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Article

Study on the influence of different types of e-sports participation on the improvement of psychological anti-pressure ability of contemporary college students

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Abstract: In recent years, e-sports, as an emerging form of competition, has been rapidly integrated into the daily life of college students, and with its rich interactivity, instant feedback and teamwork, e-sports provides them with an effective channel for emotional catharsis and psychological regulation. This study takes students from four universities as the survey object and adopts quantitative research method to analyze the relationship between different types of e-sports activities and psychological stress resistance through questionnaire survey method combined with spss. The samples were randomly sampled, and a total of 500 valid questionnaires were collected. The results of the study show that: 1. In terms of participation, the ability of students to withstand academic stress and life stress is significantly improved, and e-sports is an effective way to regulate emotions and relieve stress; 2. the three types of games (First-person Shooter, Multiplayer Online Battle Arena, Real-Time Strategy Game) have different impacts on stress tolerance, of which FPS has the greatest impact on stress tolerance; 3. the frequency of playing e-sports affects your stress tolerance; 4. teamwork and strategy play an important role in e-sports resilience.

Keywords: esports; psychological stress resistance; sports education; mental toughness; digital well-being; gamified learning; student mental health; competitive environment

1. Introduction

E-sports have become generally popular worldwide (Chan et al., 2008; Ekdahl and Ravn 2021), and there are many more issues related to e-sports (Brandtner et al., 2022; Chen et al., 2023), but the Internet is still in its infancy for contemporary humans. For example, how to develop strategies, how to create new perceptual states, how to use Esports to optimize physical and mental states, and how to adapt to and create new perceptions of life in the current fast-paced life. (Chen et al., 2022; King et al., 2017). As for the addiction of human beings when e-sports Kang began to be popular, it is particularly prominent among young people, health issues in Esports are negatively associated with prolonged sit-stand gaming, such as screen time, unhealthy gaming/eating styles, and partial overuse of the body. It is not e-sports itself that will lead to the future of human health (Pereira et al., 2021; Rudolf et al., 2020). Nowadays we can't avoid the content of Esports, how can we improve it? While recent studies have shown that high-level Esports athletes have higher levels of physical activity and fitness, any push to the limit can have negative effects. The popularity of Esports is an inevitable conclusion, we should design solutions for these health issues, optimize the new digital lifestyle is essential, and thus actively

explore how to use Esports to have a positive impact (DiFrancisco-Donoghue et al., 2019; Himmelstein et al., 2017; Pedraza-Ramirez et al., 2020; Railsback and Caporusso 2018).The main purpose of this study is to explore the impact of Esports on college students' psychological stress resistance and to analyze how factors such as game type and game duration affect the enhancement of psychological stress resistance.

For the problem of electron perception, the global research has also made some preliminary exploration (Mayer, 2019). For example, Wells et al., found that the study on the video game CrushStations can improve the new executive power (Wells et al., 2021). Homer et al., conducted two different versions of the game according to the age of teenagers and their neurocognitive development stage. Teenagers are more sensitive to e-sports than adults (Homer et al., 2019). Research shows that Esports are not just a form of entertainment, but also have great benefits in terms of increased understanding (The European Esports Federation 2020; Eichenbaum et al., 2014). Franceschini et al., found that video games can improve reading skills and visual auditory attention switching skills, especially for children with English language dyslexia (Franceschini et al., 2017). In addition, Burks' research has shown that video games can effectively improve hand-eye coordination, which has a positive impact on perception and response (Burks, 2014). Hester's report shows that teenagers spend significantly more time playing video games than going to the movies, suggesting that video games have become an important part of everyday life and offer many practical opportunities for improved comprehension (Hester, 2016). Together, these studies suggest that Esports can improve cognition and perception.

There are few researches on the anti-stress ability of e-sports through psychology. In the investigation of e-sports players in Chinese universities, the mental health status of e-sports players was assessed by psychophysyological indicators such as heart rate variability, indicating that e-sports can help college students cope with academic pressure and enhance their self-regulation ability (Cheng et al., 2023). Sergio found that high anxiety and low self-confidence were significantly correlated with HRV (Heart rate variability) changes, and proposed that interventions such as transcranial direct current stimulation (tDCS) could reduce anxiety and improve athletic performance (Sergio et al., 2022). In addition, Lee and Tam (2024) found that the association between online gaming disorder (IGD) and psychological distress is influenced by core and peripheral features of gaming. Machado et al. (2022) studied the impact of e-sports competition results on HRV and stress level, and the results showed that winners had better HRV response and lower stress level. Cheng et al. (2023) found that e-sports can relieve the psychological pressure of college students. However, e-sports also comes with certain risks. Jeffrey et al. (2023) summarized the biopsychosocial risks of e-sports, including malnutrition, stress, addiction, mental illness. Sousa et al. (2020) showed that different types of games have different effects on psychology and physiology. For example, FPS games (First-person shooter) significantly increase players' heart rate and blood pressure. Himmelstein et al. (2017) pointed out that e-sports athletes need to possess mental skills, such as imagery, to effectively cope with pressure and enhance confidence. Smith et al. (2001) suggested that interventions targeting factors such as stress and sleep could improve the mental health of Esports players. They

emphasized the importance of image development for athletes to improve performance and mental state, and proposed "layered stimulus-response training" to help athletes improve visual, auditory and other sensory images (Cumming et al., 2016). Mental toughness has been found to help Esports athletes stay still in high-pressure environments and benefit from traditional sports psychology measures (Pluss et al., 2020). Further research on the important role of self-regulation and stress assessment in Esports performance shows that players with a high degree of self-regulation perform better under pressure (Trotter et al., 2023). Stress, sleep quality, fatigue and social anxiety have been recognized as important factors affecting the mental health of athletes, indicating the need for psychosocial intervention (Smith et al., 2022). To sum up, these studies show that developing mental flexibility and self-regulation ability can effectively improve the performance and mental health level of e-sports athletes. Through the relevant investigation and research on the pressure of college students at this stage, we find that more and more college students are affected by different pressures, and their emotions become negative. Psychological stress and mental health are chronic problems faced by university students worldwide (Hamdani, 2021; Lisnyj et al., 2022; Mishra and Nargundkar, 2015; Seijts et al., 2022). The university stage is a very important period for college students to adapt to some new social, cultural and academic needs (Alsubaie et al., 2019). In addition, students may be away from home for long periods of time. Many of them may also be in residential programs. All of these factors can greatly hinder their health. Studies of graduate students have shown that 51% of them have experienced psychological distress and 40% have experienced symptoms of mental illness (De Coninck et al., 2019; Legros and Boyraz 2023; Thoits, 1985). In addition, Jang et al., also studied the relationship between entertainment gameplay and live event broadcasting, and concluded that the mediating effect of e-sports content broadcasting was fully utilized (Jang et al., 2021). In another study, Jang and Byon investigated the moderating effect of genre on the relationship between elements in a UTAUT model (Unified Theory of Acceptance and Use of Technology) and gameplay intent (Jang and Byon, 2020). These data show that the mental health of college students is a concern, so the current social, relaxation and entertainment of college students is mainly based on Esports (Baik et al., 2019; Wall et al., 1999; Yu et al., 2018).

At present, some scholars have begun to study the psychological impact of e-sports duration on players (Kari and Karhulahti 2016; Yin et al., 2020), and put forward relevant suggestions for e-sports coaches (Nagorsky and Wiemeyer, 2020). There is no doubt that e-sports is indeed becoming the most popular way of entertainment for young people year by year (Moya-Ramon et al., 2022; Pereira et al., 2021), and is gradually moving closer to the education industry. It has become a trend for Esports to become a school course (Castaldo et al., 2015; Yeo et al., 2018), so it is particularly important to study the different types of Esports, the participation, and whether they affect psychology. Therefore, attention should be paid to the health and psychological support needs of e-sports athletes (Kocak, 2022). Especially at the college level, Esports are considered to be a tool to relieve academic stress (Brown et al., 2018), but there are also risks of addiction and negative emotions, which remind

us of the need for further research on the specific effects of Esports on the mental health and resilience of college students.

2. Methodology

2.1. Participants

Multi-stage sampling method was used to select the research population for this study. As shown in **Figure 1**, sample selection was divided into two main dimensions: student sample selection and participation criteria (see **Figure 1** for details). In terms of student sample selection, the study population was limited to current students from two comprehensive universities and two sports universities, aged between 18–25 years old, involving both undergraduate and graduate students, distributed across different majors. In terms of participation criteria, participants were required to fulfill the following conditions: participate in at least one Esports activity per month, show a strong interest in Esports, have a duration of at least 30 min per game, and have participated in at least one type of Esports.

