that PE, RMSE, and ERS have direct and indirect effects on MH. PE has direct effects on MH and indirect effects via RMSE and ERS. RMSE can have both direct and indirect effects on MH via ERS. ERS has an immediate effect on MH. However, the model does not support that PE can improve the level of selection of ERS, indicating that existing studies believe that the core of PE to enhance monitoring capabilities should be controlled, not strategy change (Morris et al., 2022).

An in-depth analysis reveals that sub-variables contribution to each factor differs within the overarching framework of each factor. PE persistence of college students contributes more to PE than PE commitment, indicating that PE persistence is relatively more essential than PE commitment. SE in regulating depression/painful emotions contributes the most to RMSE (0.90), followed by SE in regulating anger/rage emotions (0.72), and SE in expressing positive emotions (0.27), indicating that PE has a greater impact on the efficacy of controlling negative emotions, but a relatively small impact on the efficacy of controlling positive emotions. Concerning ERS, the significant function of PE is to influence the use of ERS by enhancing the emotional regulatory SE, particularly cognitive reassessment strategies, as opposed to expression suppression strategies (Jones et al., 2022). Students who struggle to maintain improved health cannot perform effectively in class. Students' logical reasoning may improve over time if they have access to exceptional learning. The students' anxiety is viewed as an impediment to enhancing their health, and they must reduce it substantially. Students' use of critical thinking aids them in attaining crucial life goals necessary for advancement. However, students with a poor constructive mentality are less logical in their educational pursuits and perform worse.

Adolescents' health can significantly impact their academic performance, but they can also work diligently to improve their health. Providing students with better health facilities would be futile if they are not motivated to improve their health independently. The reliability of health-related resources can beneficially enhance students' comprehension. The superb health advancement made possible by the availability of education reduces students' anxiety. When dependable employment opportunities are created to improve pupil performance, mental health is achieved, and stress is reduced. In brief, persistence in PE, SE in regulating depression/painful emotions in RMSE, and cognitive reassessment in ERS have a greater effect on MH, indicating that exercise, efficacy, and strategies are crucial variables for effectively enhancing MH. It also suggests that more emphasis should be placed on improving RMSE and cultivating emotional regulation strategies in physical education. This is a crucial method for enhancing the MH benefits of PE (Prowse et al., 2021).

5. Conclusion

Significant relationships exist between RMSE, ERS, and subjective well-being. The RMSE has a direct and highly predictive relationship with subjective well-being. In part, attenuated regulation mediates the relationship between RMSE and subjective well-being. Generally, the model developed in this analysis corresponds well with the scale data. The anxiety and depression levels of college students are considerably higher than those of high school students, with males being more affected than females. Physical education majors are more likely to regulate depressive/painful emotions than non-physical education majors. PE influences MH by influencing RMSE. RMSE influences MH by influencing ERS. RMSE and ERS serve as intermediaries in the relationship between PE and MH.

6. Implications and Future Directions

This research has theoretical significance to the corpus of literature because it adds newly developed relationships. Physical education significantly impacts students' mental health, which is essential for critically improving their behavior. In addition, this research signified the literature's mediational relationships. It has been documented that emotion regulation effectiveness mediates the relationship between ERS and ERS. This investigation makes an original theoretical contribution to the body of knowledge. Practically, the perception of SE is an important link between PE and the psychological health of college students. It is necessary to enhance the athletic abilities of college students. By constructing a sports exercise information platform, holding sports lectures, designing novel and interesting sports classes, and organizing interesting sports competitions, we hope to increase college students' desire to engage in physical activity,

scientific exercise knowledge and skills, and a sense of SE. Physical education's promotion of students' psychological well-being can be bolstered by an environment conducive to physical activity, thereby elevating the significance of PE. Therefore, in addition to providing necessary sports venues and facilities, colleges, and universities should also design sports venues that conform to college students' aesthetic standards so that college students can perceive the objective existence of sports beauty and improve the accessibility and accessibility of college students' PE; At the same time, colleges and universities should encourage the establishment of various types of sports associations, provide special guidance teachers to ensure the quality of the associations, regularly organize community competitions, fully improve the subjective initiative of students, so that college students can enhance their physical quality and expand their interpersonal relationships by participating in sports associations and group sports, to achieve the goal of improving their psychological well-being. In future studies, neuroscientific indicators and psychological variables can be combined to explore more physiological and psychological variables to discover more problems that interfere with depression in college students.

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