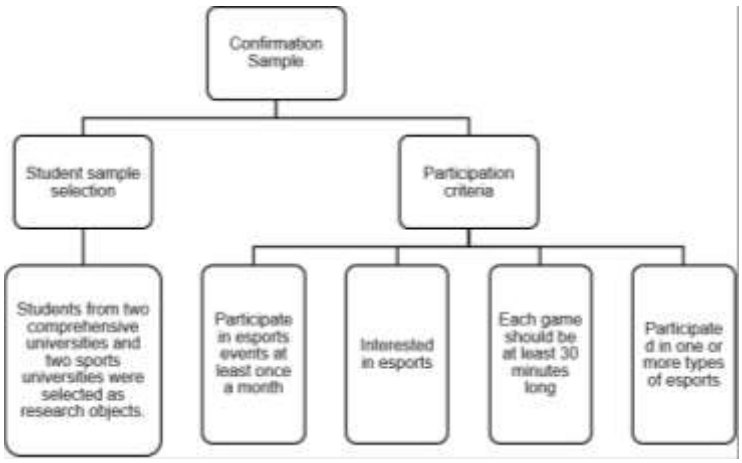

Figure 1. Sample screening stage process.

2.2. Questionnaire questions e-sports part design

This study utilizes a quantitative design and collects data through questionnaires. Questionnaires are tools for quantifying perceptions, attitudes, and behaviors, and can help obtain information from large samples and reveal patterns in the subject of study. The aim of this study was to explore the impact of Esports on the mental and physical health of young people through questionnaires, with a particular focus on the links between fitness levels, screen time and lifestyle in Esports. In order to collect data, a structured questionnaire was designed for this study, covering basic information about the participants, Esports participation, health behaviors, and measures of physical and mental health. The questionnaire contains scales and open-ended questions in order to assess participants' health status, gaming habits, and daily lifestyle. The questionnaire will be distributed through an online platform with an expected sample size of 500 participants, mainly targeting the younger age group.

In this study, after extensive reading of the relevant literature and on the basis of a large number of maturity scales, the dimensions of each variable of the effect of

Esports on psychological stress resistance (as in **Table 1**) were selected and the definitions of each dimension were described. The individual variables and their definitions are described in detail below. The questionnaire design for the Esports section focused on assessing participants' perceptions, attitudes, behaviors, and health effects of Esports. The key items in the questionnaire are listed in **Tables 2** and **3**, and the process of designing these items was guided by a rigorous theoretical framework and prior literature research. Items related to Esports engagement, time management, and game genre preference are listed in **Table 2**, aiming to understand participants' Esports engagement behaviors and health impacts. These questions focused on Likert scales designed to quantify participants' attitudes and behaviors. The items listed in **Table 3** focus on participants' health status, including the impact of prolonged gaming on physical health, mood swings while gaming, and so on.

Table 1. Variable dimensions and definitions.

variable	Dimensions	definition
Independent variable	Game duration	Time spent playing video games
	Game type	Types of video games played
Dependent variable	Psychological stress tolerance	The ability to effectively adjust one's mentality and effectively cope with and solve problems in the face of external pressure, adversity, difficulties and challenges

Table 2. Measurement items for electronic games.

Variable	Number	Corresponding measurement item in the scale
Game duration	Sh1	Do you think you can usually stay calm while playing video games for a long time?
	Sh2	Do you think you can recover quickly from adversity and face future challenges with a positive attitude while playing video games for a long time?
	Sh3	Do you think you have the ability to find effective solutions when you encounter difficulties while playing video games for a long time?
	Sh4	Do you think you can quickly adjust your mindset and re-invest in efforts when facing failure after playing video games for a long time?
Game type	Lx1	Do you feel that you can effectively manage the pressure from the game when playing MOBA (such as League of Legends, Honor of Kings, etc.) competitive online games?
	Lx2	Do you often feel anxious when playing MOBA (such as League of Legends, Honor of Kings, etc.) competitive online games?
	Lx3	Do you feel that you can effectively manage the pressure from the game when playing FPS (such as CF, Valorant, etc.) competitive online games?
	Lx4	Do you often feel anxious when playing FPS (such as CF, Valorant, etc.) competitive online games?
	Lx5	Do you feel that you can effectively manage the pressure from the game when playing card (such as Hearthstone, Happy Landlord, etc.) casual online games?
	Lx6	Do you often feel anxious when playing card games (such as Hearthstone, Happy Landlord, etc.)?
	Lx7	Do you feel that you can effectively manage the pressure from the game when playing strategy games (such as StarCraft, Civilization, etc.)?
	Lx8	Do you often feel anxious when playing strategy games (such as StarCraft, Civilization, etc.)?
	Lx9	Do you feel that you can effectively manage the pressure from the game when playing e-sports competitive (AR) technology games?
	Lx10	Do you often feel anxious when playing e-sports competitive (AR) technology games?
	Lx11	Do you feel that you can effectively manage the pressure from the sports when playing traditional competitive sports?
	Lx12	Do you often feel anxious when playing traditional competitive sports?

Table 3. Items for measuring psychological stress tolerance.

Variable	Number	Corresponding item in the scale
Psychological stress resistance	Nl1	I adapt to change.
	Nl2	Past successes give us confidence to take on new challenges.
	Nl3	I bounce back easily after a tough or difficult time.
	Nl4	I try my best no matter what.
	Nl5	I don't give up when things seem hopeless.
	Nl6	I stay focused and think clearly under pressure.
	Nl7	I am not easily discouraged by failure.
	Nl8	I can make unusual or difficult decisions.
	Nl9	I enjoy a challenge.
	Nl10	I work hard to achieve my goals.

Independent variable:

Game time: This dimension refers to the amount of time an individual spends playing video games over a period of time. The length of play time can be measured by recording daily play time, including the total amount of play time per day, week or month.

Type of game: This dimension refers to the type of video game that an individual is involved in. There are many types of games, including but not limited to strategy games, shooters, role-playing games, etc. Different types of games may have different effects on the psychological stress resistance of players.

Dependent variable:

Psychological resistance to pressure: This dimension refers to the ability of individuals to effectively adjust their mentality and actively cope with and solve problems in the face of external pressure, adversity, difficulties and challenges. Psychological ability to cope with stress includes the ability of emotional regulation, problem solving, and coping strategies with stress.

First, determine how often college students participate in Esports, including daily, several times a week, several times a month, rarely or never. Secondly, to evaluate the average daily participation time of college students in e-sports, the options include less than 1 h, 1–2 h, 2–4 h, and more than 4 h. Then, find out what types of Esports games college students are mainly involved in, including MOBA, shooting, sports, strategy, and others. In addition, it is also necessary to investigate whether college students have participated in e-sports competitions, including yes and no options. For students who have participated in the competition, further ask how often they participate, with options including weekly, monthly, quarterly, annual, rarely or never (see **Table 4**).

Table 4. Basic information items.

Your gender is:	**A Male B Female C Other D Unwilling to disclose**
Your age is:	A. 18–20 years old; B. 21–23 years old; C. 24–26 years old; D. 27 years old and above.
Your grade is:	A. Freshman; B. Sophomore; C. Junior; D. Senior; E. Graduate student.
Your major is:	A. Science and Engineering Literature/Language; B. Social Science; C. Sports D Art/Design; E. Other (please specify).
How often do you participate in e-sports?	A. Every day; B. Several times a week; C. Several times a month; D. Rarely E Never.
How long do you spend on average every day participating in e-sports?	A. Less than 1 h; B. 1 h–2 h; C. 2 h–4 h; D. More than 4 h.
What type of e-sports games do you mainly participate in?	A. MOBA (such as League of Legends, Honor of Kings); B. Shooting (such as CF, Valorant); C. Sports (such as FIFA, NBA 2K); D. Strategy (such as StarCraft, Civilization). E. Ear Sports (such as Ring Fit Adventure); F. Other (please specify).
What is your main motivation for participating in e-sports activities?	A. Relaxation and entertainment; B. Social interaction; C. Competitive challenge; D. Learning and improvement; E. Other (please specify).
What role do you play in e-sports?	A. Ordinary player; B. Entertainment player; C. Casual player.
How would you rate the overall impact of Esports on your life?	A. Very positive; B. Neutral; C. Negative; D. Very negative.

Through these basic information items, we can comprehensively understand the e-sports behavior and attitude of college students, and provide rich and detailed basic data for subsequent data analysis and research conclusions.

2.3. The psychological part of the questionnaire was designed

This study utilized an online questionnaire for data collection. The survey link was distributed to participants through platforms such as Questionnaire Star and Google Forms, which covered a wide range of respondents. The main reasons for choosing an online questionnaire were its ease of operation, the ability to obtain a large amount of valid data in a relatively short period of time, and the ease of centralized data management. The questionnaire was collected over a period of three weeks, specifically from 1 August 2024 to 21 August 2024. Participants' privacy information was strictly protected throughout the data collection process, and the privacy protection measures were detailed at the beginning of the questionnaire. All participants completed the questionnaire voluntarily and were recruited through convenience sampling method. A pilot test of the questionnaire was conducted to ensure the validity of the questionnaire design. The pilot test was conducted in mid-July 2024 with 10 university students and 5 experienced Esports players. The purpose of the pilot test was to check the logic of the questionnaire, the clarity of the language presentation and the length of time it took to complete. Based on the feedback, some of the questions were adapted to make the questionnaire content more accessible and to ensure that the psychological variables of interest to the study could be effectively measured. All questionnaire data were collected automatically through the online platform and the data were stored in the platform's database; invalid or incompletely filled questionnaires were deleted. In designing the questionnaire, special attention was paid to the construction of the dimensions of psychological stress resistance, game type and game duration. To ensure the reliability of the questionnaire, Cronbach's Alpha coefficient test was conducted for

each dimension, which showed that the Alpha coefficients of all dimensions exceeded 0.7, indicating that the questionnaire has good internal consistency. This section assesses the psychological stress resistance of college students through a series of statements divided into two parts. The first part is a video game psychological stress resistance measurement item list and the second part is a psychological stress resistance test form. Both parts utilize a 1–5 scale. For example, "When faced with academic stress, you are usually able to remain calm," using a 1–5 scale (see **Table 2**).

This section consists of 12 measurement items (Lx1–Lx12), which assess the ability of respondents to manage stress and the level of anxiety experienced during gaming or sports for different types of video games (MOBA, FPS, card, strategy, Esports) as well as traditional competitive sports. Each item was designed to explore the impact of a particular type of game or sport on respondents' feelings of stress management and anxiety. The issue of missing data was also considered in the data analysis in this paper. The mean padding method was used to deal with missing data in response to participants' missing responses. To ensure the accuracy of the analysis, the percentage of missing data was assessed and the use of the mean method was chosen only if the percentage of missing data did not exceed 5%.

These questions will help us to comprehensively understand the specific impact of different types and duration of games on students' psychological stress resistance to stress, and provide detailed data support for further analysis.

In order to make the questionnaire for testing psychological stress resistance more authoritative, the simplified test table in RICS was selected for the second part (see **Table 3**). The test sheet is scientifically validated to quantify an individual's mental resilience and ability to cope in the face of stress and challenges. The following table lists the specific items used to measure the psychological stress resistance to stress. These items cover multiple dimensions, such as adaptability, resilience, determination, concentration, etc., which can comprehensively reflect the psychological state and behavior of the respondents in the face of stress.

These questions provide a comprehensive framework for assessing the psychological stress resistance of college students, and help researchers to analyze the performance and psychological stress resistance of college students in different stressful situations.

In order to ensure the reliability of the questionnaire, we conducted a reliability test. The following table shows the scale mean, scale variance, corrected term to total correlation, and Cronbach's Alpha coefficient for each variable after deletion of certain terms. These indicators are used to assess the internal consistency of the questionnaire to ensure the stability and reliability of its measured results.

2.4. Questionnaire validity and reliability test

In order to verify the validity of the questionnaire, Cronbach's Alpha coefficient was used to measure the internal consistency of the questionnaire. The following table presents the scaled mean, scaled variance, total correlation correction term and Klonbach's Alpha coefficient for each variable after deleting the partial terms (see **Table 5**). These indicators were used to assess the internal consistency of the

questionnaire and to ensure the stability and reliability of the questionnaire measurements. In this study, the Cronbach's Alpha coefficients for all variables were greater than 0.9, indicating that the questionnaire had excellent internal consistency (see **Table 5**).

Table 5. Reliability test table.

Measurable variables	Measurable variables	Scaled mean after item removal	Scaled variance after item removal	Corrected item-total correlation	Cronbach's Alpha after item removal
Game duration	Game duration	92.86	378.035	0.542	0.937
Sh1		92.84	378.136	0.544	0.937
Sh2		92.82	379.383	0.535	0.937
Sh3		92.83	378.396	0.542	0.937
Game type	Game type	92.84	376.311	0.578	0.937
Lx1		92.85	379.020	0.527	0.937
Lx2		93.03	374.707	0.587	0.936
Lx3		93.07	370.836	0.621	0.936
Lx4		93.03	373.264	0.613	0.936
Lx5		93.04	373.095	0.595	0.936
Lx6		93.05	370.650	0.638	0.936
Lx7		92.80	378.242	0.548	0.937
Lx8		92.85	376.483	0.567	0.937
Lx9		92.82	378.111	0.549	0.937
Lx10		92.85	377.786	0.555	0.937
Lx11		92.82	377.094	0.578	0.937
Psychological stress resistance		92.83	377.573	0.559	0.937
Kx1		92.87	376.371	0.581	0.937
Kx2		93.12	371.205	0.639	0.936
Kx3		93.09	372.293	0.610	0.936
Kx4		93.11	371.253	0.616	0.936
Kx5		93.16	368.835	0.649	0.936
Kx6		93.10	370.079	0.653	0.936
Kx7		93.14	371.078	0.628	0.936
Kx8		93.07	370.663	0.640	0.936
Kx9		93.10	373.363	0.611	0.936

According to the reliability test results, Cronbach's Alpha coefficients of all variables are higher than 0.7, which indicates that all dimensions of the questionnaire have good internal consistency and the overall reliability of the questionnaire is high.

When testing the validity of the questionnaire, KMO value and Bartlett sphericity test were used to evaluate the applicability of the data and the validity of factor analysis.

Table 6. Total variance explained.

Components	Original eigenvalues			Sum of squares of rotated loadings		
	Total	**Percent of variance**	**Cumulative %**	**Total**	**Percent of variance**	**Cumulative %**
1	6.738	42.110	42.110	4.786	29.914	29.914
2	1.943	12.144	54.253	3.894	24.340	54.253
3	1.656	10.351	64.605			
4	0.573	3.578	68.183			
5	0.539	3.369	71.552			
6	0.493	3.081	74.633			
7	0.480	2.998	77.632			
8	0.462	2.885	80.517			
9	0.440	2.750	83.267			
10	0.422	2.640	85.907			
11	0.420	2.624	88.531			
12	0.398	2.485	91.016			
13	0.380	2.376	93.392			
14	0.368	2.300	95.693			
15	0.360	2.252	97.945			
16	0.329	2.055	100.000			

Through the principal component analysis in **Table 6**, we extracted 16 factors, of which the first two factors have significant explanatory power. Specifically, the initial eigenvalue of the first factor was 6.738, explaining 42.110% of the total variance, and the initial eigenvalue of the second factor was 1.943, explaining 12.144% of the total variance. After rotation, these two factors explained 29.914% and 24.340% of the variance, respectively, for a cumulative total of 54.253% of the variance explained. This result indicates that these factors accounted for more than 50% of the variance, validating the analysis. This is consistent with the study in this paper that measured psychological stress resistance in terms of two dimensions: match length and match type.

In this study, although not explicitly mentioned, exploratory factor analysis (EFA), a technique designed to identify measurement dimensions (constructs), was used. In this paper, EFA was used to test the structural validity of the questionnaire, i.e., whether the measured dimensions conformed to the intended theoretical model. EFA was primarily used to explore the structure of the measured dimensions, and thus it is more suitable for testing structural validity than for directly assessing convergent validity. In this paper, a number of key factors were extracted in the factor analysis and, as can be seen from the analysis results, the factor loadings of each measurement item were greater than 0.6 (see **Table 7**), which further proves the structural validity of the questionnaire and the consistency of the measurement dimensions.

Table 7. Factor analysis results.

Variables	Ingredients	
Lx7	0.699	
Lx5	0.690	
Lx4	0.687	
Lx6	0.683	
Lx9	0.676	
Lx12	0.662	
Lx3	0.655	
Lx10	0.654	
Lx8	0.649	
Lx11	0.641	
Lx2		0.786
Sc1		0.777
Sc2		0.771
Lx1		0.760
Sc4		0.747
Sc3		0.726

As can be seen from the factor analysis data in **Table 7**, the factor loadings ranged from 0.641 to 0.786 for each measurement item, which were all greater than 0.6, indicating that the factor structure of the questionnaire had good convergent validity and structural validity. In this study, exploratory factor analysis (EFA) was used to test the structural validity of the questionnaire and to ensure that the measurement dimensions matched the theoretical model. The main purpose of EFA is to explore the loadings of each measurement item on different factors and whether these factors can effectively explain the total variance. In the factor analysis, several factors were extracted and the first two explained more than 50% of the total variance, which met the validity criteria. The first factor had an initial eigenvalue of 6.738 and explained 42.11% of the total variance, while the second factor had an initial eigenvalue of 1.943 and explained 12.14% of the total variance. After rotation, the two factors explained 29.91% and 24.34% of the variance, respectively, totaling 54.25%, which indicates that the structure of the factor extraction was effective in explaining the overall variability of the questionnaire.

In the specific implementation of the factor analysis, the factor loadings of each measurement item were greater than 0.6, which further verified the structural validity of the questionnaire and the consistency of the expected model. The following are the detailed results of the factor analysis (see **Table 7**).

2.5. Survey process and data processing

As shown in **Figure 2**, data processing and analysis were carried out after collecting relevant questionnaires. In order to understand the participation of college students with different e-sports characteristics, SPSS was used to perform statistical analysis of participation, such as participation analysis, time-frequency analysis,

game type selection, etc.; then SPSS was used to perform regression analysis and establish a multiple regression model, which included factors such as participation, game type, game duration, etc. in the regression analysis; finally, the regression coefficient of game duration was analyzed to assess the impact of each factor on psychological stress resistance.

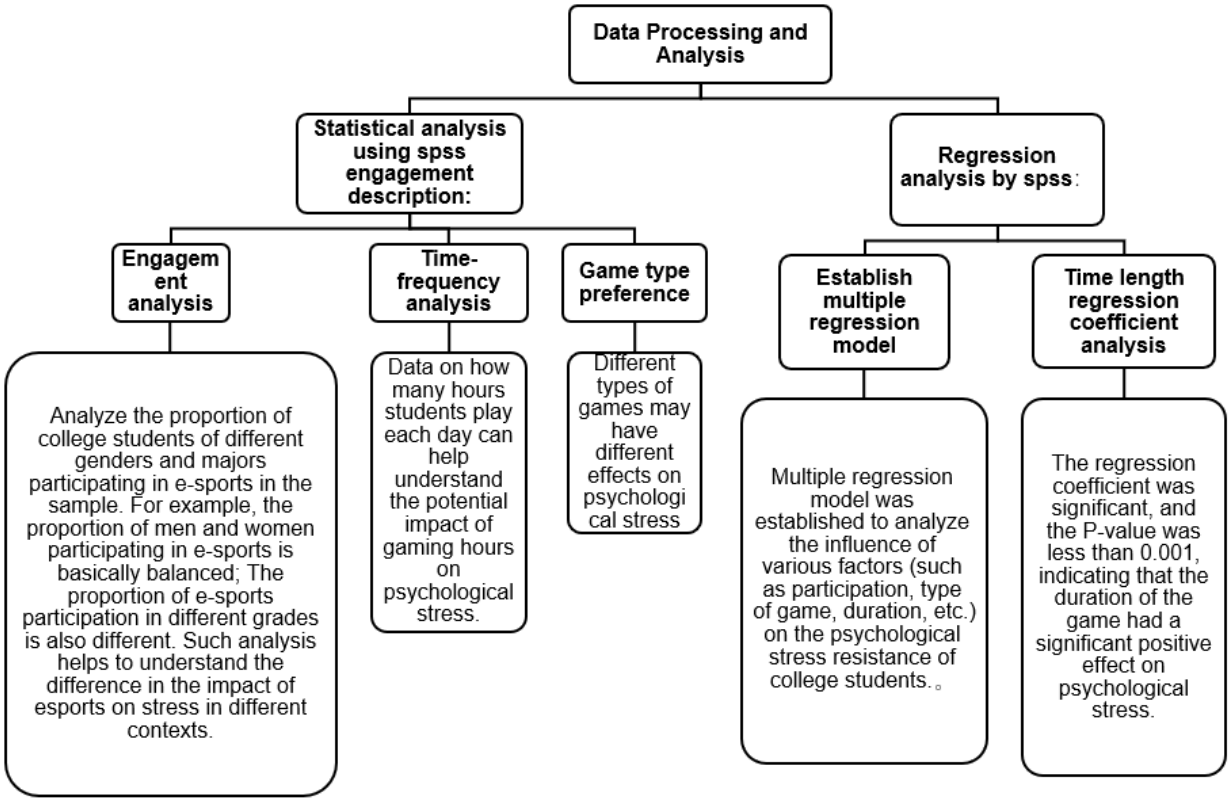

Figure 2. Process of collecting questionnaires and processing data.

First of all, in order to understand the participation of college students with different characteristics of e-sports, SPSS was used to conduct statistical analysis of participation, such as participation analysis, time-frequency analysis, game type selection, etc. Then, SPSS was used for regression analysis, multiple regression model was established, and factors such as participation, game type and game duration were included in the regression analysis. Finally, the regression coefficient of game duration was analyzed to evaluate the influence of various factors on psychological stress resistance.

3. Result

3.1. College students e-sports participation survey

Through the collection of questionnaires, we have a preliminary understanding of the current status of e-sports participation of Chinese college students, which can be divided into the following points:

Table 8. Gender ratio of college students participating in e-sports.

		Frequency	Percent	Effective percentage	Cumulative percentage
Effective	Man	426	51.1	51.1	51.1
	Woman	407	48.9	48.9	100.0
	Total	833	100.0	100.0	

As shown in **Table 8**, men and women were more closely represented in the sample at 51.1% and 48.9%, respectively. This close proportion indicates that in this sample, the distribution of male and female participants is relatively balanced, which can better represent the situation of different genders in e-sports participation. Although male students have a slight advantage in gender proportion, the gap is not significant. This suggests that the differences between male and female students in video game engagement are not as stark as conventional wisdom suggests. As can be seen from the data, both male and female college students, a considerable number of them said that they have the habit of playing video games. This phenomenon challenges the previous stereotype that video games mainly appeal to men, revealing that video games have become a universally popular form of entertainment in today's digital and information-based context.

Table 9. Analysis of college students' grade participation.

		Frequency	Percent	Effective percentage	Cumulative percentage
Effective	Sophomore year	80	9.6	9.6	9.6
	Junior	147	17.6	17.6	27.3
	Senior	142	17.0	17.0	44.3
	Freshman	48	5.8	5.8	50.1
	Graduate student	416	49.9	49.9	100.0
	Total	833	100.0	100.0	

As shown in **Table 9**, the graduate student group had the largest number of participants, accounting for 49.9% of the valid sample, nearly half. It indicates that graduate students are more interested in e-sports or more actively participate in the research of psychological stress tolerance. The proportion of lower grades and upper grades is not low, 17.6% and 17.0% respectively, for a total of 34.6%. There were relatively few participants starting college, 5.8 percent of first-year students and 9.6 percent of second-year students. Perhaps it is because these students have just entered the university and the study task is relatively light.

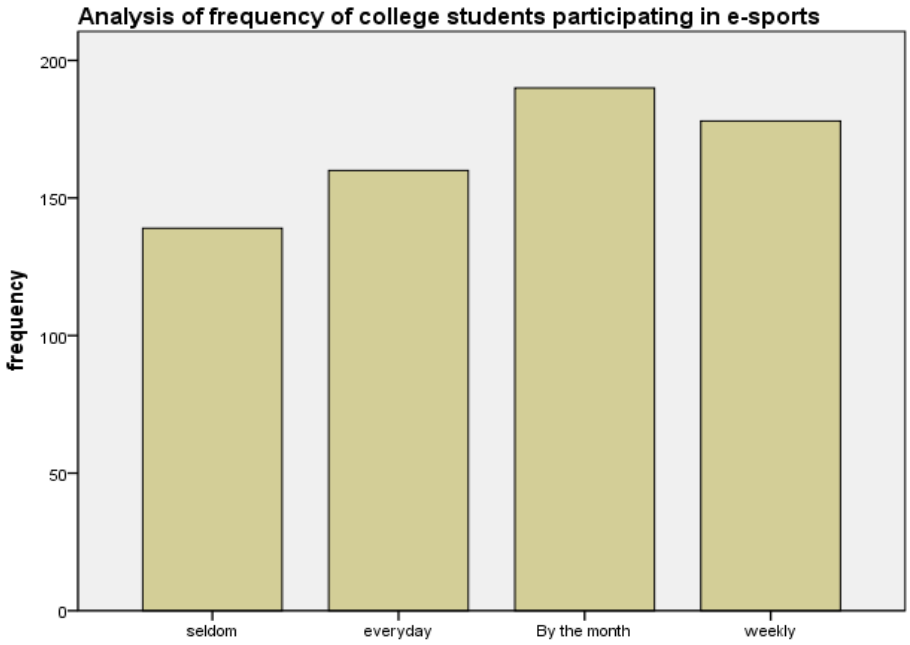

Figure 3. Frequency of college students participating in e-sports.

Figure 3 demonstrates the distribution of college students' frequency of participation in Esports. Although histograms are usually used for the presentation of frequency distribution, in this study, the histogram in **Figure 3** is used to show the distribution trend of college students' participation in Esports activities under different frequency intervals. As can be seen from the figure, most students tend to participate in Esports activities on a monthly or weekly basis, showing that most students maintain a certain balance between academics and entertainment. In contrast, the number of students who participate on a daily or irregular basis is low, indicating that most students choose a moderate frequency of Esports activities.

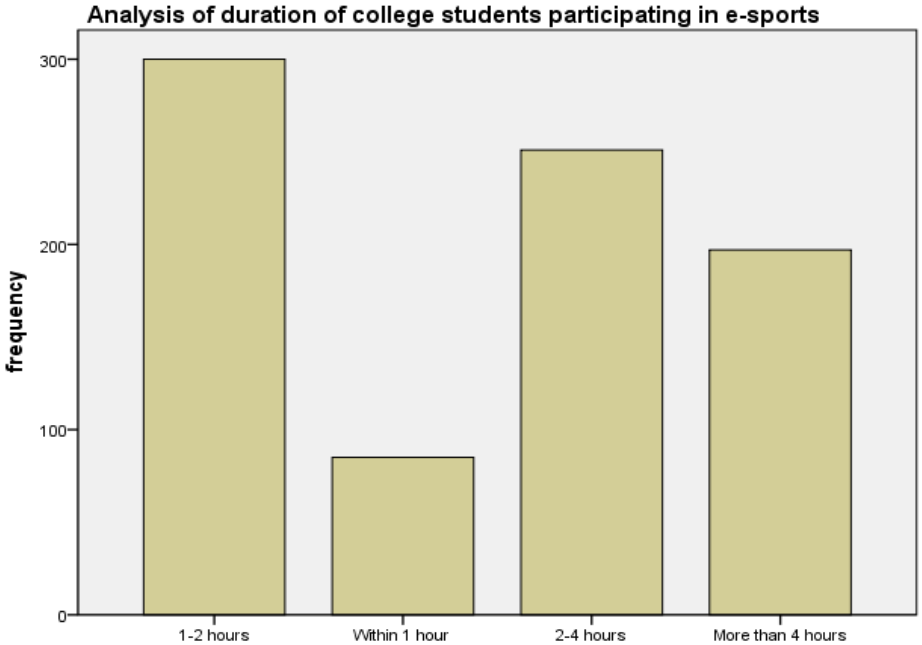

Figure 4. Duration of college students participating in e-sports.

Figure 4 shows the time distribution of college students' participation in e-sports activities, demonstrating the trend of the distribution of college students' participation hours under different time intervals. The results show that most students' participation time is centered on 1 h–2 h, followed by 2 h–4 h, with more students participating for more than 4 h, but the least number of students participating for less than 1 h. This indicates that most students choose moderate e-sports activities in order to find a balance between entertainment and study, while some students engage in e-sports activities for a longer period of time, which has a different impact on their psychology.

Table 10. College students participate in the analysis of different types of e-sports.

		Frequency	Percent	Effective percentage	Cumulative percentage
Effective	AR motion sensing sports (such as "Fitness ring adventure", "Dance All Open")	112	13.4	13.4	13.4
	MOBA (e.g., league of legends, honor of kings)	93	11.2	11.2	24.6
	Strategy (StarCraft, civilization)	172	20.6	20.6	45.3
	Cards (e.g., hearthstone, joy to the lord)	142	17.0	17.0	62.3
	Shooting (CF, fearless contract)	138	16.6	16.6	78.9
	Sports (e.g. FIFA, NBA 2K)	176	21.1	21.1	100.0
	Total	833	100.0	100.0	

College students have different levels of participation in different types of e-sports, as shown in **Table 10**. Among them, sports games ("FIFA ", "NBA 2K", etc.) have the largest number of participants, accounting for 21.1%, which shows that college students are highly interested in e-sports. This was followed by strategy games (e.g., StarCraft, Civilization) at 20.6%. Card games (Hearthstone, Glee) and shooters (CF, Fearless Contract) also had relatively high engagement rates, at 17.0% and 16.6%, respectively. Motion sports games ("Fitness Ring Adventure", "Hot Dance All-around", etc.) and MOBA games ("League of Legends", "King of Glory", etc.) accounted for a relatively low proportion, 13.4% and 11.2% respectively. These data show that different types of e-sports games are welcomed by college students to varying degrees, and the participation rate of sports, strategy, card and shooting games is relatively high.

3.2. Multiple regression analysis of different types of games on college students' psychological ability to withstand stress

3.2.1. Multicollinearity test

Multiple linear regression model is a common and effective method for economic forecasting and analysis. However, in the practical application process, there is a strong correlation between explanatory variables, which is called multicollinearity, possibly due to the inadequacy of experimental design or the internal relationship between economic variables. Multicollinearity is checked by calculating the correlation coefficient between the independent variables. If the correlation coefficient between two or more independent variables is close to 1 or −1, then it can be assumed that there is a strong linear relationship between these

variables, which can lead to multicollinearity problems. In this study, Pearson's correlation coefficient was used to detect the correlation between independent variables. When the correlation coefficient is higher than 0.8, it is necessary to consider the method of eliminating the independent variables with strong correlation.

The reason for multicollinearity is that at least two or more variables in the design matrix show an approximate linear relationship, resulting in the design matrix X less than the rank, and thus the determinant of |X'X| approaches zero. At this point, the least squares estimate of the regression coefficient $\beta = (X'X)^{-1}X'Y$ cannot be calculated. When discussing the effects of multicollinearity, the main uses of the regression model can be divided into two categories:

Regression fitting and prediction: In this case, although the t-statistic of individual regression coefficients may be small, the degree of fit of the equation and the estimates of the coefficients of variables without multicollinearity are almost unaffected. Therefore, the overall fit coefficient of determination R^2 remains nearly unchanged, and the impact on the final fitted value $\hat{y}$ is minimal. In fact, severe collinearity may even improve the fitting effect.

Studying the influence of explanatory variables on the explained variable: In this scenario, as the determinant of the design matrix approaches zero, $(XX)^{-1}$ does not exist, causing the variance of the regression coefficients $\sigma^2(X'X)^{-1}$ to increase. This makes the regression coefficients unstable, making it difficult to provide effective explanations for practical problems.

Although principal component regression has achieved some success in solving the multicollinearity problem, its effectiveness depends on the actual model. The estimation error of principal component regression may be smaller or larger than that of ordinary least squares estimation. Moreover, the interpretation of the principal components is also an issue that needs to be addressed. Due to the severe consequences brought by multicollinearity, testing for multicollinearity has become a research focus for statisticians and economists. Below are some commonly used methods for testing multicollinearity:

Correlation Coefficient Test: If the correlation coefficient between two independent variables is large and close to 1, it can be considered that multicollinearity exists in the regression model. In order to diagnose the multicollinearity problem more accurately, the variance inflation factor (VIF) is used to assess the correlation between each independent variable and the other independent variables. The formula for calculating the VIF is given below:

Variance Inflation Factor (VIF) Test:

The VIF is calculated as $VIF=\frac{1}{1-R_j^2}$ represents the determination coefficient obtained by fitting the JTH variable to the regression equation as the dependent variable and the other independent variables. The larger the VIF value, the stronger the correlation between the variable and other independent variables.

Table 11. Pearson correlation coefficient.

	Average value	Standard deviation	Psychological stress resistance	MOBA	FPS	Card leisure	Strategy	Sports competition (AR)	Traditional competitive sports
Psychological stress resistance	3.621	0.937	1						
MOBA	3.837	1.040	0.443**	1					
FPS	3.631	1.144	0.528**	0.433**	1				
Card leisure	3.688	1.106	0.415**	0.346**	0.668**	1			
Strategy	3.758	0.992	0.385**	0.278**	0.499**	0.483**	1		
Sports competition (AR)	3.860	1.024	0.506**	0.337**	0.387**	0.327**	0.440**	1	
Traditional competitive sports	3.868	0.979	0.508**	0.390**	0.426**	0.352**	0.434**	0.668**	1

* $p < 0.05$, ** $p < 0.01$.

For psychological stress resistance (as shown in **Table 11**), the absolute correlation coefficient between it and the other 6 items is less than 0.8. For MOBA, the absolute values of the correlation coefficients between MOBA and the other five items are all less than 0.8. For FPS, the absolute value of the correlation coefficient between FPS and the other four items is less than 0.8. For the card leisure category, the absolute correlation coefficient between it and the other three items is less than 0.8. For the strategy class, the absolute value of the correlation coefficient between it and the other two items is less than 0.8. For sports competition (AR), the absolute correlation coefficient between AR and the other item is less than 0.8. From the above analysis, it can be seen that no item with absolute value of correlation coefficient > 0.8 has been found, so it is suggested to adjust the standard for analysis.

3.2.2. Multiple regression result

The results of multiple regression analysis demonstrate the combined effects of different independent variables on the dependent variable. The regression coefficient of each independent variable in the regression equation indicates the direction and magnitude of its influence on the dependent variable. A positive regression coefficient suggests that an increase in the independent variable corresponds to an increase in the dependent variable, while a negative regression coefficient indicates that an increase in the independent variable results in a decrease in the dependent variable.

The *p*-value is used to test the significance of the regression coefficients, with a *p*-value below 0.05 generally considered significant, indicating that the independent variable has a statistically significant effect on the dependent variable. The adjusted *R*-squared value (Adjusted R^2) measures the explanatory power of the model, with higher values indicating better explanation of the dependent variable by the model. By analyzing the standardized coefficients (Beta values), the relative strength of the impact of different independent variables on the dependent variable can be compared.

After performing multicollinearity tests and confirming the quality of the data, this study conducted multiple regression analysis to explore the impact of different

types of games on college students' psychological stress resistance. Multiple regression analysis is a statistical method used to estimate the regression coefficients of several independent variables (MOBA, FPS, card and casual games, strategy games, sports competition games (AR), traditional competitive sports) on a single dependent variable (psychological stress resistance), thereby understanding the independent contribution of each variable to the dependent variable.

Table 12. Linear regression analysis results (n = 833).

	Unstandardized coefficients		**Standardized coefficient**	***t***	***p***	**Collinearity diagnostics**	
	B	**Standard error**	***Beta***			**VIF**	**Tolerance**
Constant	0.676	0.129	-	5.232	0.000**	-	-
Strategy	0.020	0.031	0.021	0.636	0.525	1.563	0.640
MOBA	0.157	0.027	0.174	5.755	0.000**	1.326	0.754
FPS	0.214	0.031	0.261	6.807	0.000**	2.144	0.466
Casual card	0.036	0.031	0.043	1.178	0.239	1.919	0.521
Sports (AR)	0.198	0.033	0.217	5.967	0.000**	1.920	0.521
Traditional sports	0.153	0.036	0.160	4.300	0.000**	2.006	0.498
R^2	0.432						
Adjust R^2	0.428						
F	F (6,826) = 104.585, p = 0.000						
D-W value	2.081						

Note: dependent variable = psychological stress resistance.
* $p < 0.05$, ** $p < 0.01$.

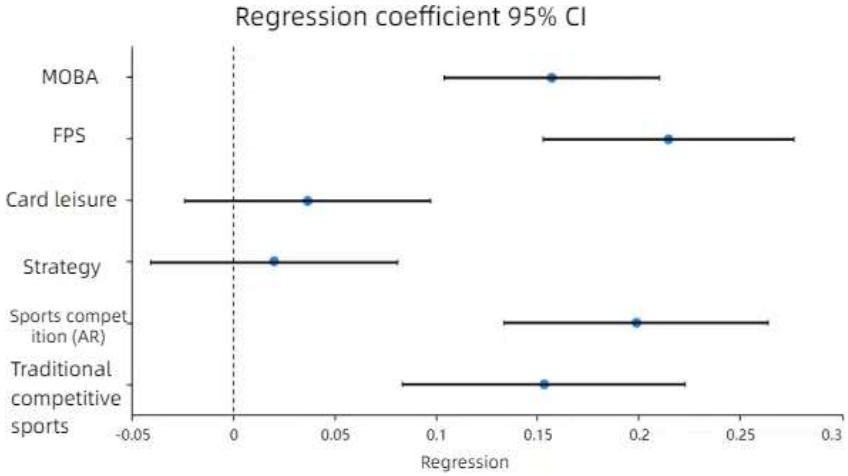

Figure 5. Different types of e-sports return coefficient.

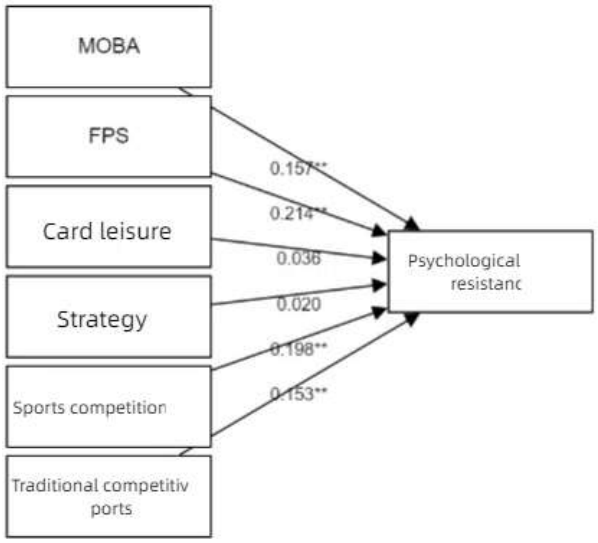

Figure 6. Path analysis diagram.

The results of linear regression analysis show that (as shown in **Table 12**) with MOBA, FPS, card leisure, strategy, Sports competition (AR) and traditional competitive sports as independent variables, and psychological stress resistance as dependent variables, the model formula obtained is as follows: Psychological resistance = 0.676 + 0.157MOBA + 0.214FPS + 0.036 card leisure + 0.020 Strategy + 0.198 Sports (AR) + 0.153 traditional sports. The R-square value of the model is 0.432, indicating that these independent variables can explain 43.2% of the change in psychological stress resistance. The F-test showed that the model was significant (F = 104.585, p = 0.000), meaning that at least one independent variable had a significant effect on psychological stress resistance (see **Figure 5**). The results of multicollinearity test show that the VIF values of all independent variables are less than 5, indicating that there is no serious collinearity problem. The D-W value is close to 2, indicating that there is no autocorrelation in the model and no correlation between the data.

As shown in the results of **Figure 6**. The specific analysis results are as follows: The regression coefficient of MOBA was 0.157 (t = 5.755, p = 0.000), that of FPS was 0.214 (t = 6.807, p = 0.000), and that of sports competition (AR) was 0.198 (t = 5.967, p = 0.000). The regression coefficient of traditional competitive sports is 0.153 (t = 4.300, p = 0.000), which indicates that they have a significant positive impact on psychological stress resistance. On the contrary, the regression coefficient of card leisure class was 0.036 (t = 1.178, p = 0.239), and that of strategy class was 0.020 (t = 0.636, p = 0.525), indicating that these two types of games had no significant effect on psychological stress.

Summary analysis shows that MOBA, FPS, AR and traditional competitive sports have significant positive effects on psychological stress resistance, while card leisure and strategy games have no significant effects.

3.2.3. Path analysis: The effect of game duration on psychological stress resistance

Path analysis is a multivariate statistical method used to explore and quantify direct and indirect relationships between multiple variables. It demonstrates causal

paths between variables by building structural equation models (SEM). Each path is represented by a path coefficient (usually a standardized regression coefficient) that reflects the direct influence of one variable on another. In the path analysis model, there are direct paths (arrows from one variable pointing directly to another) and indirect paths (paths through which an influence is passed through an intermediate variable). In this study, the path analysis method was used to explore the influence of game duration on the psychological stress resistance of college students. Among them, the effects of Sh1, Sh2, Sh3, Sh4 and game duration on Nl1, Nl6, Nl9, Nl10 and psychological stress resistance were explored.

Table 13. Summary of model regression coefficients.

X		**Y**	**Unstandardized path coefficients**	***SE***	***z* (CR value)**	***p***	**Standardized path coefficients**
Sc1	→	Xl1	0.295	0.033	9.016	0.000	0.298
Sc3	→	Lx9	0.302	0.035	8.605	0.000	0.286
Sc2	→	Lx6	0.318	0.036	8.735	0.000	0.290
Game duration	→	Psychological stress resistance	0.478	0.030	15.775	0.000	0.480
Sc4	→	Xl10	0.280	0.036	7.841	0.000	0.262

Note: → indicates path influence.

As can be seen from **Table 13**, the standardized path coefficient of sc1 on xl1 is 0.298, and is significant at the level of 0.01 ($z = 9.016$, $p = 0.000 < 0.01$), indicating that sc1 has a significant positive influence on xl1. The standardized path coefficient of Sc3 on Lx9 is 0.286, which is also significant at the level of 0.01 ($z = 8.605$, $p = 0.000 < 0.01$), indicating that Sc3 has a significant positive effect on lx9. The standardized path coefficient of Sc2 on Lx6 was 0.290, and was significant at the level of 0.01 ($z = 8.735$, $p = 0.000 < 0.01$), indicating that Sc2 had a significant positive effect on lx6. The standardized path coefficient of game duration on psychological stress resistance was 0.480, which was significant at 0.01 level ($z = 15.775$, $p = 0.000 < 0.01$), indicating that game duration had a significant positive effect on psychological stress resistance. The standardized path coefficient of Sc4 on Xl10 is 0.262, which is significant at the level of 0.01 ($z = 7.841$, $p = 0.000 < 0.01$), indicating that sc4 has a significant positive effect on xl10.

In conclusion, the results of path analysis clearly reveal the significant positive impact of game duration on the psychological stress resistance of college students. In particular, the influence of game time is large, which indicates that game time plays a key role in improving psychological stress resistance. The significant positive influence of Sc1, Sc2, Sc3, Sc4 and other factors on relevant psychological variables also supports the research hypothesis.

3.2.4. Interactive effects of game duration and game type

interaction effect refers to the effect of one independent variable on the dependent variable depending on the level of another independent variable. In statistical analysis, interaction effects reveal complex relationships between variables, indicating that two or more variables work together to have an impact on the outcome, rather than simply adding up their independent effects. There may be

an interaction effect between game duration and game type, and this relationship can be examined using interaction effect analysis. Through the introduction of interactive terms, we can better understand the comprehensive impact of different game duration and game type combination on psychological stress resistance. In the interaction effect analysis, we not only pay attention to the influence of game duration and game type on psychological stress resistance, but also examine the interaction between them. Game duration variables (Sh1, Sh2, Sh3, Sh4) and game type variables (e.g., MOBA, FPS, cards, strategy, etc.) are considered as independent variables, and the total psychological stress resistance score is considered as the dependent variable. By introducing the interaction term of game duration and game type, we analyze their joint influence.

Table 14. Research variable processing.

description	Name	Data type	Data Processing
Dependent variable	E-sports	Quantification	No treatment
Independent variable	Game duration	Quantification	Centralization
Moderator variable	Game type	Quantification	Centralization

As can be seen from **Table 14**. It can be seen from the above table that independent variables (game duration) and moderating variables (game type) in this study are treated as follows: centralized, dependent variables (e-sports) are not treated.

Table 15. Results of the moderation effect analysis.

	Model 1					Model 2					Model 3				
	B	**Standard error**	***t***	***p***	***β***	***B***	**Standard error**	***t***	***p***	***β***	***B***	**Standard error**	***t***	***p***	***β***
Constant	3.779	0.016	230.159	0.000**	-	3.779	0.000	902998747250920 80.000	0.000**	-	3.779	0.000	111051537562430 54.000	0.000**	-
Game duration	0.659	0.017	37.723	0.000**	0.795	0.250	0.000	435966122727134 7.000	0.000**	0.302	0.250	0.000	606653658371134 .000	0.000**	0.302
Game type						0.750	0.000	113099306060884 42.000	0.000**	0.782	0.750	0.000	169875757097642 7.250	0.000**	0.782
Game duration*game type											0.000	0.000	28.395	0.000**	0.000
R^2	0.631					1.000					1.000				
Adjustment R^2	0.631					1.000					1.000				
F value	*F* (1831)=1423.061, *p*=0.000					*F* (2830) = 1.7348205072755634× 10^{32}, *p* = 0.000					*F* (3829) = 2.6166772923859724× 10^{30}, *p* = 0.000				
$\triangle R^2$	0.631					0.369					0.000				
$\triangle F$ value	*F* (1831)=1423.061, *p*=0.000					*F* (1830) = null, *p* = 0.000					*F* (1829) = null, *p* = null				

Note: dependent variable = e-sports.
* $p < 0.05$**, $p < 0.01$.

As can be seen from **Table 15**. From the above table, we can see that the

adjustment effect is divided into three models, and model 1 includes the independent variable (game duration). Model 2 adds the moderating variable (type of game) to model 1, and Model 3 adds the interaction term (product of the independent variable and the moderating variable) to model 2.

For model 1, the purpose is to study the influence of the independent variable (game duration) on the dependent variable (e-sports) without considering the interference of the moderating variable (game type). As can be seen from the above table, the independent variable (game duration) presents a significant significance (t = 37.723, p = 0.000 < 0.05). This means that the length of play has a significant impact on Esports. **Figure 7** suggests that game duration may affect psychological resilience, with longer durations being associated with greater resilience, depending on the specific group or condition (low, medium or high level).

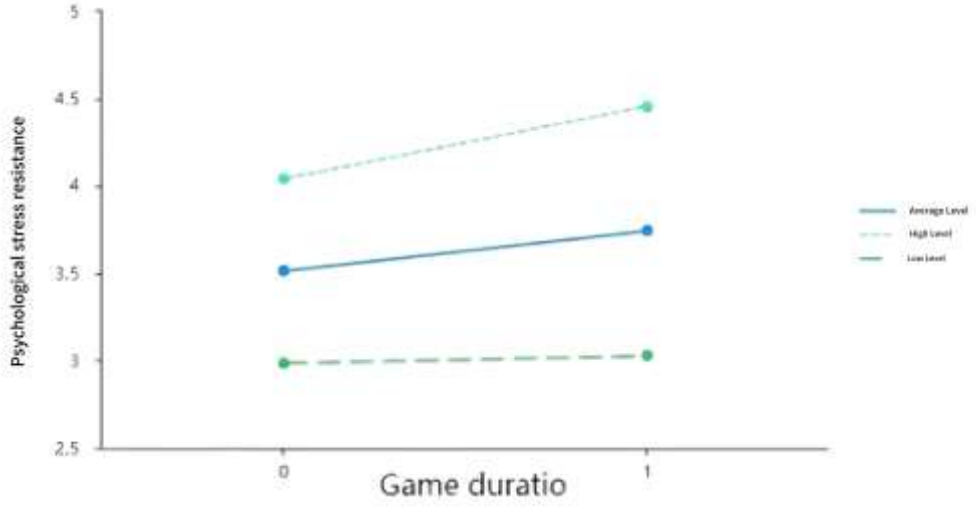

Figure 7. Effect of game duration on psychological stress adjustment.

The moderating effect can be examined in two ways. The first is the significance of the change in F-value from model 2 to model 3; The second is to look at the significance of the interaction terms in Model 3. This time, the moderating effect is analyzed in the second way.

As can be seen from the above table, the interaction terms between game duration and game type show significant significance (t = 28.395, p = 0.000 < 0.05). It means that the influence of game duration on e-sports is significantly different when the moderating variable (game type) is at different levels.

Interaction effect analysis reveals the complex relationship between play duration and play type, showing their combined effect on psychological stress resistance. In this analysis, the interaction term between game duration and game type significantly affects psychological stress resistance, indicating that different game types may regulate the intensity of the influence of game duration on psychological stress resistance. This means that different types of games may amplify or weaken the positive or negative effects of playing time on psychological stress resistance, resulting in different psychological effects. By introducing the interaction term, the results not only validate the importance of play duration and play type individually, but also reveal the synergistic effect when they work together.

3.2.5. The relationship between different types of games and psychological stress resistance of college students and the moderating effect of playing time

The influence of different types of games on the psychological stress resistance of college students and the regulating effect of game duration is a complex and multi-level research topic. Different types of games (such as shooters, card games, strategy games, etc.) have different effects on psychological stress resistance. For example, a shooting game might enhance the player's psychological stress resistance through training in quick decision making and reaction time; Card games, on the other hand, may improve the player's patience and ability to cope with stress through exercises in strategy and planning. Strategy games can also improve players' stress management skills through complex scenarios and resource management.

Game duration, as an important regulating variable, affects the specific effects of different game types on psychological stress resistance. Shorter game duration may provide moderate entertainment and relaxation, and enhance psychological stress resistance to stress; Too long a game may cause fatigue and addiction, but weaken the psychological ability to resist stress. Therefore, the moderating effects of game duration need to be carefully analyzed. In the short and long time, the positive influence of different types of games on psychological stress ability may be more obvious; Over longer periods of time, certain types of play can have a negative impact on psychological stress resistance. When discussing the influence of different types of games on the psychological stress resistance of college students, considering that the duration of games may have a moderating effect on this relationship, this paper further analyzes the moderating effect. Moderating effect analysis is a statistical method used to detect how a variable (the moderating variable) affects the strength and direction of the relationship between the independent and dependent variables. In this study, we used game duration as a moderating variable to investigate its role in the relationship between different types of games and psychological stress resistance to stress.

Table 16. Description of research variable processing.

Type	Name	Data type	Data processing
Dependent variable	Psychological resistance	Quantification	No treatment
Independent variable	Game type	Quantification	Centralization
Moderator variable	Game duration	Quantification	Centralization

As can be seen from **Table 16**, we can see that the independent variable (game type) and moderating variable (game duration) in this study are processed in the following way: centralization, and the dependent variable (psychological stress resistance) is not processed.

Table 17. Results of the moderating effect analysis.

	Model 1					**Model 2**					**Model 3**				
	B	**Standard error**	***t***	***p***	***β***	***B***	**Standard error**	***t***	***p***	***β***	***B***	**Standard error**	***t***	***p***	***β***
Constant	3.621	0.025	144.992	0.000**	-	3.621	0.025	146.453	0.000**	-	3.513	0.029	119.491	0.000**	-
Game type	0.789	0.033	24.005	0.000**	0.640	0.681	0.041	16.522	0.000**	0.553	0.694	0.040	17.220	0.000**	0.564
Game duration						0.141	0.033	4.223	0.000**	0.141	0.228	0.035	6.472	0.000**	0.229
Game type*game duration											0.245	0.038	6.430	0.000**	0.191
R^2	0.409					0.422					0.449				
Adjust R^2	0.409					0.421					0.447				
F -number	F(1831) = 576.218, p = 0.000					F(2830) = 302.863, p = 0.000					F(3829) = 225.506, p = 0.000				
$\triangle R^2$	0.409					0.012					0.027				
$\triangle F$-number	F(1831) = 576.218, p = 0.000					F(1830) = 17.835, p = 0.000					F(1829) = 41.347, p = 0.000				

Note: dependent variable = psychological stress resistance.
* $p < 0.05$ **, $p < 0.01$.

As can be seen from **Table 17**, we can see that the moderating effect is divided into three models, and Model 1 includes the independent variable (type of game). Model 2 adds a moderating variable (game duration) based on model 1, and Model 3 adds an interaction term (product of the independent variable and the moderating variable) based on model 2.

For model 1, the purpose is to study the influence of independent variable (game type) on dependent variable (psychological stress resistance) without considering the interference of regulating variable (game duration). As can be seen from the above table, the independent variable (game type) presents a significant significance (t = 24.005, p = 0.000 < 0.05). This means that the type of play has a significant effect on psychological stress.

The moderating effect can be examined in two ways. The first is the significance of the change in *F*-value from model 2 to model 3; The second is to look at the significance of the interaction terms in Model 3. This time, the moderating effect is analyzed in the second way.

As can be seen from the above table, the interaction term between game type and game duration presents a significant significance (t = 6.430, p = 0.000 < 0.05). It means that the influence of game type on psychological stress resistance is significantly different when the regulating variable (game duration) is at different levels.

4. Conclusion

4.1. Motivation and difference of game participation

The main motivations for students to participate in Esports include socializing, entertainment, self-actualization, and competition. College students use Esports to gain social interaction, relieve academic pressure, and experience a sense of accomplishment in competition. At the same time, students from different academic backgrounds also have different participation preferences, for example, art and design students prefer games with rich visual effects, while sports and strategy games appeal to a wider group because of their teamwork and strategy.

4.2. Different effects of e-sports on psychological stress resistance

E-sports has shown remarkable effect in improving college students' psychological ability to withstand pressure. Different types of games, such as FPS, MOBA, card strategy, etc., use different game mechanics to develop the player's ability to cope and make decisions in high-intensity environments. The higher frequency of e-sports participation is positively correlated with psychological stress resistance, and reasonably designed e-sports activities can assist mental health education in colleges and universities.

4.3. Positive effects of playing time

Studies have shown that moderate play time can positively affect psychological stress resistance. Playing different types of games over a long period of time helped students cope better with stress in real life, but over a long period of time, the effect was weakened. Through pathway and mediation analysis, the study further quantified the significant positive effect of game duration on psychological stress resistance.

4.4. Interactive impact of game type and duration

The interactive effects of game duration and type on psychological stress tolerance showed complexity. Short MOBA and strategy games can effectively increase stress resistance, while long FPS and card games can lead to mental fatigue. Proper game time control is the key to ensuring mental health.

4.5. The role of social support in e-sports

Social support plays a key role in improving psychological stress resistance in e-sports participation. The support of family, friends, and school not only provides emotional and material help, but also relieves the negative emotions of failure in the game and enhances team cohesion. The e-sports resources and platforms provided by the university help college students develop their e-sports abilities in a healthy environment.

4.6. Limitations of the study

Although this study provides insight into the impact of Esports on the psychological resilience of college students, there are some limitations. The study relied heavily on self-reported survey data, which may be subject to social desirability bias or participant recall bias. The study did not consider the potential impact of individual differences in participants, such as personality traits or cultural

background, on the results. The sample size and geographical limitation of the sample could affect the broad applicability of the findings.

4.7. Implications for practice

The results of this study provide valuable guidance for colleges and universities in designing a combination of mental health education and e-sports activities. The study shows that moderate Esports participation can help improve college students' psychological resilience, especially the effect of short-term participation in MOBA and strategy games is significant. Therefore, colleges and universities can use e-sports as part of mental health education, and reasonably plan the duration and type of e-sports activities to help students better cope with stress.

4.8. Social impact on education

Esports show a very important social impact in the field of education, including a significant role in the development of students' abilities and mental health. Esports provide a new type of teaching tool for education, which can help to stimulate students' interest in learning. By integrating Esports into teaching, teamwork, strategy development, and other mechanisms are applied to classroom activities to enhance students' initiative. E-sports play an important role in the mental health education of college students. Many students find it difficult to find effective ways to vent their stress under the pressure of academics. Through its immersive nature, e-sports provide students with ways to relieve pressure and cultivate the ability to regulate emotions under high-pressure environments.

4.9. Role in national development

E-sports show potential in the field of national development. The development of the Esports industry has energized the national economy. The Esports industry covers a variety of fields such as content creation, tournament organization, related technology development, etc., providing a large number of employment opportunities for young people. Esports play an important role in the construction of the country's cultural soft power. China's outstanding performance in international e-sports events has enhanced the country's image and strengthened its international influence through e-sports cultural output. In the context of the current digital transformation, the highly skilled talents cultivated by e-sports education can meet the country's demand for talents in information technology and artificial intelligence.

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